

# Water Return Demonstration Project

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## Public Final Report

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Prepared for

Alberta Innovates, Dr. Mark Donner, Ph.D.

Prepared by

Syncrude Research and Development



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**APPLICANT INFORMATION:**

<b>Applicant (Organization):</b>	<b>Syncrude Research and Development.</b>
<b>Address:</b>	9421-17Ave., NW, Edmonton, Alberta
<b>Applicant Representative Name:</b>	Warren Zubot
<b>Title:</b>	Senior Engineering Associate
<b>Phone Number:</b>	(825) 409 7479
<b>Email:</b>	wzubot@suncor.com

**PROJECT PARTNERS**

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BOD <sub>5</sub>	5-day biochemical oxygen demand
BTEX:	Benzene, Toluene, Ethylbenzene, and Xylenes
COD	chemical oxygen demand
DIC:	dissolved inorganic carbon
DOC	dissolved organic carbon
EC50	effective concentration producing 50% reduced effect to test organisms
FFT:	Fluid Fine Tailings
FTIR	Fourier transform infra-red
FWAL	freshwater aquatic life
LC50:	lethal concentration at which 50% of test organisms die
MLSB:	Mildred Lake Settling Basin
Mm <sup>3</sup> :	million cubic meters (10 <sup>6</sup> m <sup>3</sup> )
NAs:	naphthenic acids
OSPW:	oil sands process water (aka recycle water or RCW)
PAHs:	polycyclic aromatic hydrocarbons
PC:	petroleum coke produced by Fluid Cokers™
PE:	polyethylene
Ppb:	parts per billion (e.g., µg/kg)
Ppm:	parts per million (e.g., mg/kg)
RCW:	recycled OSPW from free-water zone of settling basins
SCL	Syn crude Canada Ltd.
TDS:	total dissolved solids
TPH	total petroleum hydrocarbons
TSS:	total suspended solids
VOCs:	volatile organic compounds
TMF:	Tailings Management Framework
WRDP	Water Return Demonstration Project
Wt.%:	weight per cent (g/100g)

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Appendix A: Water Chemistry Tables

Appendix B Ecotoxicity Assessment of Coke Treated Oil Sands Process-Affected Water



## EXECUTIVE SUMMARY

This report describes the results of the Water Return Demonstration Project (WRDP) which was a large-scale pilot program designed to treat oil sands process water (OSPW) with petroleum coke (PC) – a byproduct of Syncrude’s (SCL) Fluid Coking™ process that is used to upgrade bitumen into synthetic crude oil. Previous studies have shown that PC can be used as activated carbon to reduce concentrations of dissolved organic compounds present in OSPW. SCL produces about 20 kg of product PC per barrel of synthetic crude oil produced. Based on current production rates, the technology has the potential to treat at least 8 Mm<sup>3</sup> of OSPW per year.

The WRDP is based on a 3-stage treatment process and involves the hydraulic deposition of a freshly produced slurry of OSPW and PC (Stage 1) into a containment facility (Stage 2) approximately 150 m wide by 465 m in length. The rate of collection of treated OSPW is controlled with an under-drain system installed at the base of the containment facility within the formed PC deposit. The reaction kinetics of the adsorption process are such that the longer the water is retained within the voids of the coke deposit (porewater residence time), the further the reduction in component concentrations. For the field program completed in 2021, porewater residence times were between about 2 weeks and 2 months. The collected water was then directed to an aerated pond (Stage 3) with a residence time of about 8 days to permit additional treatment to reduce ammonia concentrations and for final quality testing of the Treated OSPW.

The water quality testing program can be categorized into two components: (a) an onsite testing program to quantify the chemistry and acute toxicity of OSPW from the source and throughout the treatment process and, (b) a detailed aquatic toxicity study designed to test sub-lethal effects using a broad suite of toxicity tests including fathead minnows (*Pimephales promelas*), green algae (*Pseudokirchneriella*), *Ceriodaphnia dubia*, *Hyalella azteca*, fingernail clams (*Sphaerium* sp.), freshwater mussels (*Lampsilis siliquodia*), and walleye (*Sander vitreus*). In addition, mesocosms experiments inoculated with periphyton and benthic invertebrates sourced from the Athabasca River were used to assess effects.

The treatment process reduced concentrations of dissolved organic compounds and produced Treated OSPW that was not acutely toxic based on bacteria, zooplankton, and fish bioassays. Removal efficiencies for naphthenic acids (NAs) were about 85%. Removal of phenolic compounds and hydrocarbons exceeded 95% and removal of polycyclic aromatic hydrocarbons (PAHs) exceeded 99%. Reductions in concentrations of total suspended solids (TSS) and ammonia were greater than 98%.

The most sensitive sub-lethal endpoint was found to be periphyton growth rates when Treated OSPW was mixed with Athabasca River at concentrations of 3.2% and higher. At Treated OSPW concentrations less than 3.2%, there were no effects to periphyton or any of the species tested. Using this result because it is the most sensitive and assuming a Treated OSPW release of 8 Mm<sup>3</sup>/year into the Athabasca River flowing at the 1Q10 flow condition (~99m<sup>3</sup>/s), modelling calculations indicate a 3.2% dilution would be achieved between about 100 and 200 m downstream of the release point (Four Elements, 2022). This is about an order of magnitude more conservative than the 2 km length restriction as per chronic mixing zone guidance recommended for industrial and municipal discharges in Alberta (AEP, 1995).



## **1.0 INTRODUCTION**

### **1.1 GENERAL**

Beginning in the 1920s, significant efforts were undertaken by the Alberta Government and entrepreneurs to develop the commercialization potential of Canada's oil sands resource. What began as a technical curiosity has evolved into an industry that provides significant economic benefits to the Canadian economy. Commercial scale crude oil production from the mineable oil sands has been occurring for over five decades. The business timeframes for existing projects are long and, in many cases, will extend into the latter part of the 21st century.

Since 1967, oil sands companies have operated with a "zero-release" practice for oil sands process water (OSPW). Water and fluid materials have been and continue to be stored in "out-of-pit" and "in-pit" tailings facilities. However, to reduce long-term containment requirements, minimize landscape disturbances, expedite terrestrial and aquatic reclamation activities, mitigate OSPW salinization, and achieve mine closure outcomes, appropriately treated OSPW will have to be returned to the environment.

In March 2015, the Government of Alberta issued the Tailings Management Framework (TMF) for the Mineable Athabasca Oil Sands. The framework provides provincial regulatory direction that requires volumes of fluid fine tailings (FFT) to be reduced during and after mine operations. Alberta had indicated support of the TMF by enabling the potential release of treated OSPW to the environment with necessary scientific and regulatory oversight. The release of treated water was acknowledged as part of the broader oil sands water management system. Pilot projects designed to treat OSPW for return to the environment were to be subjected to a three-phase implementation approach:

- Phase 1 consists of establishing context and design.
- Phase 2 is to operationalize and evaluate closed-circuit, pilot-scale treatment projects.
- Provided Phases 1 and 2 are completed to the satisfaction of the government, a Phase 3 may be permitted to allow for up to two years of treated water release to the environment.

Synchrude's (SCL) Water Release Demonstration Project (WRDP) was initially commissioned in 2019 with subsequent operation and water quality testing in 2021. It is a novel application of water treatment based on the principles of adsorption using petroleum coke (PC) produced by Fluid Coking, filtration, and biodegradation. The purpose of the technology is to reduce concentrations of constituents present in OSPW to ensure the treated water can be released to the Athabasca River in a manner protective of human and ecological health.

The WRDP was operating within Phase 2 of the above noted framework with the intention, and subject to acceptable results, to progress to Phase 3 which may have permitted a pilot scale release to the Athabasca River for up to two years to further progress the technology and to collect scientific evidence to ensure the release of treated OSPW is protective of the Athabasca River system downstream of the release point. Although the WRDP objectives have not changed, industry was advised, in the summer of 2019, that releases of treated OSPW – either for commercial or Research and Development purposes (e.g., technology development applications) – will not be permitted until regulations are available under the



*Federal Fisheries Act*. It is Syncrude's understanding such regulations will not be available until 2025. Consequently, the project has been paused and construction of a pipeline from the WRDP facility to the river to progress to Phase 3 has been deferred/terminated until appropriate regulatory clarity is available.

This report presents the results of the closed-circuit water quality assessment program that was completed in 2021. The program can be categorized into two components: (a) an onsite testing program to quantify the chemistry/acute toxicity of OSPW from the source and throughout the treatment process and, (b) a detailed aquatic toxicity study designed to test sublethal effects over an approximately six-week period using a broad suite of toxicity tests. This phase incorporates both laboratory and on-site testing of the treated OSPW and includes on-lease chronic toxicity testing using a mobile testing facility and the use of mesocosms inoculated with periphyton and benthic macroinvertebrate assemblages from the Athabasca River watershed.

## **1.2 PREVIOUS STUDIES**

Previous studies have shown that contact between OSPW and PC produced from a Fluid Coker™ can reduce dissolved organic compounds present in OSPW based on an adsorption process (Zubot, 2010; Zubot et al, 2012 and 2021). Development of water treatment technology using PC followed a staged-gate process, in accordance with Syncrude's three-stage Research and Development Project Management Process (R&D PMP). Key findings are summarized as follows:

- Removal of dissolved organic compounds (DOC) from OSPW using PC in an adsorption-on-carbon process following Langmuir and Freundlich isotherm models. In OSPW, the major constituent of DOC is the ionic form of naphthenic acids. This group of low molecular weight (<500 m/e) aliphatic carboxylic acids are solubilized during bitumen extraction from oil sand ore using hot water digestion under alkaline conditions. The resulting OSPW contain naphthenic acids (NAs) concentrations in the range between about 50 and mg/L. NAs are natural surfactants and have been shown to be responsible for most aquatic acute toxicity of OSPW, and therefore are an important target for OSPW treatment. Under lab and field testing, adsorption capacities of PC for removal ranged between about 0.1 and 0.46 mg NAs/g PC, with averaged efficiencies being about 0.26 mg NAs/g PC (Zubot, 2010).
- Adsorption capacity of PC is significantly less than commercially available activated carbons. However, even with relatively low adsorption, SCL's Fluid Cokers produce PC in quantities that have the potential for treating between about 8 and 12 Mm<sup>3</sup> of OSPW per year.
- PC is primarily carbon (> 80 wt.%) but contains a significant amount of sulphur (~7 wt.%) and trace metals associated with its formation during the thermal cracking of bitumen in the fluid coking operation. While trace metals in PC are elevated, most are present at concentrations less than 10 mg/kg. Elements that exceed 10 mg/kg included vanadium, zirconium, barium, strontium, nickel, cesium, lanthanum, molybdenum, neodymium, yttrium, cobalt and zinc.
- The particle size distribution of PC is similar to fine-grained sand (mean diameter ~150 µm). The permeability of the material is high (~10<sup>-5</sup> m/s) and it exhibits good drainage properties.



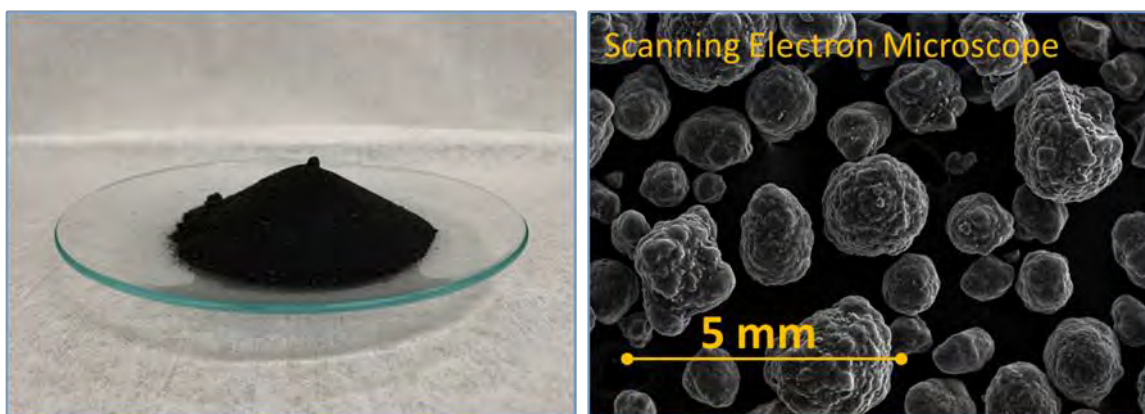
- PC produced in SCL's fluid cokers is quenched with OSPW. The resulting slurry is moved by pipeline (i.e., coke sluicing lines of PC/OSPW slurries) to the current storage location – the Mildred Lake Settling Basin. During transport, initial PC adsorption occurs as fresh PC contacts OSPW within the pipeline that acts as “plug flow” carbon adsorption stage and reduces concentrations of dissolved organic compounds (e.g., NAs).
- NAs are typically present at concentrations between 50 and 80 mg/L in OSPW. Lab and field pilot projects showed that PC treatment of OSPW can rapidly reduce NAs to concentrations less than 20 mg/L, and with time of contact within the PC deposit, further reduction to less than 10 mg/L occurs. This indicates treatment efficiencies for removing NAs can be expected to exceed 80%.
- Previous work confirmed laboratory experiments that PC adsorption of organic constituents in OSPW is a biphasic process (Zubot 2010). The initial removal rate of NAs is fast, followed by a slower diffusion-controlled process.
- With the exception of vanadium, most trace elements did not significantly leach or mobilize from the petroleum coke matrix into OSPW. Two constituents which did increase in concentrations were cadmium and molybdenum. Cadmium levels however, did not exceed the current Canadian Council of Ministers of the Environment (CCME) freshwater aquatic life guideline of 1 µg/L. Molybdenum concentrations did exceed the CCME guideline value of 73 µg/L in both untreated (~100 µg/L) and treated OSPW (~1000 µg/L). The CCME does note that molybdenum is an essential trace element for aquatic organisms and is a growth promoter for phytoplankton, periphyton and macrophytes;
- Vanadium concentrations were elevated (approximately 2-10 mg/L) after initial Coke/OSPW contact (i.e., Stage 1). With extended retention of OSPW in a coke deposit (Stage 2), geochemical interactions result in significant reductions in the treated OSPW. The field data indicates that porewater retention times of 8 weeks or more will result in vanadium concentrations of less than 1 mg/L. The use of steel tanks in the pilot program has provided additional evidence that metal oxides (e.g., rust) can be used to increase removal of vanadium;
- The treatment process reduced OSPW concentrations of barium, selenium, and strontium;
- Parent and alkylated polycyclic aromatic hydrocarbon (PAHs) in untreated OSPW were measured at concentrations up to 8.5 µg/L. The treated OSPW contained PAH concentrations that were significantly reduced and most individual PAH constituents were present at concentrations less than analytical detection limits;
- Changes in OSPW properties after contact and drainage from PC deposits include the removal of acute toxicity. Bioassays (Microtox™, rainbow trout and daphnia magna) indicate OSPW subjected to PC treatment can produce water that is not acutely toxic



## 2.0 PROJECT DESCRIPTION

### 2.1 PRODUCTION OF ACTIVATED CARBON – FLUID COKING

To produce synthetic crude oil, Syncrude Canada Ltd. operates three fluid coking units as part of an upgrading process. The purpose of fluid coking is to convert bitumen feedstock into distillates suitable for hydrotreating and to reduce the specific gravity and viscosity to ensure a suitable product for transport by pipeline. The process results in the formation of carbon-based byproduct known as petroleum coke (PC) which possess properties similar to activated carbon. A photograph and a scanning electron microscope image of this material is shown in Figure 1.



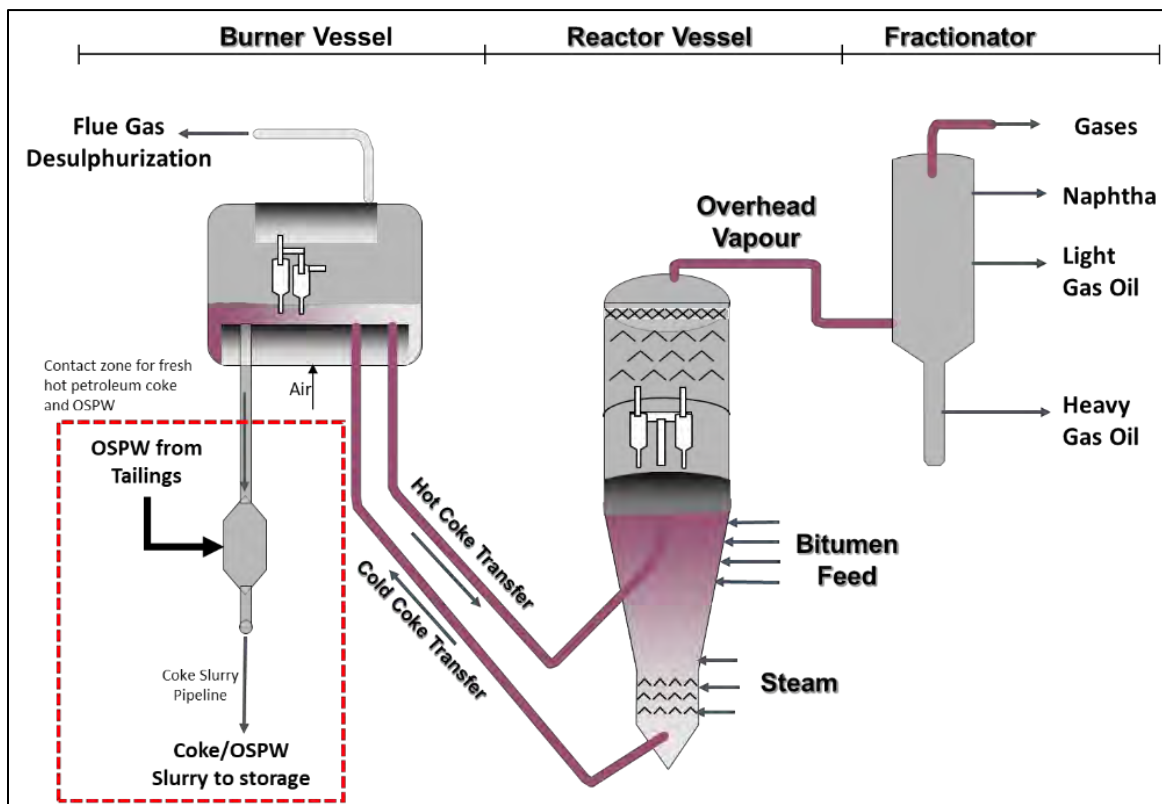
**Figure 1: Coke Produced by Fluid Coking using Bitumen as Feedstock**

Activated carbon has been broadly defined as an amorphous carbon-based material that has been prepared to significantly enhance the porosity and interparticulate surface area (Bansal et al., 1988). Manufacturing activated carbon generally involves two stages: carbonization of the carbonaceous precursor and activation of the resulting char. Although variants are possible, the process usually involves heating a carbon-based material to volatilize lower molecular weight constituents, with the subsequent formation of a carbonized structure. Physical activation is then completed in the presence of an oxidizing gas—typically water, carbon dioxide or air. This preparation process is achieved during the fluid coking process using bitumen as the carbonaceous precursor. To illustrate the process, a simplified flow diagram of a Fluid Coker is shown in Figure 2.

The process begins when bitumen feed is sprayed into a fluidized bed of hot coke particles ( $\sim 600^{\circ}\text{C}$ ) contained within the coker *Reactor Vessel*. Pyrolysis reactions between the bitumen feed and the coke yields volatile hydrocarbons and a deposit of coke on the bed particles. Vapor hydrocarbons are stripped using steam and passed through cyclones to remove any entrained solids. To sustain reactor temperatures, PC is continuously recirculated between the reactor and a burner vessel. Steam stripped PC is withdrawn from the bottom of the reactor (cold PC) and transferred to the burner where a portion of the coke is combusted to provide heat. The partially combusted material (hot PC) is returned to the



reactor to provide heat to sustain reactor conditions. It is the *Burner Vessel*, where air is introduced and the material partially combusted which results in the “activation” to produce a carbon material with suitable adsorption properties. To prevent the solids inventory from increasing, PC is constantly withdrawn from the burner vessel and mixed with OSPW to form a slurry mixture that is transported by pipeline to a designated area for long-term storage.



**Figure 2: Simplified Process Flow Diagram – Fluid Cokers**

SCL produces about 20 kg of product PC (i.e., PC withdrawn from the burner vessel) per barrel of synthetic crude oil produced (Zubot, 2010). The coke sluice lines are designed to transport PC/OSPW slurries at PC concentrations of about 20-22 wt.%. In accordance with the Oil Sands Conservation Rules s48 and s49 (Oil Sands Conservation Act, 1988), Syncrude stores produced petroleum coke on its leases for the purposes of energy resource conservation. Currently, the material is placed and stored within the Mildred Lake Settling Basin (MLSB) tailings facility.



## 2.2 FIELD FACILITY

Syncrude's Fluid Coking operation (Figure 2) requires PC to be constantly withdrawn from the burner component of the Fluid Coker. The material is mixed with OSPW to form a slurry that is hydraulically transported by pipeline to a designated storage area. Presently, this is the Mildred Lake Settling Basin (MLSB). Following deposition of the slurry, the water runs off the beach and reports to the operational inventory of OSPW.

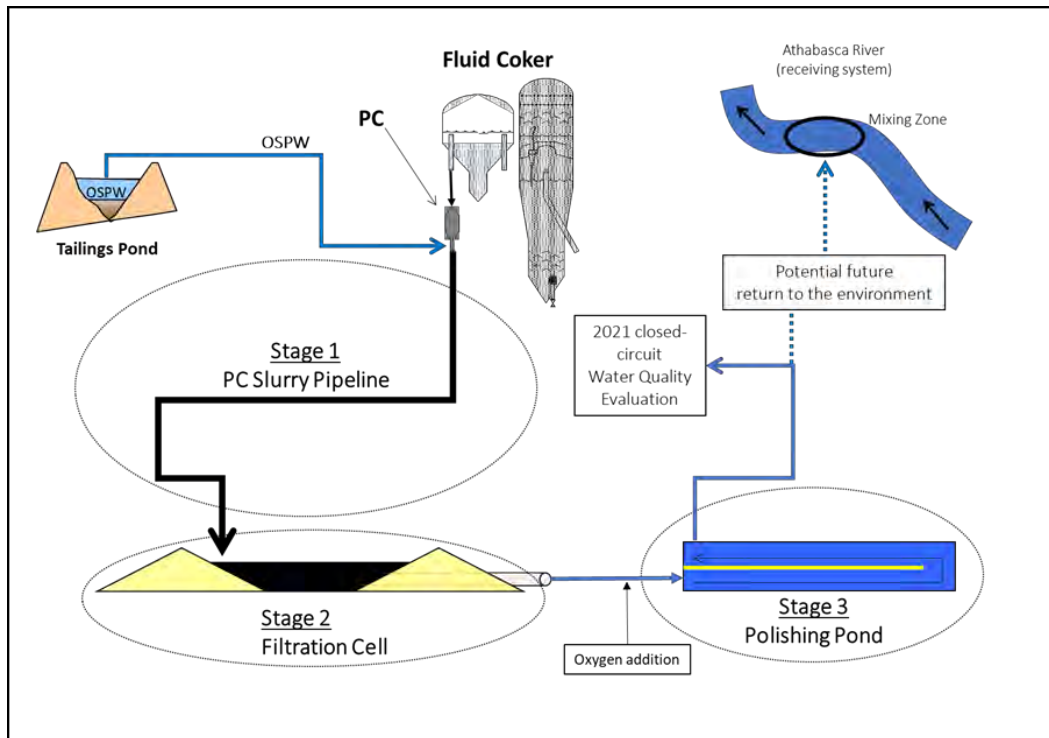
A unique water treatment opportunity is possible if the slurry transport water is suitably isolated and collected. Operationally, this may be achievable by discharging the slurry into a dedicated containment structure with engineered underdrainage to allow the collection of the pore water. This is the basis of Syncrude's Water Return Demonstration Project (WRDP) which was commissioned in spring 2019. A simplified process flow diagram is provided in Figure 3 and shows the three stages that comprise the treatment process.

Firstly, the petroleum coke (i.e., activated carbon) which is produced from the fluid cokers is mixed with OSPW (i.e., untreated water) that has been sourced from a tailings' facility. The water/coke mixture is then transported in a pipeline (Stage 1) as a slurry and deposited into a large containment cell (Stage 2) that is equipped with engineered under-drainage (8" slotted HDPE pipe) wrapped in a geotextile fabric. The hydraulically placed coke deposit contained within the earthen cell is subsequently under-drained to perform as a filter bed. The purpose of Stages 1 and 2 is to reduce concentrations of total suspended solids (e.g., clay particles), free-phase hydrocarbons (e.g., bitumen) and dissolved organic constituents (e.g., naphthenic acids). Stage 3 is the final stage of treatment. It is an aerated pond to permit biological degradation of ammonia and to serve as a holding facility to allow for final water quality testing.

For future potential release scenarios, and should confirmatory water testing indicate an unacceptable quality, the water can be rerouted to the existing OSPW inventory. This will ensure "off-spec" water is not released to the environment.

Photographs of the WRDP are shown in Figures 4 and 5. The facility is situated on the southeast portion of Syncrude's Mildred Lake Settling Basin (MLSB). The facilities comprising Stages 2 and 3 are approximately 150 m and 76 m in width, respectively, and 465 m in length to permit the treatment of approximately 1 million cubic meters of OSPW before the deposited bed of coke reaches the freeboard limit of the containment cell. Stages 2 and 3 are also referred to as a "Filtration Cell" and "Polishing Pond", respectively.





**Figure 3: Three Stage OSPW Treatment Process (WRDP)**



**Figure 4: Aerial view of the WRDP**





**Figure 5: Water Return Demonstration Facility (WRDP) Facility**



## 2.3 OBJECTIVES

A key water treatment objective is to reduce concentrations of select constituents present in OSPW to ensure the treated water can be released to the Athabasca River at rates that are protective of human and ecological health. The 2021 field program consisted of two testing programs:

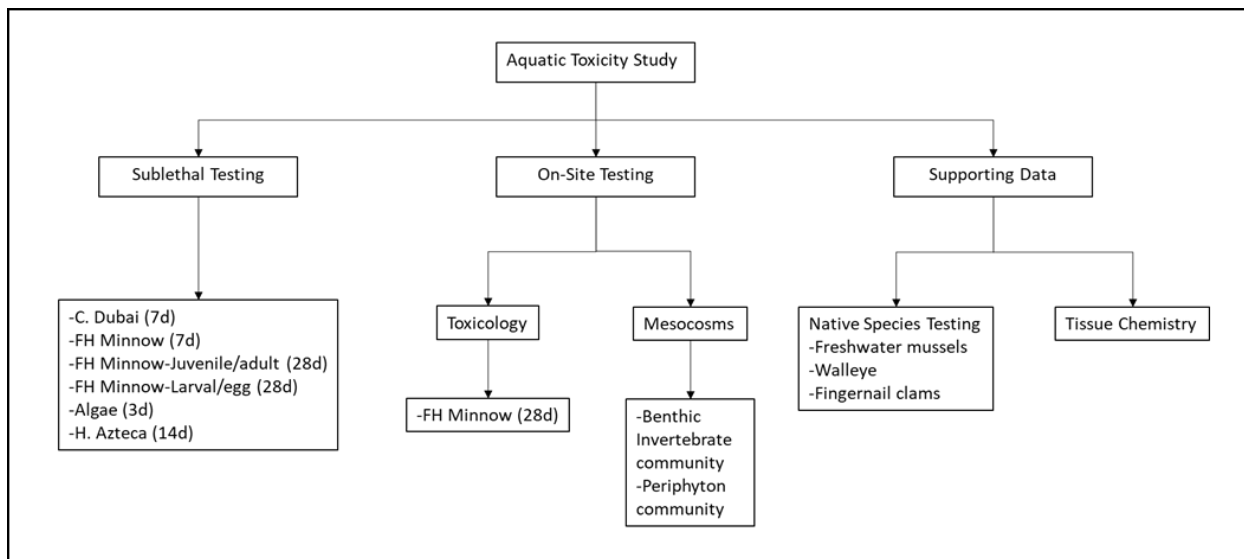
- an onsite program to assess the quality of water from the source (i.e., tailings facilities) to final treatment (i.e., exiting Stage 3), and
- an offsite program to test the treated OSPW using a broad suite of toxicity tests which incorporates both external laboratory testing of the treated OSPW and testing at facilities located at the Fort McKay Incubator Park. The source of treated OSPW for the offsite program was water that exited Stage 3 of the treatment process.

This onsite program assessed the quality of OSPW throughout the treatment process to quantify changes in constituent concentrations including:

- total suspended solids (TSS).
- major cations and anions, pH, total dissolved solids, and conductivity.
- nutrients including ammonia and phosphate.
- naphthenic acids (NAs) by the method of FTIR spectroscopy.
- trace elements – total and dissolved.
- polycyclic aromatic hydrocarbons (PAHs) – parent and alkylated.
- 5-day biochemical oxygen demand (BOD<sub>5</sub>) and chemical oxygen demand (COD).
- phenols.
- benzene, toluene, ethylbenzene, and xylenes (BTEX).
- total petroleum hydrocarbons (TPH).
- dissolved organic carbon (DOC) and colour.
- acute toxicity of OSPW before and after treatment using Environment Canada sanctioned bioassays which included Microtox<sup>TM</sup>, Rainbow Trout and Daphnia Magna.

The offsite program included toxicological testing using standard and non-standard tests as well as the use of mesocosms to assess the response of aquatic invertebrate communities to treated OSPW. Specific components of the 2021 study are shown in Figure 6.





**Figure 6: Summary of the 2021 Aquatic Toxicology Study**



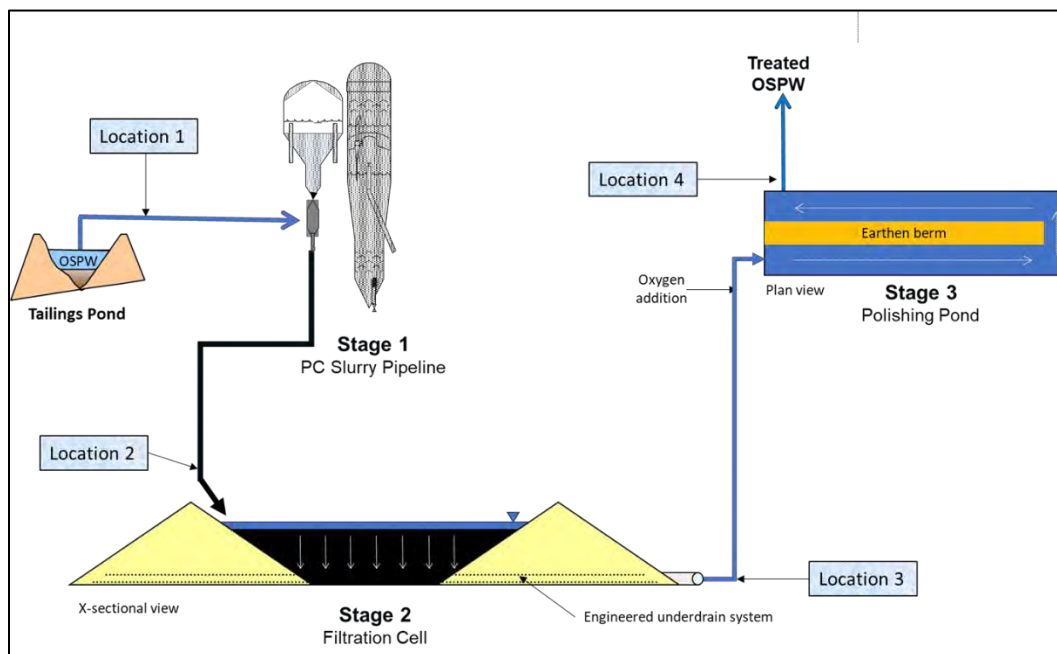
## 3.0 METHODOLOGY

### 3.1 ONSITE WATER CHEMISTRY

A sampling program was implemented to assess the change in OSPW quality throughout the treatment process at four locations which are shown in Figure 7:

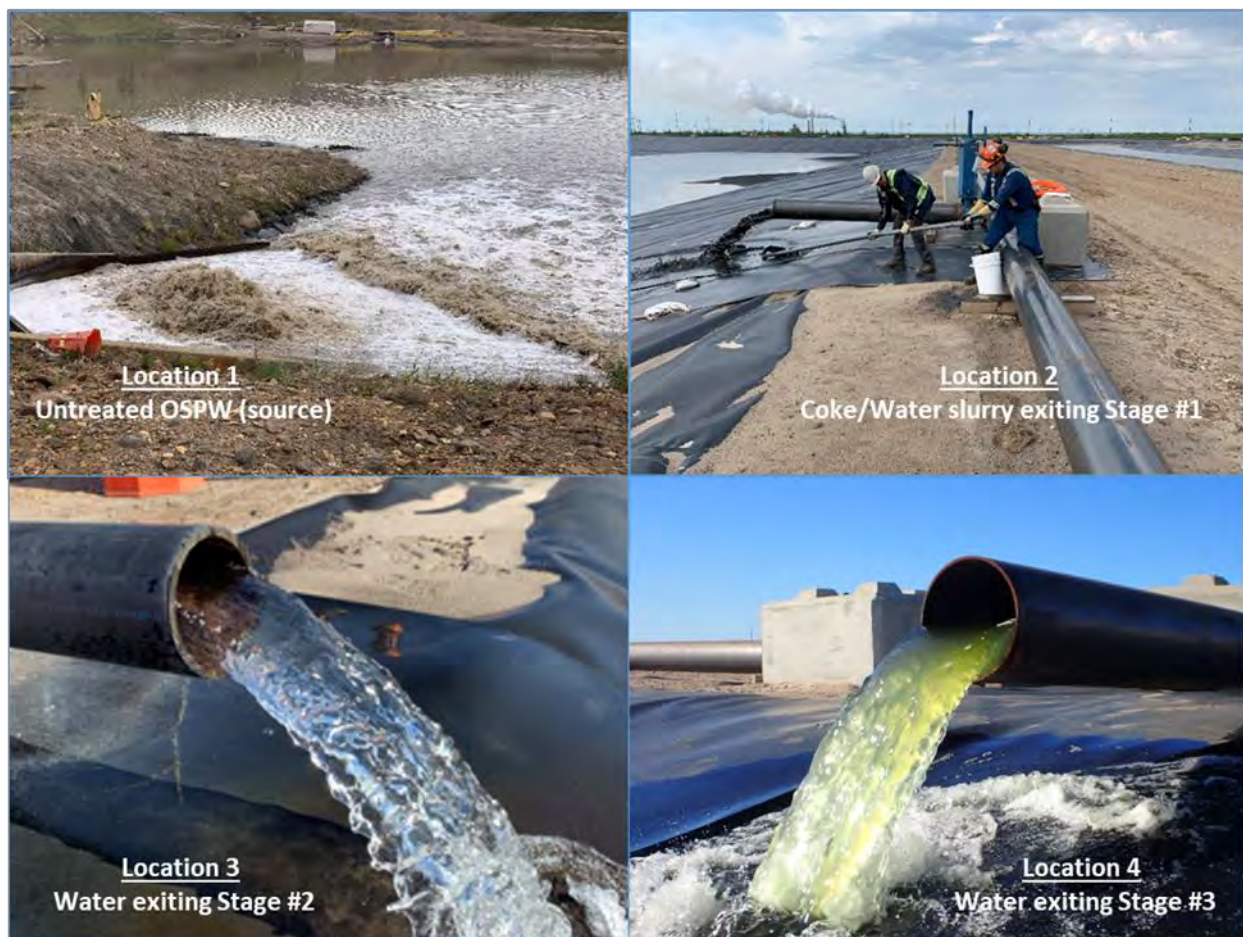
- Location 1
  - Untreated OSPW sourced from the Recycle Water (RCW) Pond.
- Location 2
  - Treated OSPW after pipeline transport (i.e., Stage 1).
- Location 3
  - Treated OSPW after drainage through a contained PC deposit (i.e., Stage 2).
- Location 4
  - Treated OSPW after treatment in an aerated polishing pond (i.e., Stage 3).

Following collection, samples were labelled using an identifier based on location, date, and time. For example, if a sample of untreated OSPW was collected on July 19 at 3:00 PM, the identifier would be LOC1-20210719-1500. Selected photographs showing the water at the four sample locations are included in Figure 8.



**Figure 7: Sample Locations**





**Figure 8: Water at four Sample Locations**

The source of OSPW for the treatment process was Syncrude's RCW pond. As indicated in Figure 8, this water was brown in colour due to the presence of fine-grained material (i.e., clays) that has not settled after being retained in tailings settling ponds. Also, as evident in the photo, OSPW when agitated or subjected to turbulent flow conditions will foam due to the presence of naphthenic acids which are a form of dissolved organic matter present in OSPW. These compounds are beneficial to bitumen recovery as surface active sodium naphthenates, however, at concentrations present in OSPW they are acutely toxic to many aquatic biota (Schramm et al., 2000). Naphthenic acids are a complex mixture of alkyl-substituted acyclic and cycloaliphatic carboxylic acids with the general formula  $C_nH_{2n+Z}O_2$  where  $n$  indicates the number of carbon atoms and  $Z$  specifies the hydrogen deficiency due to ring formation (Clemente and Fedorak, 2005). The value of  $Z$  is either zero or a negative, even integer. The number of rings—fused or bridged—in a specific compound can be derived by taking the absolute value of  $Z$  and dividing by 2.



### 3.2 SAMPLE ANALYSES – WATER QUALITY

Untreated and treated samples were collected directly into 20 L polyethylene (PE) pails. For water chemistry, subsamples were placed into dedicated laboratory supplied containers, preserved as necessary, and submitted for laboratory analyses to Bureau Veritas Laboratories Inc. (BV Labs) within 24 hours of collection for all analytes except for pH, conductivity, and naphthenic acids (NAs) which were completed at Syncrude's Research facility located in Edmonton, Alberta. Analytes included trace metals (dissolved and total), major anions and cations, ammonia, alkalinity, parent and alkylated polycyclic aromatic hydrocarbons (PAHs), total dissolved solids (TDS), total suspended solids (TSS), 5-day biological oxygen demand (BOD<sub>5</sub>), chemical oxygen demand (COD), phenols, total petroleum hydrocarbons (TPH), dissolved organic carbon (DOC), and true colour. For dissolved trace elements, analyses were completed on samples that were field filtered using a Millipore® 0.45 µm syringe filter and preserved with nitric acid. OSPW/PC slurry samples collected from Location 2 were allowed to gravity settle and the overlying water filtered using 0.45 µm syringe filters. Analytical methods followed by BV Labs are summarized in Table 1.

**Table 1: Analytical Methods used by BV Labs.**

Analyte	Method
<i>General Properties</i>	
True Colour	SM 23 2120 Cm
Total Dissolved Solids (TDS)	Calculated
Total Suspended Solids (TSS)	SM 23 2540 D m
<i>Inorganics</i>	
Elements by ICP	EPA 6010d R5 m
Elements by ICPMS	EPA 6020b R2 m
Chloride	SM23-4500-Cl/SO4-E m
Sulphate	SM23-4500-Cl/SO4-E m
Alkalinity	SM 23 2320 B m
Phosphorus	SM 23 4500-P A,B,F m
Ion Balance	Calculated
Ammonia-N Total	SM 23 4500 NH3 A G m
Nitrogen	SM 23 4110 B m/SM 23 4500-N C m
Mercury-low level	BCMOE BCLM Oct2013 m
Nitrate/Nitrite	SM23 4500 NO3m



**Table 1: Analytical Methods used by BV Labs. (Con't)**

Analyte	Method
<i>Organics</i>	
Dissolved Organic Carbon (DOC)	MMCW 119 1996 m
Biochemical Oxygen Demand (BOD <sub>5</sub> )	SM 23 5210 B m
Chemical Oxygen Demand (COD)	SM 23 5220 D m
Phenols	EPA 9066 RO m
TPH (BTEX/F1/F2)	CCME CWS/EPA 8260 d m/ PHC-CWS m
Parent and Alkylated PAHs	EPA 8270e M
<i>Toxicology</i>	
Rainbow Trout ( <i>Oncorhynchus mykiss</i> )	EPS 1 RM13 2nd ed m
Water Flea ( <i>Daphnia Magna</i> )	EPS 1 RM14 2nd ed m
MicroTox™ ( <i>Allivibrio fischeri</i> )	EPS 1/RM/24 Modified MicroTox EC 50 (15

Samples were also analyzed at SCL's Research facility in Edmonton, Alberta for naphthenic acids (NAs), pH, and conductivity. Samples were collected directly from the 20 L pails, using either 250 mL, or 500 mL dedicated glass containers, and shipped to Edmonton in an ice-chilled cooler within 48 h following collection.

NAs in OSPW were quantified using the Fourier Transform Infrared Spectroscopy (FT-IR) method described by Ripmeester and Duford (2019). The procedure involved acidifying with hydrochloric acid an appropriate volume of OSPW sample (50 to 80 mL) to pH 2 and triple-extracting the NAs precipitate with dichloromethane (with a 2:1 v/v sample to solvent ratio). The extracts were combined, evaporated to dryness and then re-dissolved in a known quantity of dichloromethane. A Bruker Alpha FTIR spectrometer was used to quantify infrared light adsorption at two wavenumbers: 1703 cm<sup>-1</sup> and 1740 cm<sup>-1</sup> which corresponds to the carbonyl stretch of monomer and dimer carboxylic acid groups. The concentration of NAs in the solvent was determined by comparing the total peak height of the samples to a standard calibration curve. Prior to analyses, a five-point calibration line was established using a commercially purchased naphthenic acid standard (Fluka #70340) with a method detection limit of 0.1 mg/L.

Conductivity and pH values were measured using a Jenway 4330 dual conductivity and pH meter. Prior to pH measurement, the electrode system was calibrated using commercially purchased (Metrohm) standard buffer solutions (pH 4, 7 and 9). The conductivity meter was calibrated using a 1000 µS standard solution purchased from Fisher Scientific Ltd.

Selected samples from Locations 1, 3 and 4 (Figure 7) were collected into dedicated 20 L HDPE pails and shipped to BV Labs for toxicology based on Environment Canada testing protocols using rainbow trout, daphnia magna, and luminescent bacteria (MicroTox™).



## **4.0 PROJECT RESULTS**

### **4.1 ON-SITE PROGRAM**

During the 2021 program, technology effectiveness for treating OSPW at an operational scale was evaluated through a sampling and analytical program conducted between July 19 and October 13. Water samples from the four locations shown in Figures 7 and 8 were collected for analyses based on the methods described in Section 3.2. Between mid-July to early August, samples of OSPW prior to treatment were taken from the recycle water pond (LOC1). The untreated water was mixed with fresh petroleum coke to produce a slurry that can be transported by pipeline (Figure 2). The resulting slurry was deposited to the filtration cell (Stage 2) as shown in Figures 3 and 4. Samples of the coke slurry were taken at the discharge point (LOC2) between mid-July and August. During the period up to mid-August, a coke bed was allowed to develop to ensure a filter bed over the underdrains. Water was collected from the underdrain system (LOC3) between August 11 and October 13. These samples were representative of the water quality that was placed into the polishing pond (Figure 3). Water samples were collected from the outlet of polishing pond between August 24 and September 29 (LOC4) and were representative of Stage 3 treated waters. It should be noted that Treated OSPW exiting the polishing pond (Stage 3) was returned to the on-site inventory of OSPW, rather than being allowed to be released.

In Figure 8, a visual comparison of waters collected at LOC1 to LOC4 is shown. Untreated OSPW (LOC1) exhibited significant concentrations of mineral particulate, whereas the Treated OSPW produced from Stage 2 (LOC3) was clear with no visual evidence of suspended solids or biota. This contrasts to the Treated OSPW from Stage 3 (LOC4) which displayed a noticeable greenish tinge indicating the presence of an algal bloom.

The complete set of water chemistry data collected for the 2021 field pilot is included in Tables A1 to A8, Appendix A.

#### **4.1.1 DISSOLVED ORGANIC COMPOUNDS**

To assess the effectiveness of the process to reduce concentrations of dissolved organic compounds present in OSPW, samples were collected at the OSPW source (Location 1) and throughout the treatment process after Stage #1 (Location 2), Stage #2 (Location#3), and Stage #3 (Location 4). The following water quality measurements were used to assess changes in organic constituents:

- Naphthenic acids (NAs)
- Dissolved organic carbon
- Chemical Oxygen Demand (COD)
- Biochemical oxygen demand (5 day)
- True colour
- Total petroleum hydrocarbons



- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Phenols
- Polycyclic Aromatic Hydrocarbons

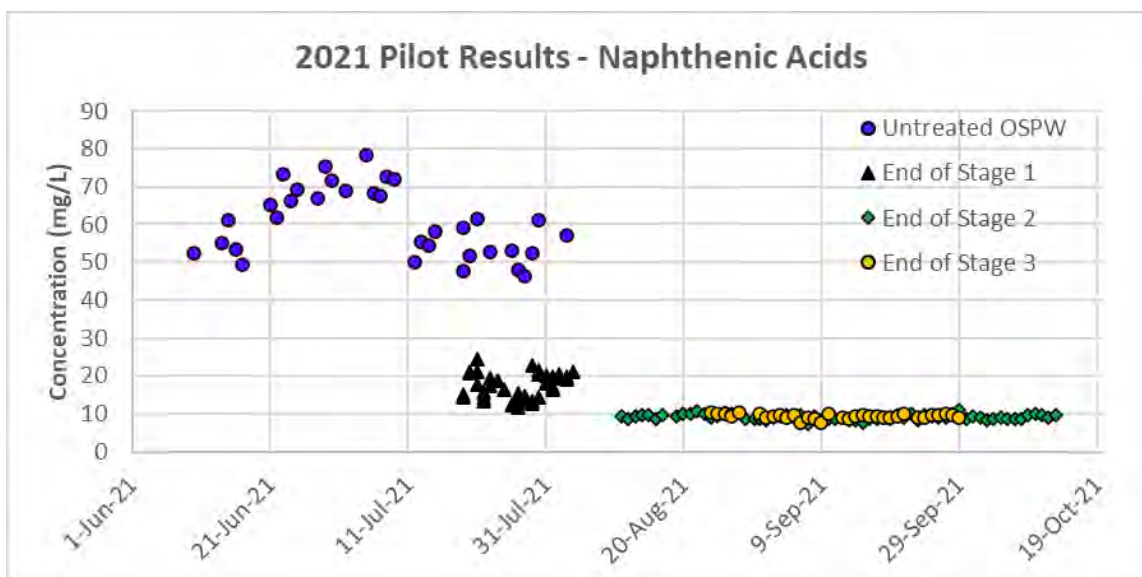
#### **4.1.1.1 Naphthenic Acids**

Naphthenic acids account for the majority of dissolved organic matter present in OSPW (Boerger et al., 1986; Gulley et al., 1993; Grewer et al., 2010). NAs concentrations in untreated OSPW ranged between 46.3 and 78.4 mg/L and averaged 60.6 mg/L (Figure 9). Following Stage 1, concentrations ranged between 11.5 and 24.3 mg/L and averaged 17.6 mg/L representing about a 71% reduction. The engineering design basis for the pipeline is to transport coke/OSPW slurries at concentrations of about 20-22 wt.%. However, in practice, there is considerable variation in the amount of coke in the pipeline and is subject to coker operating conditions such as bitumen feed rates, silo operation, water addition rates, etc. Because the removal efficiency in Stage 1 is directly related to the concentration of PC in the slurry (Zubot, 2010), the variability in NAs concentrations exiting Stage 1 reflects operational variations of the amount of PC in the pipeline.

Following Stage 2, concentrations ranged between 7.3 and 10.8 mg/L and averaged 9.1 mg/L. Relative to the untreated OSPW, this represents a removal efficiency of about 85%. Relative to the untreated OSPW and treated OSPW following Stage 1, the variability in NAs concentrations was attenuated in Stage 2. For the 2021 field program, treated OSPW samples collected from Stage 2 occurred over about 2 months between August 11 and October 13, 2021. Previous work (Zubot, 2012) has demonstrated the adsorption process with PC is biphasic. Initially the adsorption reactions are fast and followed by a slower diffusion-controlled process. It is anticipated, as the porewater residence time increases, additional removal of NAs will occur, although this was not readily apparent during the 2021 field program because of the limited time the facility was operational.

After Stage 3, NAs concentrations were practically unchanged relative to the water exiting Stage 2. Concentrations averaged 9.3 mg/L and ranged between 7.5 and 10.4 mg/L. The water residence time of Stage 3 was approximately 8 days. The purpose of Stage 3 is to promote biological degradation of ammonia. It was not expected to further reduce concentrations of NAs because of long time periods required for aerobic degradation of the class of compounds (Han et al., 2009; Harris, 2010).





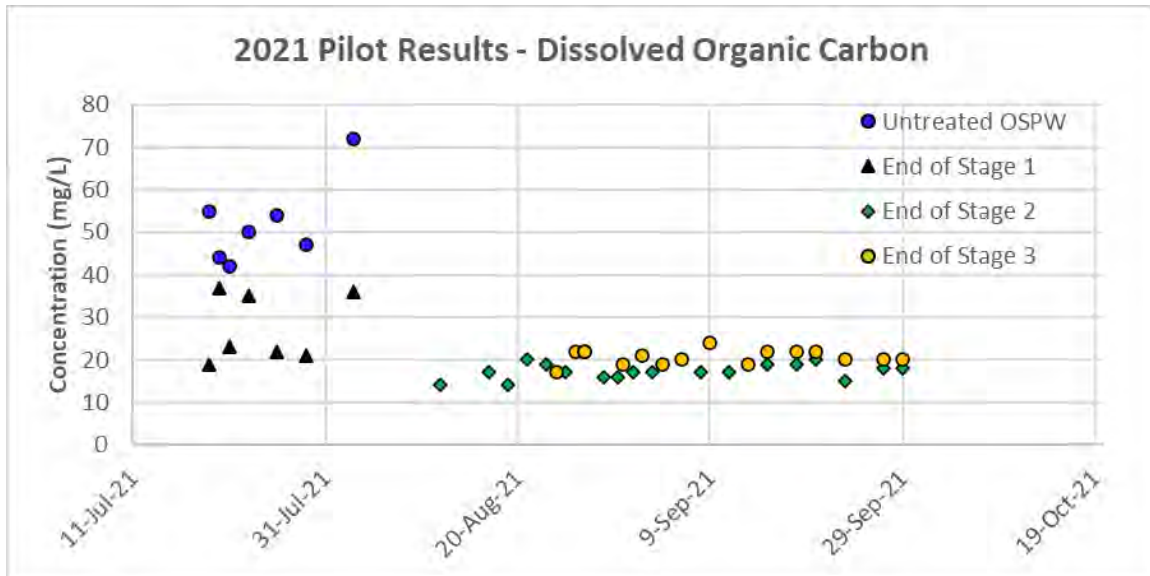
**Figure 9: Change in NAs concentrations in OSPW**

#### 4.1.1.2 DOC, COD, BOD5, and True Colour

Dissolved organic carbon (DOC) and chemical oxygen demand (COD) were measured to quantify the aggregate amount of organic matter present in the untreated and treated OSPW. DOC is a direct measure of the total organic content and, unlike COD, it is independent of the oxidation state of the carbon. COD is an indirect measure of the organic matter present in water and is based on measuring the oxygen equivalent of the organic matter of a water sample that is susceptible to oxidation by a strong oxidizing agent.

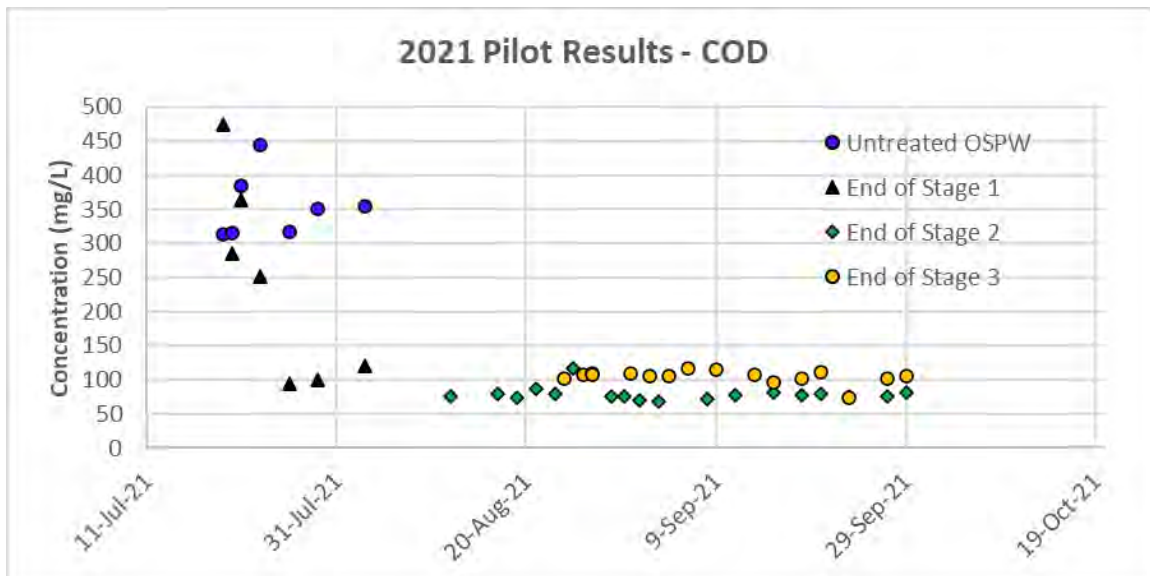
As shown in Figure 10, concentrations of dissolved organic carbon (DOC) in untreated OSPW ranged between 42 and 72 mg/L and averaged 52 mg/L. After Stage 1, concentrations averaged 26.2 mg/L representing a 50% reduction. Following Stage 2 treatment, levels were further reduced and averaged 17.2 mg/L. Relative to untreated OSPW, this correlates to a removal efficiency of about 67%. Following Stage 3, concentrations slightly increased and averaged 20.2 mg/L. This corresponds to visual indications of increased primary production (Figure 8)





**Figure 10: Change in DOC concentrations in OSPW**

Changes in chemical oxygen demand (COD) in OSPW throughout the treatment process are shown in Figure 11. In untreated OSPW, COD concentration ranged between 313 and 445 mg/L and averaged 354 mg/L. After Stage 1 average COD concentrations were 241 mg/L which were further reduced to an average of 79 mg/L following Stage 2. This represents a removal efficiency of 78%. After Stage 3, there was a slight increase in COD with concentrations averaging 105 mg/L which is consistent with elevated biological production.

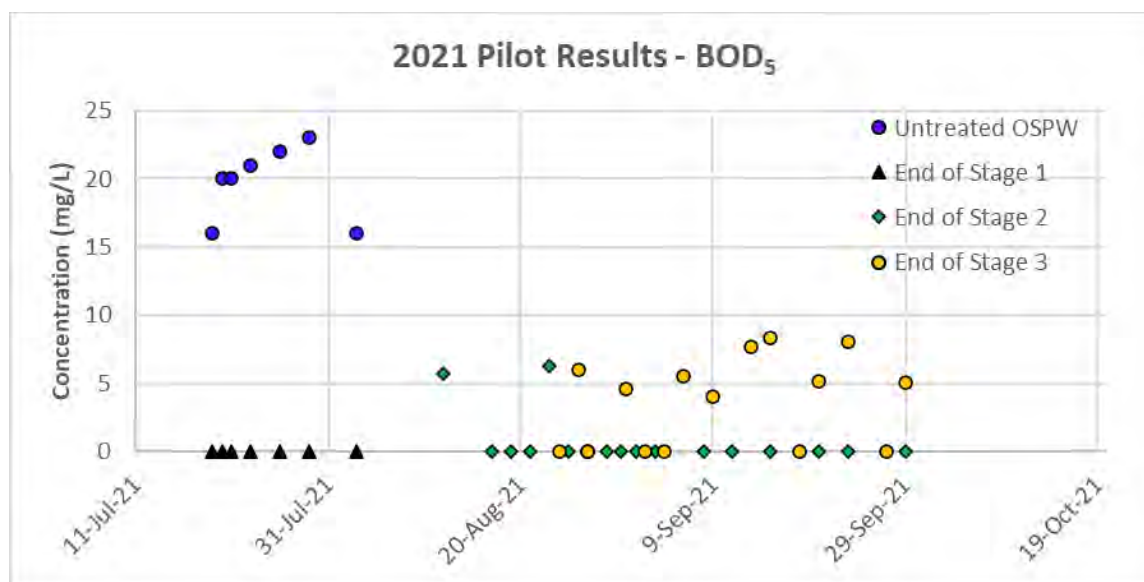


**Figure 11: Change in COD concentrations in OSPW**



To assess changes in the amount of biodegradable organic matter present in OSPW, biochemical oxygen demand (BOD<sub>5</sub>) measurements were completed. These tests (Figure 12) measured the amount of molecular oxygen utilized over a 5-day time period for the degradation of organic material.

In untreated OSPW, BOD<sub>5</sub> concentrations ranged between 16 and 23 mg/L and averaged 20 mg/L. Following Stages 1 and 2 of the treatment processes, concentrations were generally less than laboratory detection limits. In Figure 12, BOD<sub>5</sub> measurements reported as less than detection limits are shown on the x-axis as zero values. Table A3, Appendix A includes the laboratory reported detection limits which varied for some samples but ranged between 2 and 6 mg/L. Following Stage 3 treatment, and similar to DOC and COD concentrations, an increase in BOD<sub>5</sub> concentrations was observed. Excluding the values reported as “less than” detection limits”, BOD<sub>5</sub> concentrations after Stage 3 treatment averaged 6 mg/L.



**Figure 12: Change in BOD5 concentrations in OSPW**

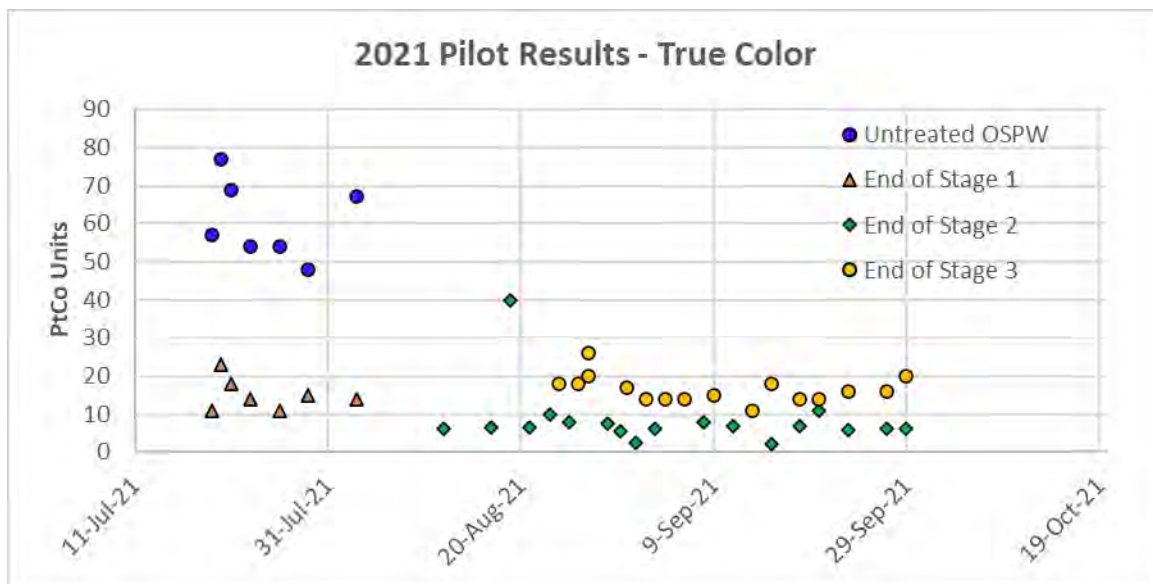
True colour is an aesthetic property of particle-free water that is reported as colour units (tcu) based on the platinum-cobalt method. This contrasts to “apparent colour” which includes not only colour due to dissolved substances in solution, but also that due to suspended matter. Untreated OSPW has a characteristic yellow colour because of the dissolved organic compounds. This is illustrated in Figure 13 which shows particle-free OSPW before and after removal of dissolved organic material.





**Figure 13: Change in True Colour in OSPW**

Changes in true colour of OSPW are shown in Figure 14. The colour units (tcu) of untreated OSPW averaged 61 tcu and ranged between 48 and 77 tcu. Following Stage 1 and 2 treatments, the colour progressively decreased. After Stage 1, the colour ranged between 11 and 23 tcu and averaged representing colour removal of about 85% relative to untreated OSPW. After Stage 3, there was an increase in colour which averaged 17 tcu and ranged between 11 and 26 tcu.



**Figure 14: Change in True Colour in OSPW**

Concentrations of DOC, BOD<sub>5</sub>, COD and true colour (Figures 10-14) increased in Stage 3, relative to Stage 2 and is indicative of increased rates of primary production (i.e., rate of fixation of solar energy into cell



tissue) that occurred in the polishing pond. The concentration of organic matter in a natural water body results from an interplay of net productivity, release of organic substances by phytoplankton and the import and export of organic matter (Stumm, Morgan, 1996). Unlike aggregate measures of organic carbon (DOC, BOD<sub>5</sub>, COD) which increased in Stage 3, there were no increases in NAs concentrations (Figure 9). This is an expected result given these compounds are not byproducts of cellular respiration. Figure 15 shows several photographs of the treated OSPW in Stages 2 and 3. The green colour of the water apparent in Stage 3 is due to the presence of formed algae. The primary production which occurred was enhanced by at least two characteristics of the treated OSPW leaving Stage 2: the water was clear (Figure 25) which permitted photosynthesis via sunlight penetrating the water column and it was nutrient rich (Figure 46).



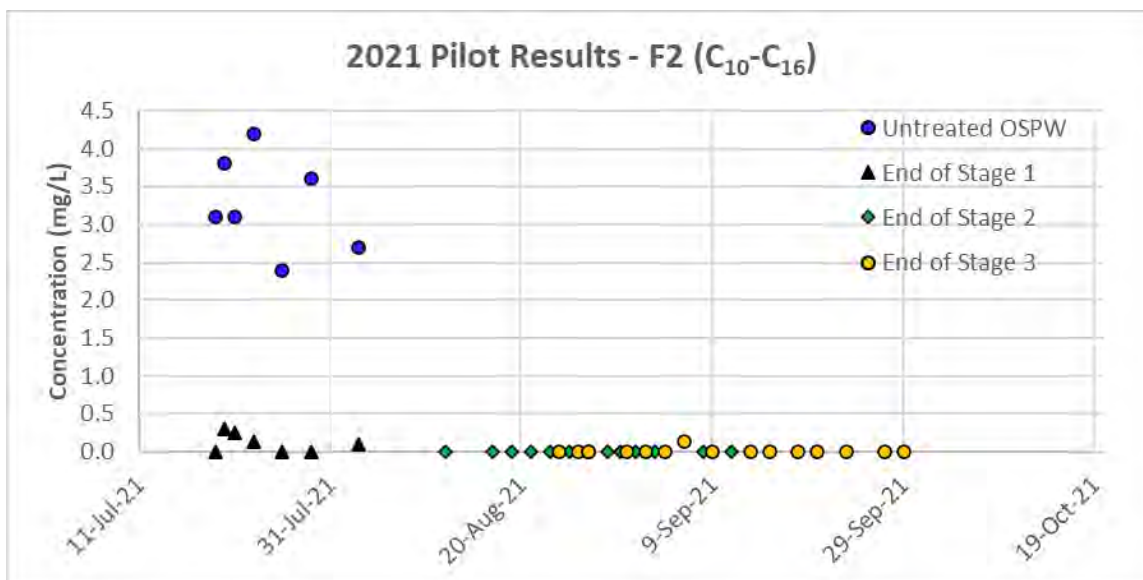
**Figure 15: OSPW at Stages 2 and 3.**

#### **4.1.1.3 Total Petroleum Hydrocarbons**

The aqueous extraction process does result in some hydrocarbons solubilizing into OSPW. Total petroleum hydrocarbons (TPH) were quantified into three fractions based on carbon number: F1(C<sub>6</sub>-C<sub>10</sub>), F2 (C<sub>10</sub>-C<sub>16</sub>), and F3 (C<sub>16</sub>-C<sub>34</sub>). In the untreated and treated OSPW (Stages 1, 2, and 3), all samples contained F1 hydrocarbons at concentrations less than the detection limit of 100 µg/L (Table A3, Appendix A).



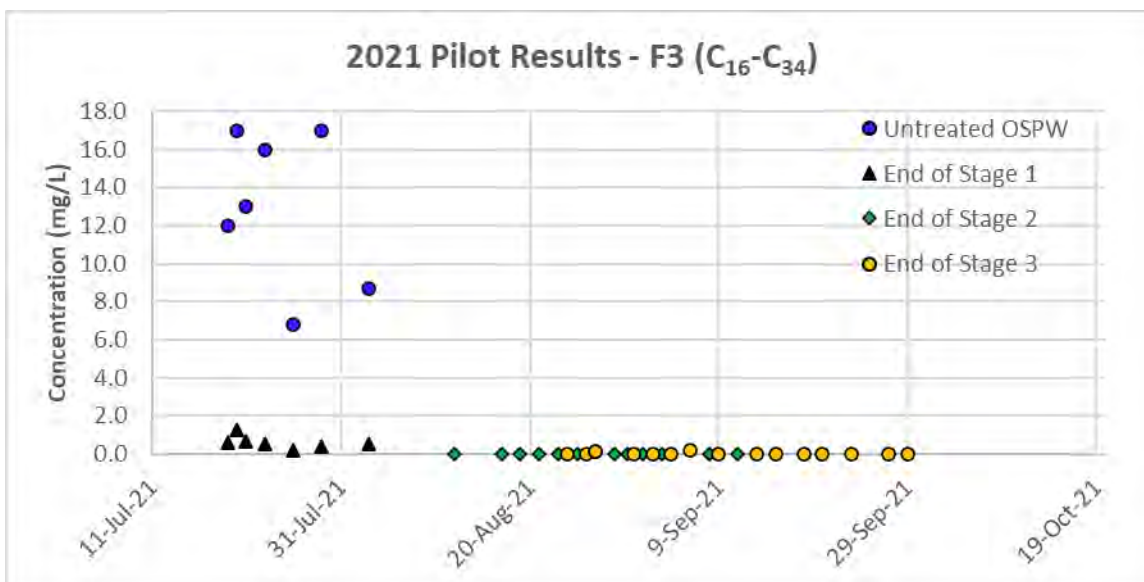
F2 hydrocarbons were present in untreated OSPW at an average concentration of 3.3 mg/L and ranged between 2.4 and 4.2 mg/L. As shown in Figure 16, the treated OSPW after Stages 1, contained F2 components at or near the method detection limit of 0.1 mg/L. Following Stages 2 and 3, concentrations were less than analytical detection limits indicating removal efficiencies exceeding 95%.



**Figure 16: Changes in F2 Hydrocarbons in OSPW**

F3 hydrocarbons in untreated OSPW ranged between 6.8 and 17.0 mg/L and averaged 12.9 mg/L. Following Stage 1 treatment, concentrations were significantly reduced and averaged 0.6 mg/L and ranged between 0.2 and 1.3mg/L. After Stages 2 and 3, F3 hydrocarbon concentrations were generally less than analytical detection limits (0.1mg/L) as shown in Figure 17 and Table A3, Appendix A.

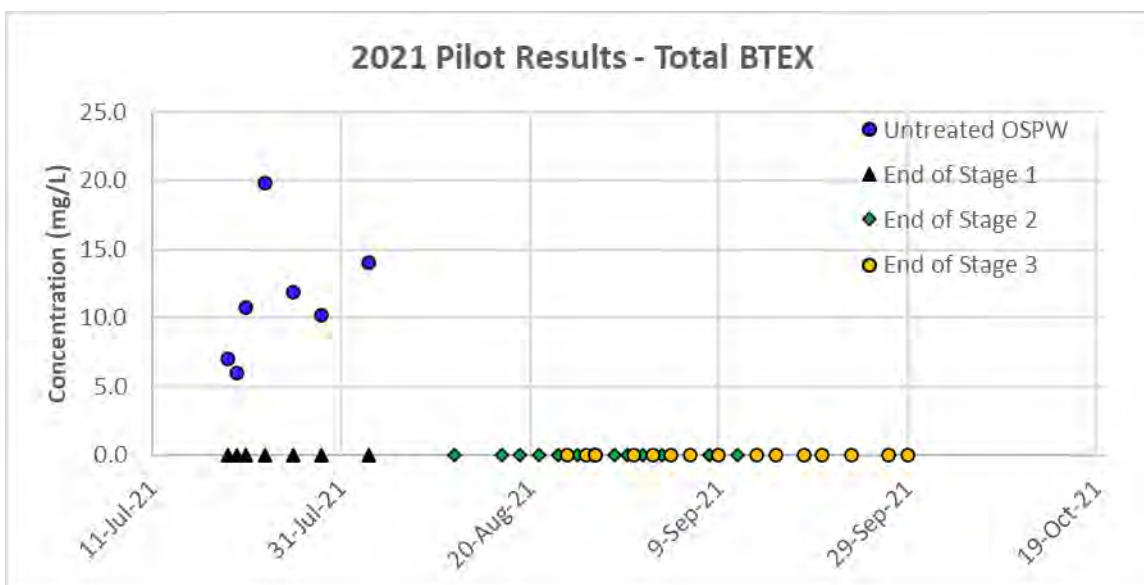




**Figure 17: Changes in F3 Hydrocarbons in OSPW**

#### 4.1.1.4 Benzene, toluene, ethylbenzene, and xylenes

In untreated OSPW, total concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) averaged 11 µg/L and ranged between 6 and 20 µg/L. As indicated in Table A3, Appendix A, total BTEX was primarily attributable to xylenes. As shown in Figure 18 and after Stage 1, as well as Stages 2 and 3, BTEX components were less than laboratory detection limits (0.4 µg/L).

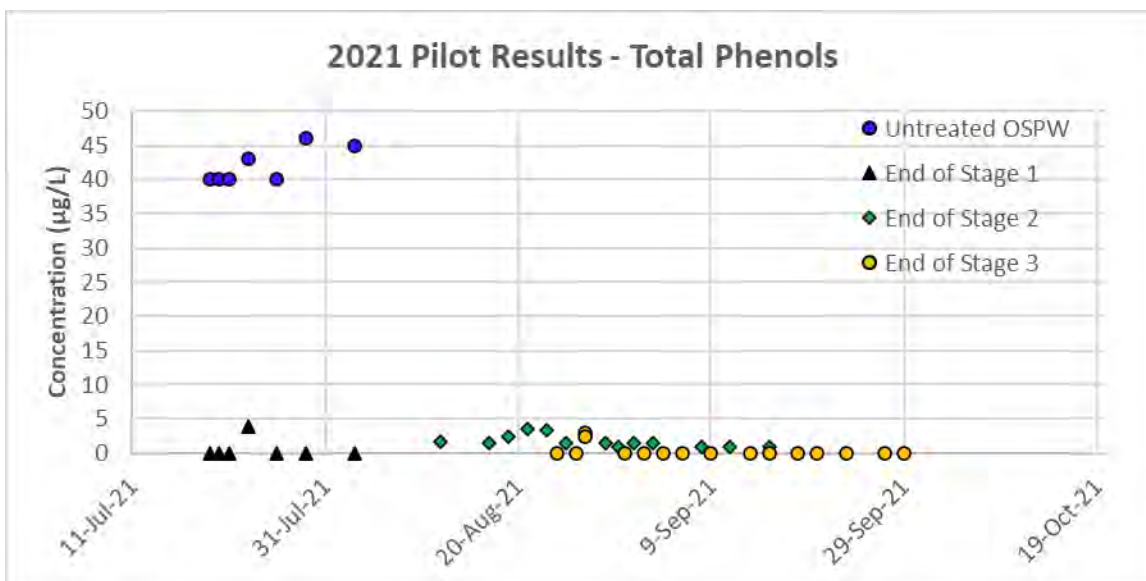


**Figure 18: Changes in BTEX in OSPW**



#### 4.1.1.5 Phenols

Phenolic compounds are relatively polar and represent a small fraction of the dissolved organics present in OSPW. Changes in concentrations of total phenols are shown in Figure 19. The method of analyses (EPA 9066 R) is based on distillation and reaction to form a red complex which is quantified by absorbance techniques. In general, it measures total phenols, ortho and meta substituted phenols, and in some cases, para substituted phenols (Standard Methods, 1995). Method detection limits did vary based on the sample and ranged between 1.5 and 5 µg/L. In untreated OSPW, phenols averaged 42 µg/L and ranged between 40 and 46 µg/L. Following Stage 2, phenol concentrations were reduced and varied between less than 1.5 ug/L and 3.6 µg/L. Following Stage 3, concentrations were further reduced and in general were less than the detection limit of 1.5 µg/L. Relative to untreated OSPW, removal efficiencies after Stage 3 generally exceeded 95%.



**Figure 19: Changes in Phenols in OSPW**

#### 4.1.1.6 PAHs

Samples of untreated OSPW and after the three treatment stages were analyzed for parent and alkylated polycyclic aromatic hydrocarbons (PAHs). In OSPW, the dominated types are the alkylated forms. Individual PAH data is provided in Table A7, Appendix A. Total PAHs which represent the summation of the individual parent and alkylated forms are shown in Figure 20.

In untreated OSPW, concentrations of total PAHs ranged between 72 and 442 µg/L and averaged 214 µg/L. Following Stage 1, concentrations were significantly reduced and ranged between 0.3 and 3.4 µg/L and averaged 1.4 µg/L. Following Stage 3, total PAHs ranged between less than detection limits and 0.53 µg/L and averaged 0.15 µg/L, representing a removal efficiency exceeding 99%. These results



are consistent with the chemical and physical properties of PAHs which, in general, have very low water solubility's, low vapor pressures and high octanol-water partition coefficients (McKay 1991).

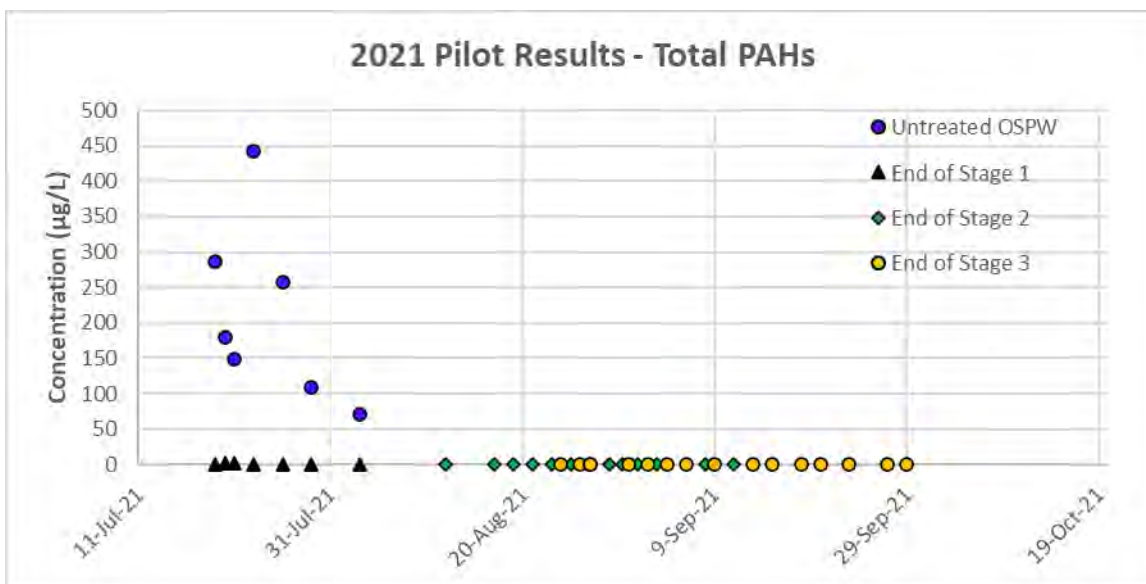
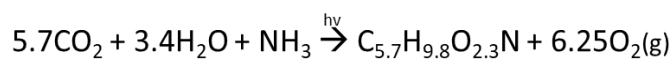


Figure 20: Changes in total PAHs

#### 4.1.2 GENERAL CHEMISTRY

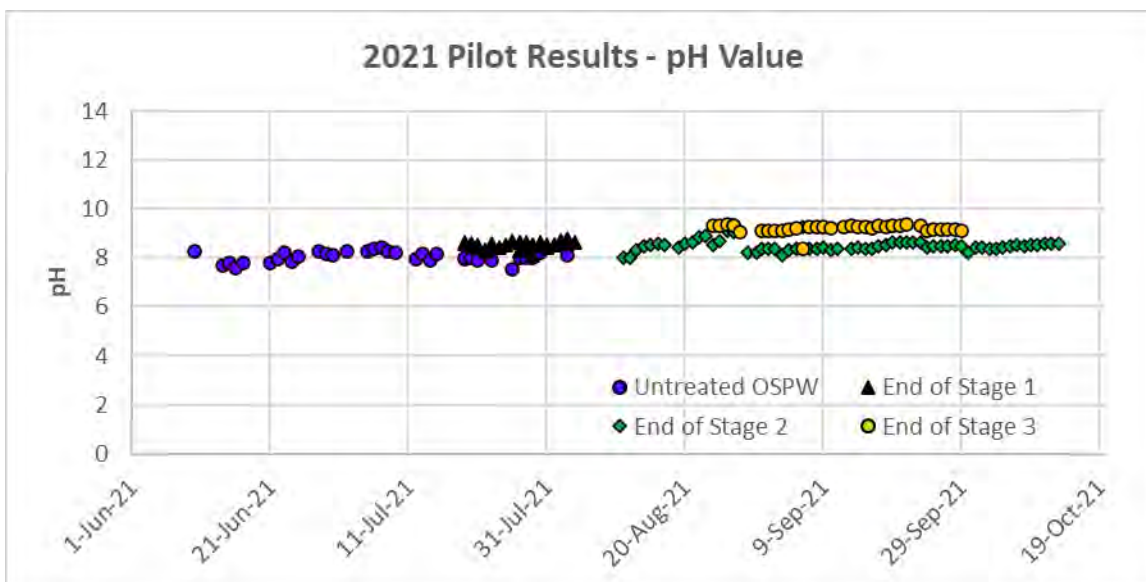
##### 4.1.2.1 pH

Figure 21 presents the pH measurements of the OSPW throughout the treatment process. The average pH of the untreated water was 8.0. After Stage 1, the pH of the treated OSPW increased and averaged 8.5. There was no significant pH increase following Stage 2. However, after Stage 3, the pH value further increased and ranged between 8.2 and 9.4 and averaged 9.2. This increase is likely related to the biological activity in the polishing pond which contained sufficient quantities of algae that produced water that was green in colour (Figure 15). Algae subsist on inorganic nutrients and produce organic matter by photosynthesis. A general formula for the photosynthetic production of algal biomass, exclusive of the phosphorus requirement, is shown by the following reaction (Manahan, S.E.,1991):



When photosynthesis occurs, the amount of  $\text{CO}_2(\text{aq})$  decreases because it is converted to cell tissue, which results in a pH increase. The removal of carbon dioxide during periods of photosynthetic activity is often the underlying cause for elevated pH values in open water bodies that contain algae blooms (Macintosh, 2022)





**Figure 21: Changes in pH value**

#### 4.1.2.2 Major Cations

In OSPW, the major cations include monovalent sodium and potassium and divalent magnesium and calcium. Sodium is the dominant cation present in OSPW and potassium in a relatively minor component. Sources of sodium include connate water which reports to OSPW during the extraction process, the use of sodium hydroxide as a process aid, and the addition of saline groundwaters to existing operational inventories of OSPW. Sodium salts are highly soluble, and the cation is relatively conservative, although the ion is prone to ion exchange reactions. The divalent cations calcium and magnesium are relatively non-conservative. Concentrations will be affected by pH changes, precipitation/evaporation and cation exchange reactions with clay minerals.

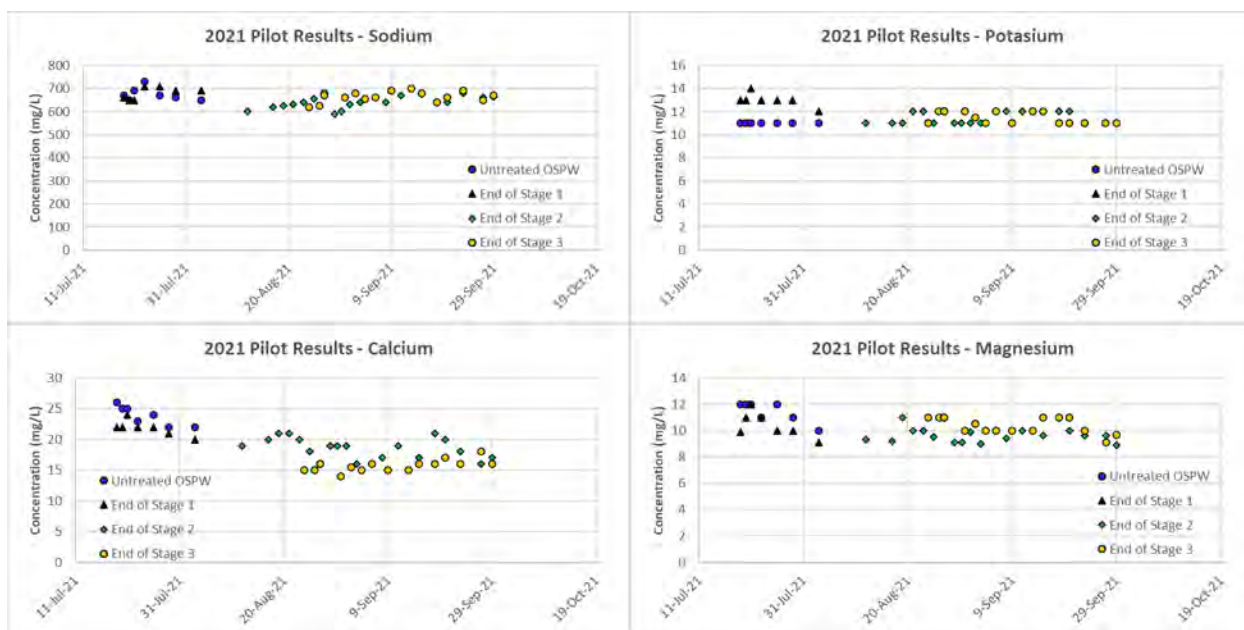
Concentrations of sodium, potassium, calcium, and magnesium in the untreated and treated OSPW are shown in Figure 22. With the exception of calcium, the treatment process did not materially increase or decrease concentrations of major cations.

Calcium concentrations decreased as the water progressed through the treatment process. In the untreated OSPW concentrations averaged 23.9 mg/L, and following Stages 1, 2, and 3, calcium levels averaged 21.9, 18.7, and 15.7 mg/L, respectively. The reduction is likely attributable to the increased pH which occurred in Stage 3 (Figure 21). Calcium carbonate can be precipitated when algae removes carbon dioxide from the water, thus increasing the pH in accordance with the following reaction:



The removal of dissolved carbon dioxide shifts the above reaction to the right which will reduce concentrations of calcium in the treated OSPW





**Figure 22: Changes in Major Cations**

#### 4.1.2.3 Major Anions

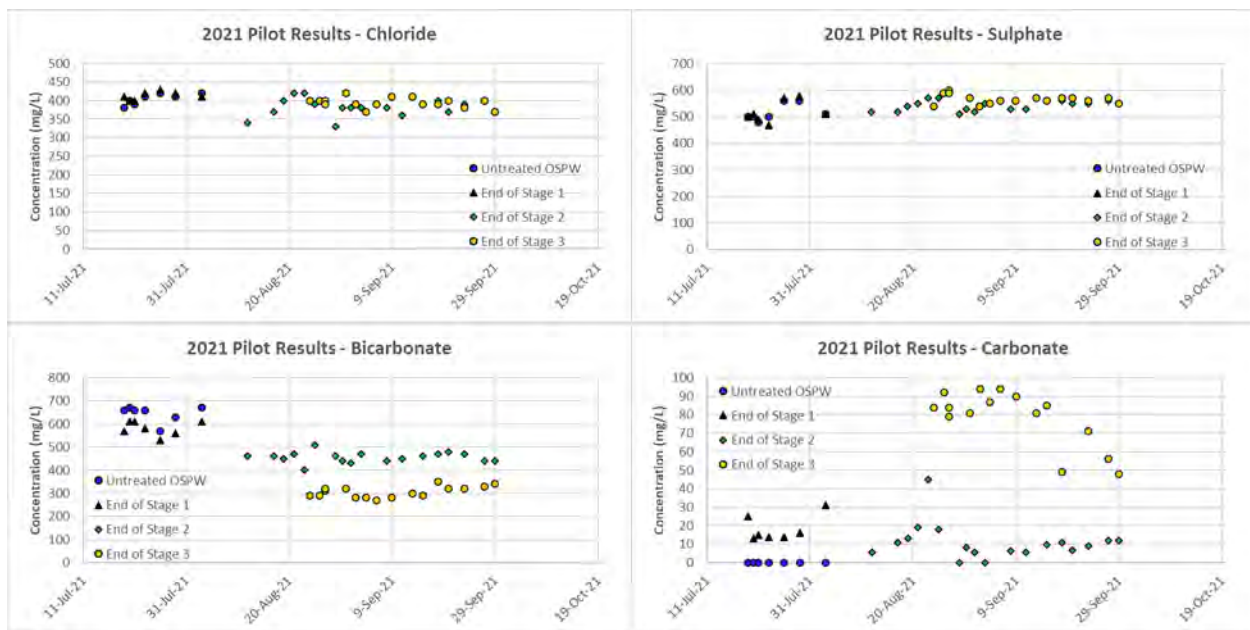
In OSPW, the major anions include chloride, sulphate, bicarbonate, and carbonate. The chloride ion is conservative and is not subject to chemical reactions such as precipitation, ion exchange and volatilization. The sulphate ion provided aerobic conditions are maintained is also relatively conservative ion with few sinks. However, under anaerobic conditions (negative redox potential), the ion can undergo microbial reduction and precipitation as sulfides. Inorganic carbon is in a dynamic equilibrium between bicarbonate ( $\text{HCO}_3^-$ ) and carbonate ( $\text{CO}_3^{2-}$ ) species.

Changes in concentrations of bicarbonate and carbonate relate to the pH of the water. The consumption of carbon dioxide due to photosynthesis resulted in an increase in the pH of the OSPW (Figure 21). The pH changes relate to the carbonate system as follows:



As the pH of OSPW increases (average pH on untreated OSPW ~ 8.0, average pH after stage 3 ~ 9.2), bicarbonate is converted to carbonate. The most pronounced decrease in bicarbonate occurred across Stage 3. In addition to conversion of bicarbonate to carbonate due to the pH increase, bicarbonate (i.e., dissolved carbon dioxide) was also consumed due to photosynthetic processes in Stage 3 which converted inorganic carbon to organic carbon. As indicated in Table A1, Appendix A, there was no alkalinity due to the hydroxide ion because the pH of the treated water (Stage 3) did not exceed 9.5.





**Figure 23: Changes in Major Anions**



#### 4.1.2.4 Electrical Conductivity

Electrical conductivity measurements of the OSPW are shown in Figure 24. Consistent with the cation and anion measurements, there were no material changes in conductivity as the OSPW progressed through the treatment process. In the untreated OSPW, conductivities averaged 3401  $\mu\text{S}/\text{cm}$  and ranged between 2960 and 3830  $\mu\text{S}/\text{cm}$ . After Stage 1, conductivities ranged between 3260 and 3470  $\mu\text{S}/\text{cm}$  and averaged 3346  $\mu\text{S}/\text{cm}$ . Following Stage 2, the conductivities ranged between 2720 and 3280  $\mu\text{S}/\text{cm}$  and averaged 3055  $\mu\text{S}/\text{cm}$ . The conductivity of the treated OSPW exiting Stage 3 averaged 3154  $\mu\text{S}/\text{cm}$  and ranged between 3040 and 3290  $\mu\text{S}/\text{cm}$ .

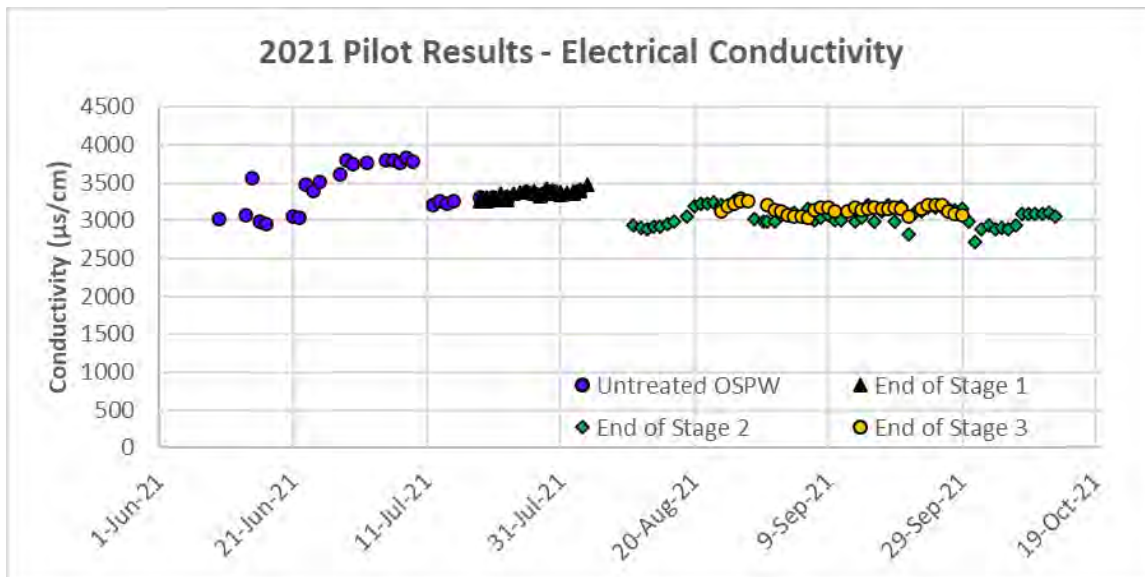


Figure 24: Changes in Electrical Conductivity

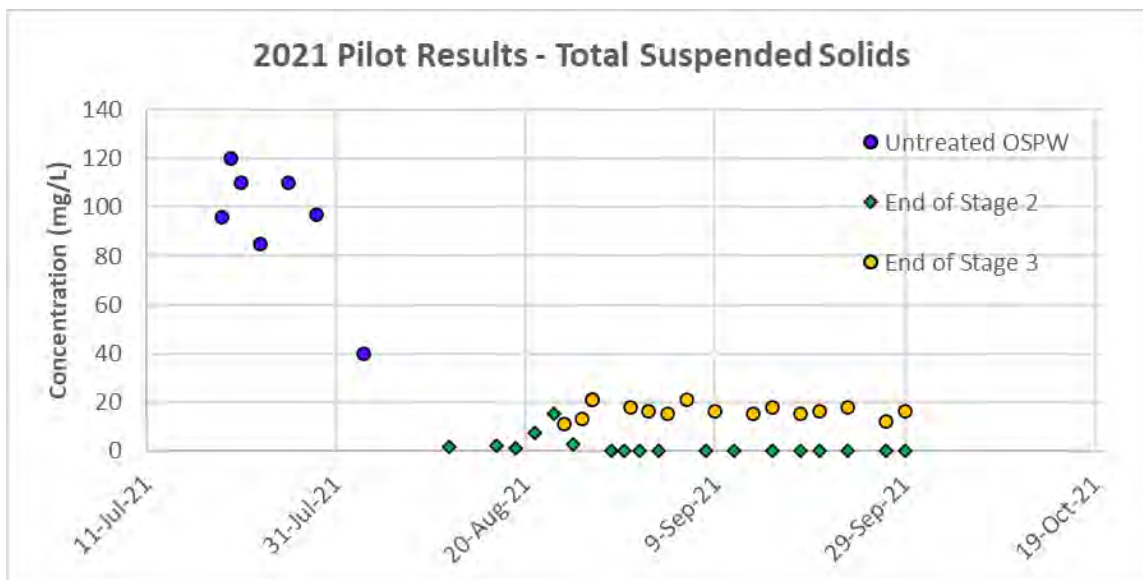
#### 4.1.2.5 Total Suspended Solids (TSS)

The untreated OSPW was sourced from the Recycle Water (RCW) Pond which receives OSPW from numerous tailings ponds including the Mildred Lake Settling Basin, North Mine South Pond, and the Southwest In-pit. One function of tailings structures is to permit settling of fine solids (sand, silt, clay) to allow clarification prior to water reuse/recycle applications which includes bitumen extraction, material hydrotransport (e.g., ore transport), and process cooling. In general, OSPW residence times within the tailings system are in timeframes of months. Although the tailings structures are very effective at removing sand and silt, clay particles, due to their small size, do not settle effectively even with very long settling times. A photograph of the OSPW source is shown in the upper left photograph of Figure 8. The clay sized particles are the cause for the turbidity of OSPW.

Figure 25 shows changes in TSS concentrations as the water progressed through the process. The TSS level in untreated OSPW averaged 94 mg/L and ranged between 40 and 120 mg/L. After Stage 2, levels were generally less than laboratory detection limits ( $<1$  mg/L) with the exception of the first 7 samples



collected during the initial start-up of the facility between August 12 and August 25, 2021. During this timeframe, TSS concentrations averaged 5 mg/L and ranged between 1 and 15 mg/L. This was because a bed of coke solids had not completely formed around sections of the underdrain pipes. However, as the coke slurry (Stage 1) was discharged into the filtration cell (Stage 2), coke solids eventually covered the underdrain pipes which formed a complete filter bed. This resulted in removal of clay-seized particles to concentrations less than laboratory detection limits. After Stage 2 and relative to the untreated OSPW, removal efficiencies of the fine solids exceeded 98%.



**Figure 25: Changes in Total Suspended Solids**

In Stage 3, there was an increase in TSS concentrations. Concentrations ranged between 11 and 21 mg/L and averaged 16 mg/L. However, unlike the TSS in the untreated OSPW which was due to clay minerals, in Stage 3 the TSS was due to biological solids including green algae (Figure 15). This is consistent with the primary productivity evident in the polishing pond. Additional evidence of biological activity within Stage 3 is shown in Figure 26 which shows the biological fouling and associated plugging on the screen of the suction intake for the pump that removed water from Stage 3. Although Stage 3 was anticipated to become biologically active, it was not expected to affect the performance of the pump to the degree that occurred. To mitigate, additional routine weekly cleaning of the pump intake structure was performed to maintain design flow rates.





**Figure 26: Fouling on the Screen of the Pump Intake (Stage 3)**



#### 4.1.3 TRACE ELEMENTS: DISSOLVED AND TOTAL

The recovery of bitumen from oil sands involves an alkaline hot water digestion as the basis for the extraction process during which trace elements are added. However, OSPW is maintained at alkaline conditions, so most elements are present at low concentrations and are controlled by precipitation and/or cation exchange reactions.

Concentrations of total and dissolved trace elements were quantified in the untreated OSPW and in OSPW after the three stages of treatment. Samples were collected in dedicated containers and preserved as directed by the laboratory. Dissolved elements were assessed by passing the samples through a 0.45 µm membrane filter and then preserving with nitric acid. Total elements were determined on unfiltered samples preserved with nitric acid. Other than elements associated with the mineral particulate fraction, such as aluminum and iron, total and dissolved concentrations were comparable. In addition, many of the trace elements were present at concentrations near or less than laboratory detection limits. These included beryllium, cobalt, lead, mercury, silver, tin, and thallium.

The results of select elements are presented in Figures 27 to 45 which show dissolved and total concentrations. The complete set of laboratory data is included in Tables A5 and A6, Appendix A. General observations/comments are summarized as follows.

##### Aluminum

Following Stage 2 treatment, total and dissolved concentrations of aluminum (Figure 27) were reduced relative to untreated OSPW. After Stage 3, dissolved concentrations in OSPW were generally less than 100 µg/L. Dissolved aluminum concentrations were consistently lower than total concentrations indicating the element was present in colloidal form.

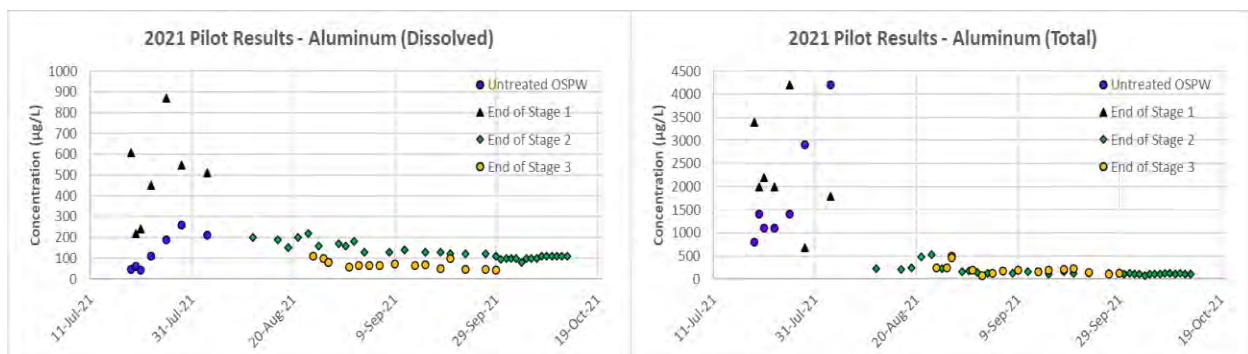


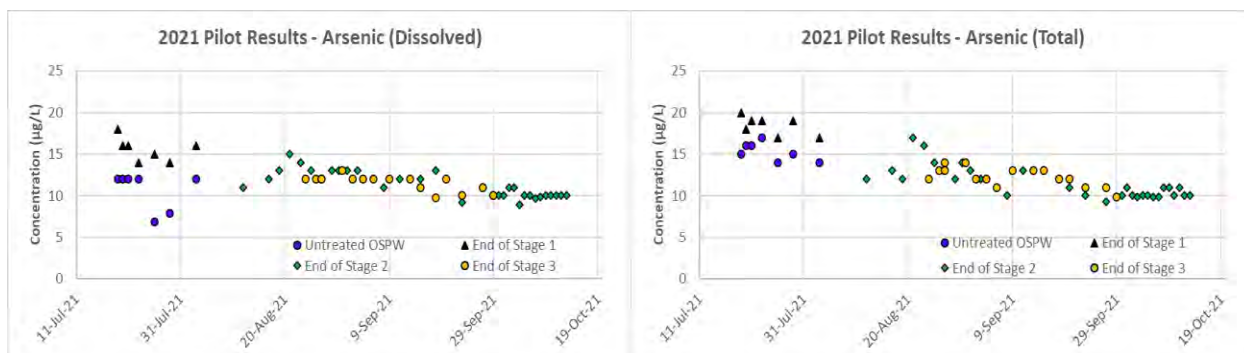
Figure 27: Changes in Aluminum: Dissolved and Total

##### Arsenic

Total and dissolved arsenic concentrations (Figure 28) showed a small increase following contact with PC, however after as the water progressed through Stages 2 and 4, levels modestly decreased after Stage 3



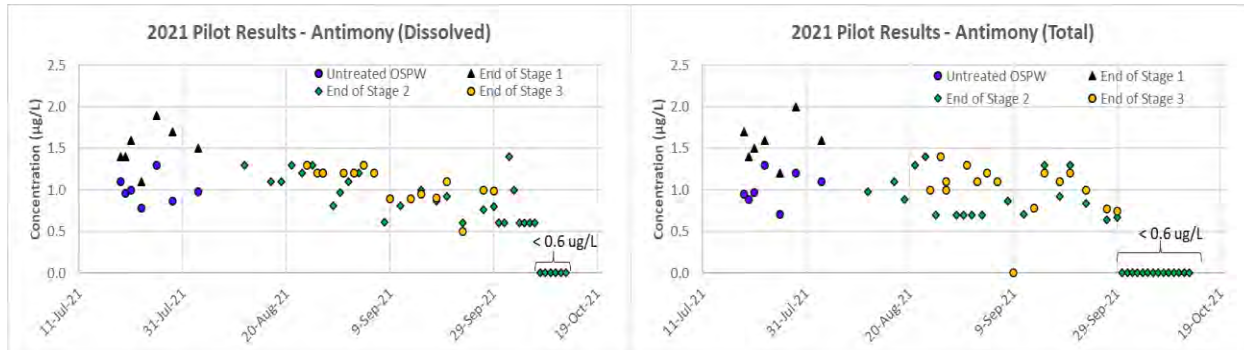
relative to the untreated OSPW. The water exiting Stage 3 contained average dissolved and total arsenic concentrations of 11.6 and 12.2  $\mu\text{g/L}$ , respectively.



**Figure 28: Changes in Arsenic: Dissolved and Total**

### Antimony

OSPW concentrations of dissolved and total antimony (Figure 29) were generally less than 2  $\mu\text{g/L}$  and did not significantly increase or decrease throughout the treatment process.

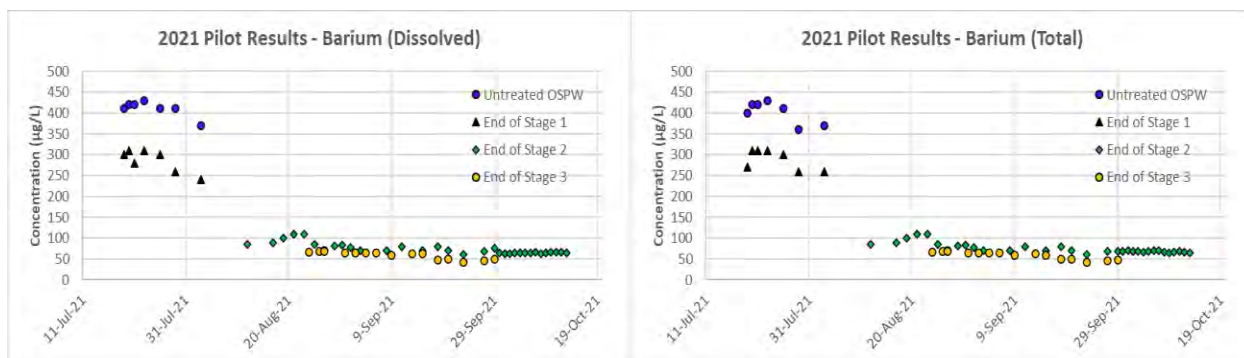


**Figure 29: Changes in Antimony: Dissolved and Total**

### Barium

Reductions in OSPW concentrations of barium were observed (Figure 30). In the untreated OSPW, total barium concentrations averaged 401  $\mu\text{g/L}$ . After Stage 3, levels averaged 59  $\mu\text{g/L}$  representing a 85% reduction. Concentrations of dissolved and total barium were approximately equal indicating the element existed primarily in dissolved form.

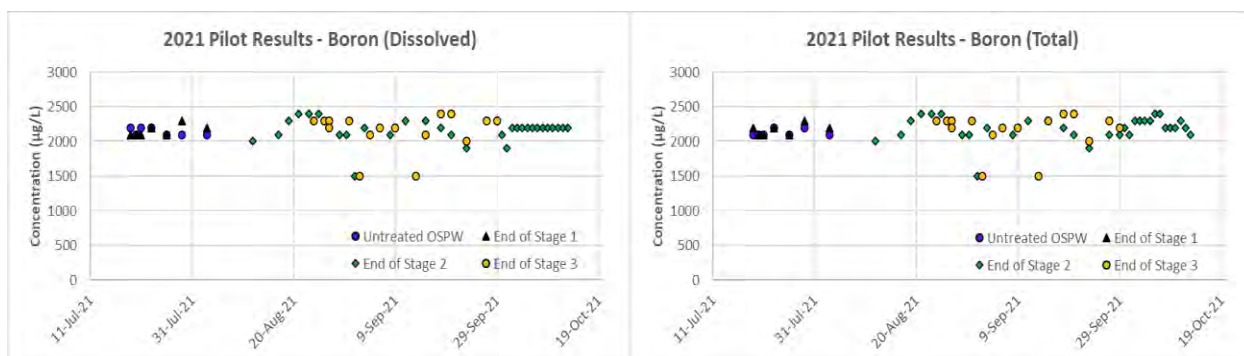




**Figure 30: Changes in Barium: Dissolved and Total**

### Boron

Total and dissolved boron concentrations (Figure 31) ranged between 1.5 and 2.5 mg/L and were not affected by the treatment process. Similar to chloride, boron is a relatively conservative element and is not affected by chemical processes such as ion exchange, adsorption, and/or precipitation.

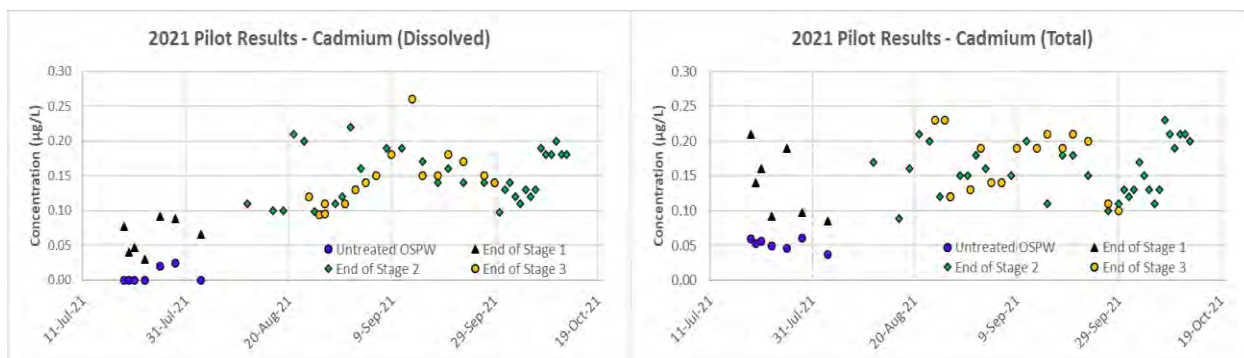


**Figure 31: Changes in Boron: Dissolved and Total**

### Cadmium

Total and dissolved cadmium concentrations increased following contact with petroleum coke (Figure 32). In untreated OSPW dissolved concentrations were generally less than 0.02 µg/L and total concentrations averaged 0.05 µg/L, respectively. After Stage 3, dissolved and total levels averaged 0.15, and 0.16 µg/L, respectively.

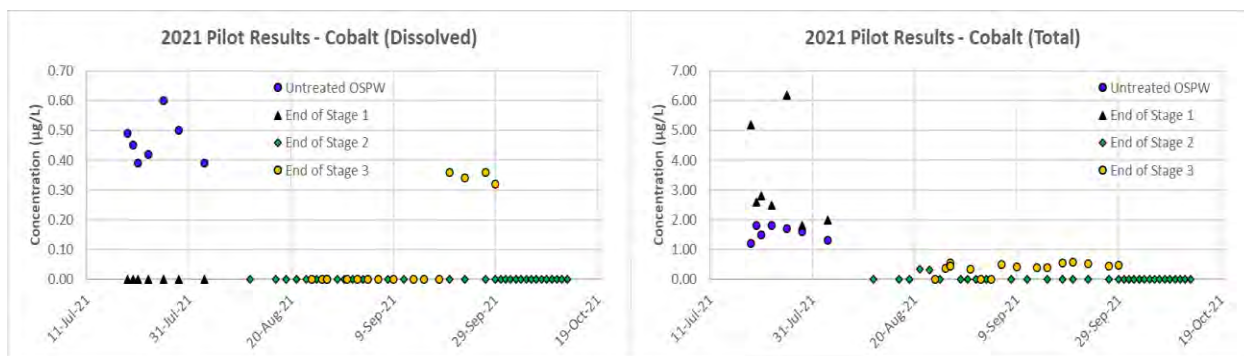




**Figure 32: Changes in Cadmium: Dissolved and Total**

### Cobalt

Total and dissolved cobalt concentrations (Figure 33) decreased following contact with petroleum coke. In untreated OSPW dissolved and total cobalt concentrations averaged 0.46 and 1.56 µg/L, respectively. After Stage 3, dissolved concentrations were generally less than laboratory detection limits (0.3 µg/L) and total concentrations were less than 1 µg/L.

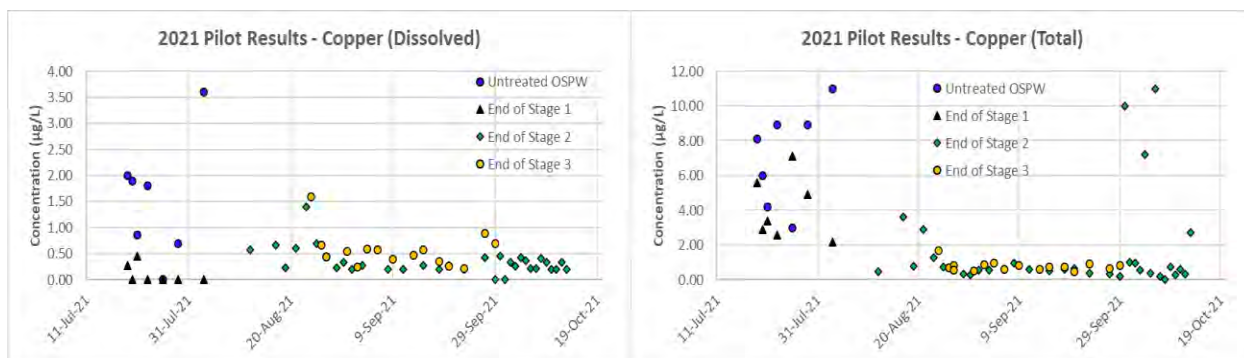


**Figure 33: Changes in Cobalt: Dissolved and Total**

### Copper

In untreated OSPW, dissolved and total copper concentrations averaged 1.8 and 7.2 µg/L, respectively (Figure 34). After Stage 3 of the treatment process, dissolved and total concentrations were reduced and averaged 0.56 and 0.79 µg/L, respectively.

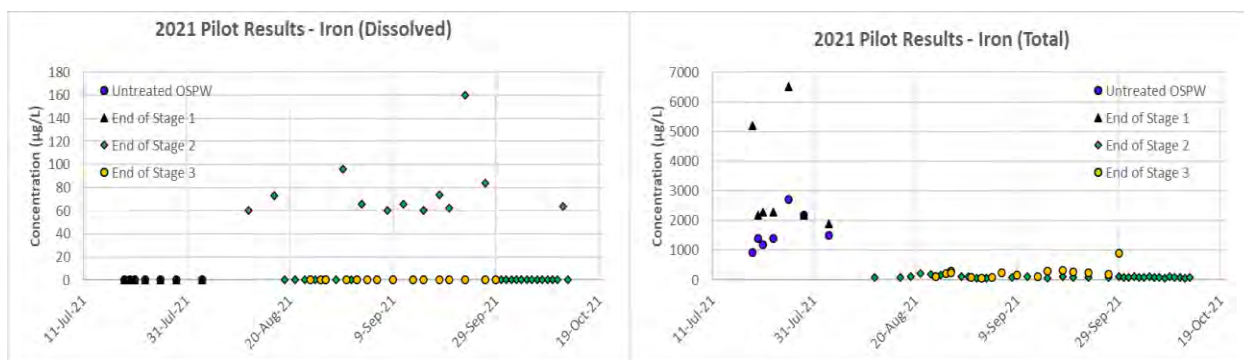




**Figure 34: Changes in Copper: Dissolved and Total**

### Iron

Total iron concentrations decreased during the treatment process (Figure 35). In untreated OSPW concentrations averaged 1618  $\mu\text{g/L}$  and following Stage 3, concentrations averaged 245  $\mu\text{g/L}$ . This reduction appears related to removal of the TSS (Figure 24). Dissolved iron, with the exception of Stage 2 where levels ranged between 60 and 160  $\mu\text{g/L}$ , was less than detection limits (60  $\mu\text{g/L}$ ) in untreated OSPW and in the treated OSPW after Stage 3.

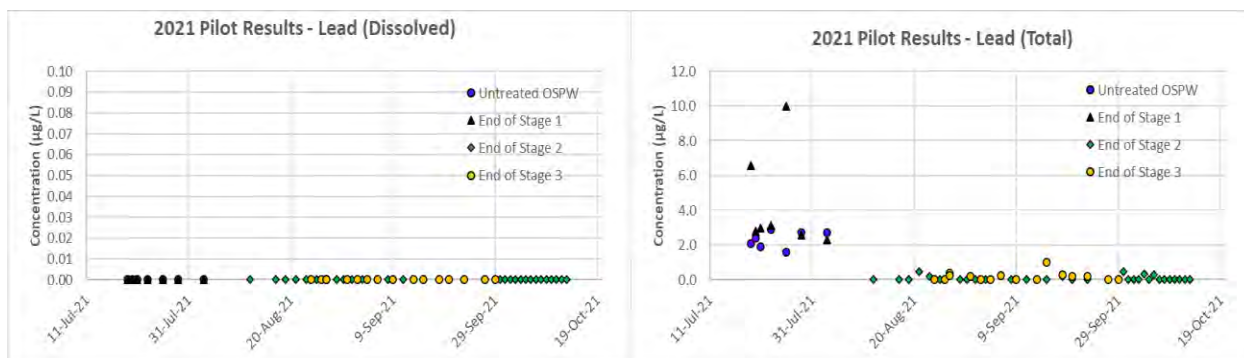


**Figure 35: Changes in Iron: Dissolved and Total**

### Lead

Concentrations of dissolved lead were less than detection limits (0.2  $\mu\text{g/L}$ ) and unchanged by the treatment process (Figure 36). Total lead concentrations in the untreated OSPW averaged 2.3  $\mu\text{g/L}$  and after Stage 3 averaged 0.35  $\mu\text{g/L}$ . This reduction in total lead appears related to removal of the TSS in Stage 2.

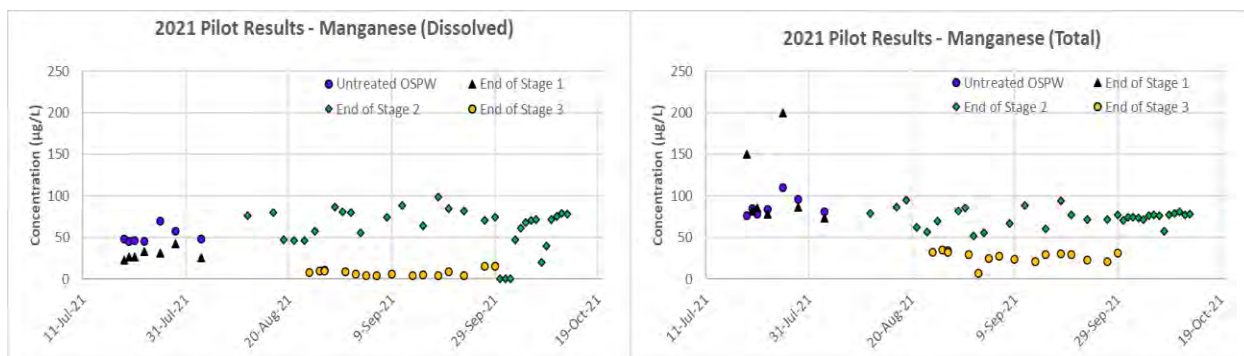




**Figure 36: Changes in Lead: Dissolved and Total**

## Manganese

In untreated OSPW, total and dissolved concentrations of manganese averaged 87 and 51 µg/L, respectively. In the treated OSPW after Stage 2, there was a slight increase in dissolved concentrations which averaged 68 µg/L, however, after Stage 3, concentrations were reduced (Figure 37). Total and dissolved concentrations averaged 27 and 8 µg/L, respectively.

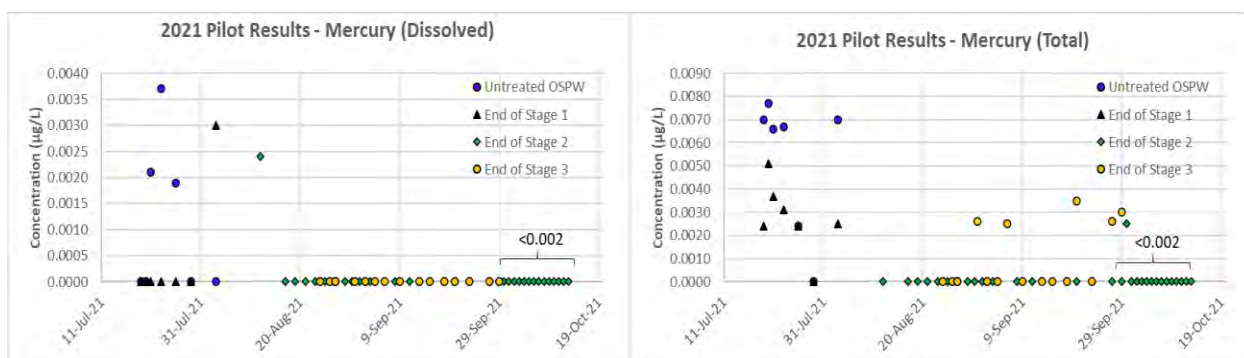


**Figure 37: Changes in Manganese: Dissolved and Total**

## Mercury

Total and dissolved concentrations of mercury (Figure 38) did decrease and after Stage 3 were typically less than analytical detection limits. However, it should be noted OSPW concentrations were very low and did not exceed four times the laboratory detection limit of 0.002 µg/L.

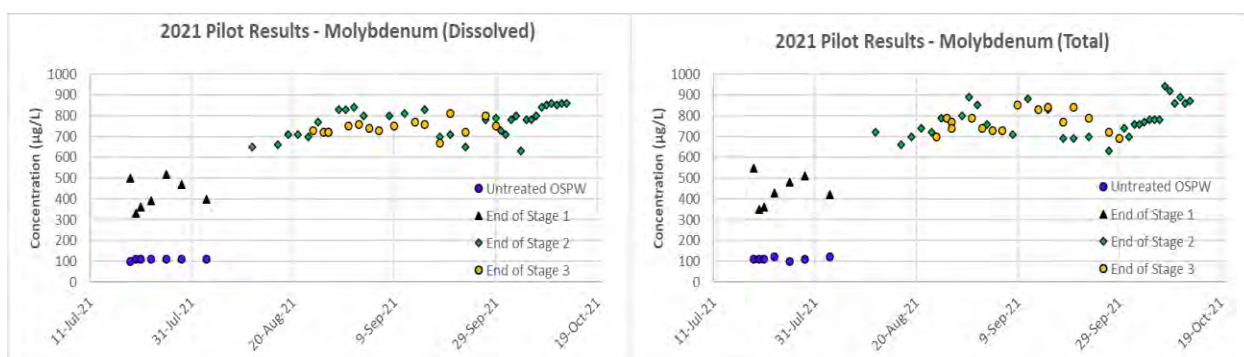




**Figure 38: Changes in Mercury: Dissolved and Total**

## Molybdenum

Variations in the concentrations of total and dissolved molybdenum were approximately equal in the untreated water and after the three treatment stages indicating the element exists primarily in dissolved form (Figure 39). Concentrations of molybdenum did increase as the OSPW progressed through Stages 1 and 2 indicating the coke was the source of the element. Dissolved concentrations in the untreated OSPW averaged 109 µg/L. After Stage 1, concentrations increased and averaged 424 µg/L. After Stage 2 concentrations further increased and averaged 772 µg/L. After Stage 3, molybdenum concentrations slightly decreased and averaged 744 µg/L.

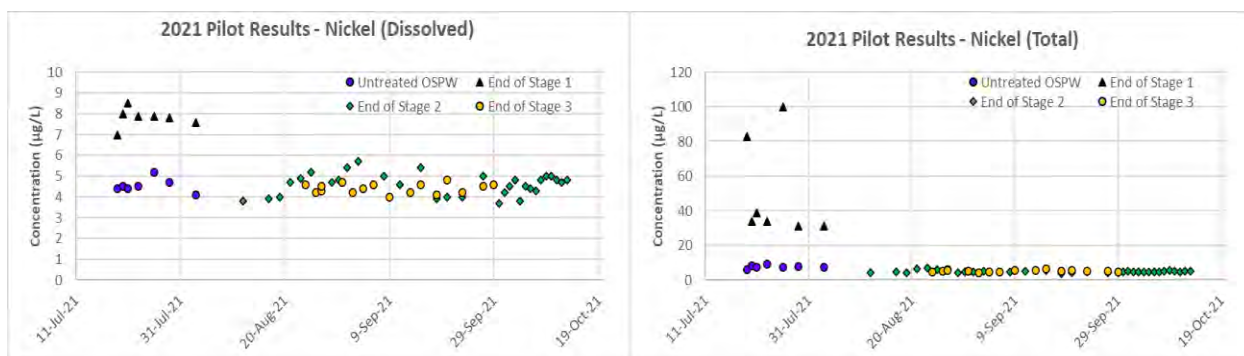


**Figure 39: Changes in Molybdenum: Dissolved and Total**

## Nickel

Total and dissolved concentrations of nickel were temporarily elevated after Stage 1. However, after Stages 2 and 3 the treated OSPW contained levels of nickel that were not materially different than the untreated OSPW (Figure 40). Average concentrations of dissolved nickel in the untreated OSPW and after Stages 1, 2, and 3 were 4.5, 7.8, 4.6, and 4.4 µg/L, respectively. Average concentrations of total nickel in the untreated OSPW and after Stages 1, 2, and 3 were 7.7, 50.3, 4.9, and 5.3 µg/L, respectively.

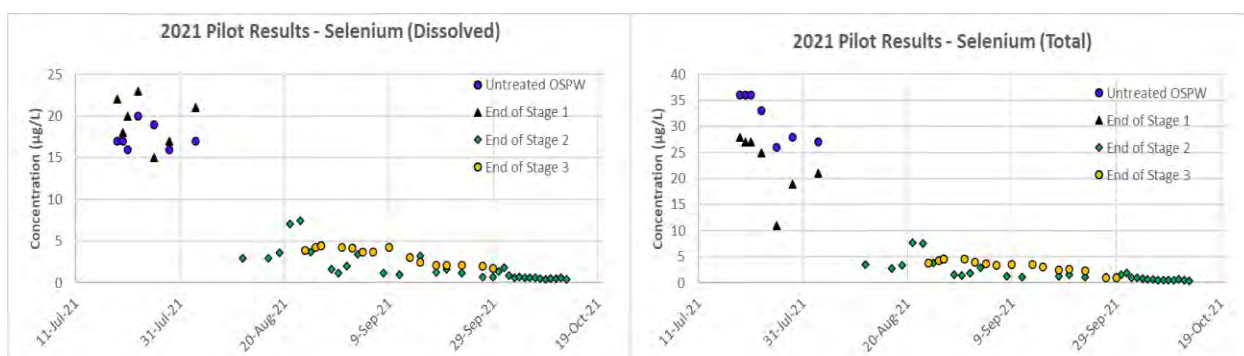




**Figure 40: Changes in Nickel: Dissolved and Total**

### Selenium

The treatment process was effective at removing dissolved and total concentrations of selenium (Figure 41). In untreated OSPW, total and dissolved concentrations averaged 31.7 and 17.4 µg/L, respectively. After Stage 2, both total and dissolved averaged about 1.8 µg/L representing removal efficiencies exceeding 90%.

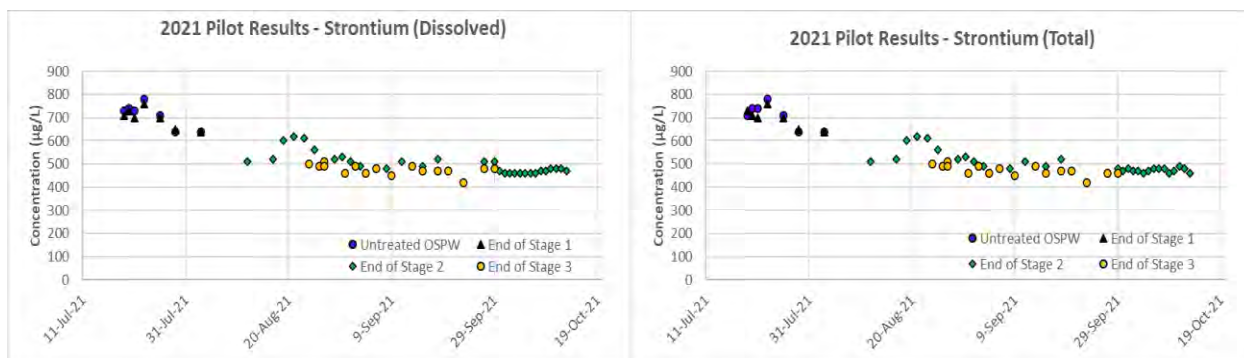


**Figure 41: Changes in Selenium: Dissolved and Total**

### Strontium

Modest reductions (30-35%) in strontium were observed (Figure 42). The element exists in OSPW primarily in dissolved forms. In untreated OSPW, dissolved concentrations averaged 740 µg/L. After Stages 2 and 3, concentrations averaged 498 and 477 µg/L, respectively.

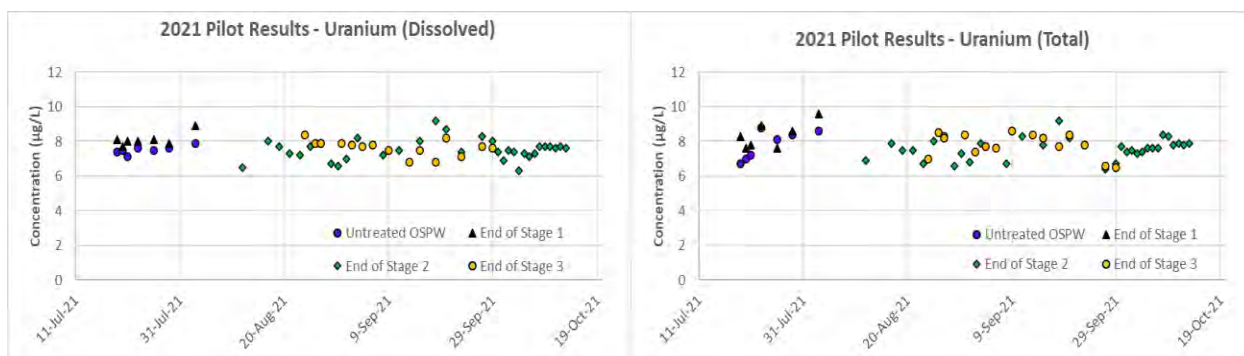




**Figure 42: Changes in Strontium: Dissolved and Total**

## Uranium

Total and dissolved concentrations of uranium were similar indicating the element is present in OSPW primarily in dissolved form. Uranium concentrations did not materially increase or decrease throughout the treatment process (Figure 43). Concentrations ranged between 6.3 and 9.6 µg/L.



**Figure 43: Changes in Uranium: Dissolved and Total**

## Vanadium

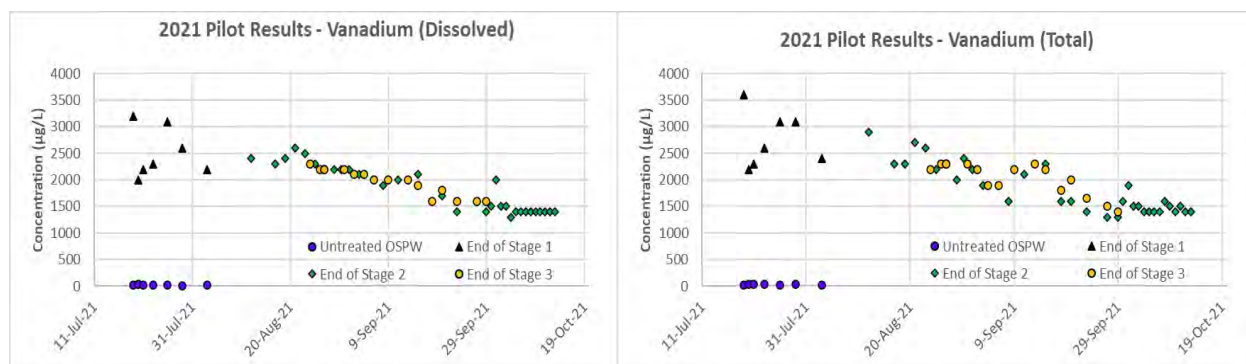
Typical vanadium concentrations in SCL's bitumen average about 225 mg/kg. During the hot water extraction process, there is no evidence that vanadium is solubilized into OSPW at elevated concentrations indicating the vanadium is effectively bound as an organo-metallic complex. During the fluid coking process (Figure 2), the organic complex is thermally cracked, and elemental vanadium is incorporated into the PC matrix as an oxide. Vanadium concentrations within the PC matrix have been reported to be about 1200 mg/kg (Zubot, 2010) indicating the element is concentrated in petroleum coke.

As indicated in Figure 44, large temporal changes in vanadium concentrations were observed. Average concentrations of total and dissolved vanadium in untreated OSPW were 34 and 21 µg/L, respectively. However, after Stage 1, total and dissolved vanadium concentrations increased and averaged 2575 and



2514 µg/L, respectively. This increase is associated with leaching of vanadium from the petroleum coke matrix into OSPW after the material is partially combusted during the coking process (Figure 2). Retention of the OSPW within the pore spaces of the coke deposit (Stage 2) resulted in reduced vanadium concentrations.

Metal oxides have been shown to be effective adsorbents for removing vanadium from aqueous solutions (Zubot 2010). The production of petroleum coke within the burner vessel of the fluid coker (Figure 2) converts metal species present in bitumen to oxidized forms that reside within the carbon matrix. Consequently, this material acts as an adsorbent to remove vanadium. The removal of vanadium shown in Figure 44 is consistent with former studies (Zubot, 2010, 2012) where similar effects were observed. The removal efficiency is related to the residence time of the OSPW within the coke pores. The longer the residence time, the greater the removal. This is evident in Figure 44 which shows gradual and steady reductions in vanadium concentrations in the treated OSPW exiting Stage 2.

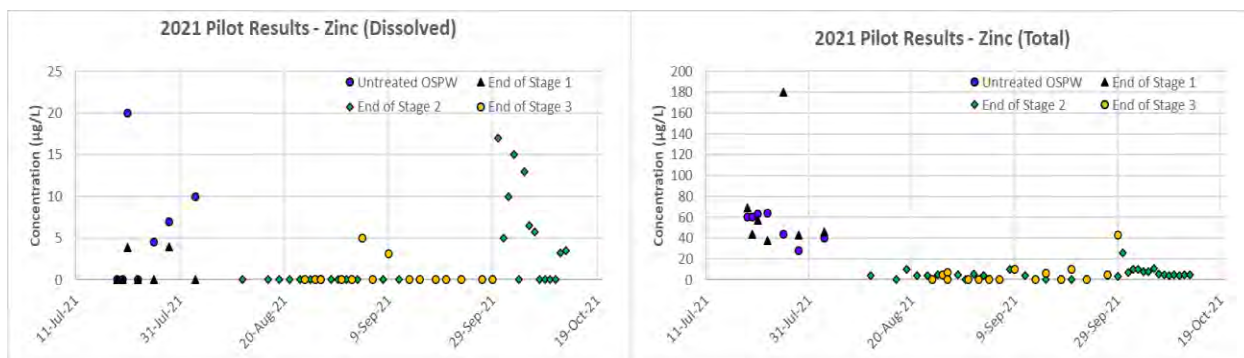


**Figure 44: Changes in Vanadium: Dissolved and Total**

## Zinc

In untreated OSPW, total and dissolved zinc concentrations averaged 10.3 and 51.3 µg/L, respectively. After Stage 2, dissolved concentrations were generally less than laboratory detection limits (3µg/L), however, samples collected in early October ranged between <3 and 17 µg/L. After Stage 3, dissolved zinc concentrations averaged 4.1µg/L (Figure 45). Total zinc concentrations averaged 68 µg/L after Stage 2, and a further reduction was observed in the treated OSPW after Stage 3 which averaged 12.4 µg/L.





**Figure 45: Changes in Zinc: Dissolved and Total**



#### 4.1.4 NUTRIENTS

##### 4.1.4.1 Ammonia

In Syncrude's OSPW, ammonia is added to the inventory of OSPW as a by-product from upgrading activities. Changes in total ammonia concentrations as the water progressed through the treatment process are shown in Figure 46. In the untreated OSPW ammonia concentrations averaged 12 mg/L. After Stages 1 and 2, concentrations decreased and averaged 9.5 and 2.2 mg/L, respectively. The treated OSPW after Stage 3 contained an average ammonia concentration of 0.08 mg/L. Relative to untreated OSPW, this represents a removal efficiency exceeding 93%. The average change in concentration between water entering and exiting Stage 3 was 2.1 mg/L, and as evident in Figure 15, the presence of algae in Stage 3 would result in ammonia consumption in accordance with the following formula for the photosynthetic production of algal biomass (Manahan, S.E., 1991):

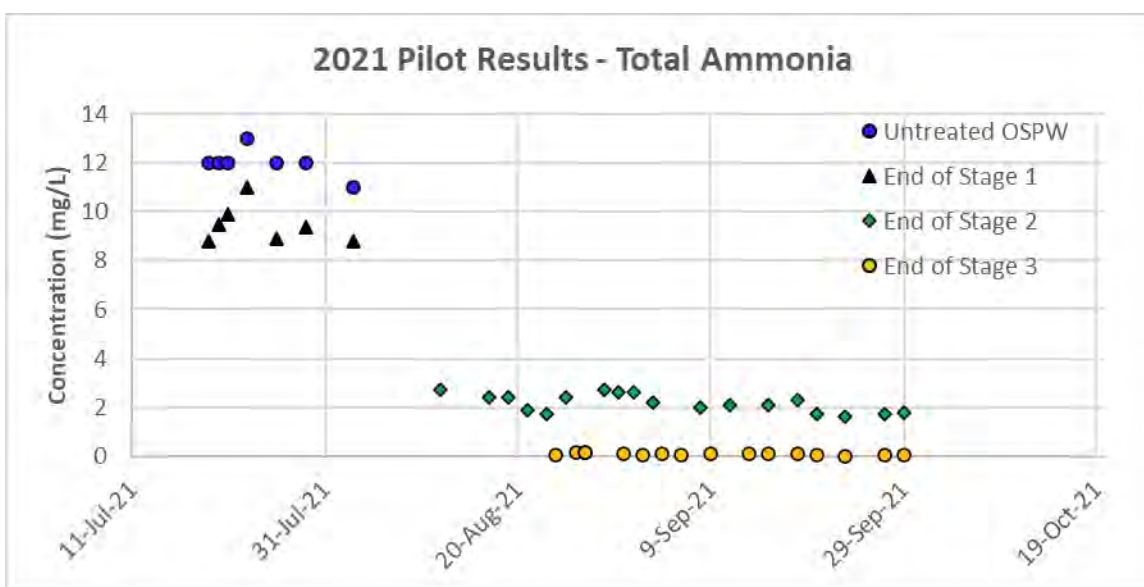
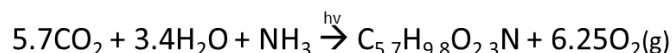
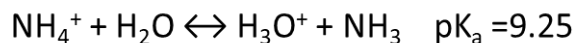


Figure 46: Change in Total Ammonia Concentrations in OSPW

As indicated in Figure 21, the average pH of untreated OSPW was 8.0. After Stages 1, 2, and 3, average pH values of the treated OSPW were 8.5, 8.5, and 9.2, respectively and corresponding with the increased pH is a shift from ionized ammonia ( $\text{NH}_4^+$ ) to the unionized form ( $\text{NH}_3$ ) in accordance with the following reaction:



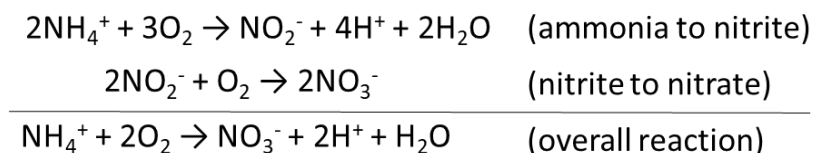


Based on the pKa of 9.25 @ 25C of the  $\text{NH}_4^+/\text{NH}_3$  system, and at pH values of 8.0, 8.5, and 9.2, about 5.3%, 15.1% and 47% of the total ammonia will exist as unionized ammonia, respectively and is a potential removal mechanism because of its relatively high vapor pressure. Therefore, the observed reductions in ammonia removal across the treatment process can be attributed to at least two factors: (1) its use as a nutrient to support the growth of biomass and (2) conversion to unionized ammonia which is volatile and can partition to the air phase as indicated by the following reaction (Stumm, Morgan, 1996).



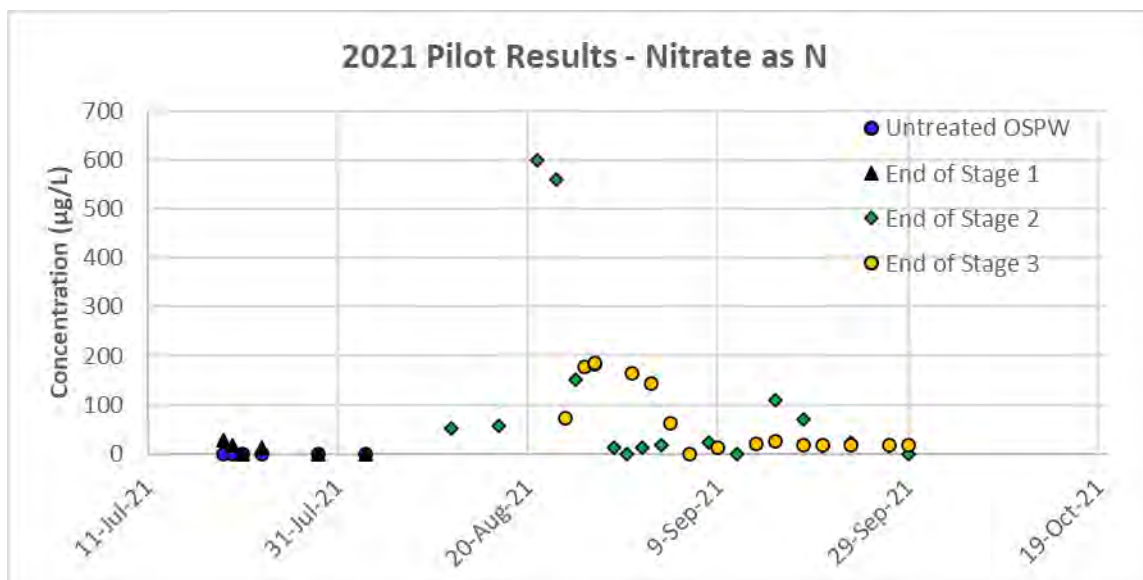
#### 4.1.4.2 Nitrate and Nitrite

The oxidized forms of nitrogen - nitrate and nitrite - were monitored throughout the treatment process and the results are shown Figures 47 and 48, respectively. The nitrification of ammonia nitrogen occurs via a two-step biological process shown as follows (Metcalf, Eddy, 2004):

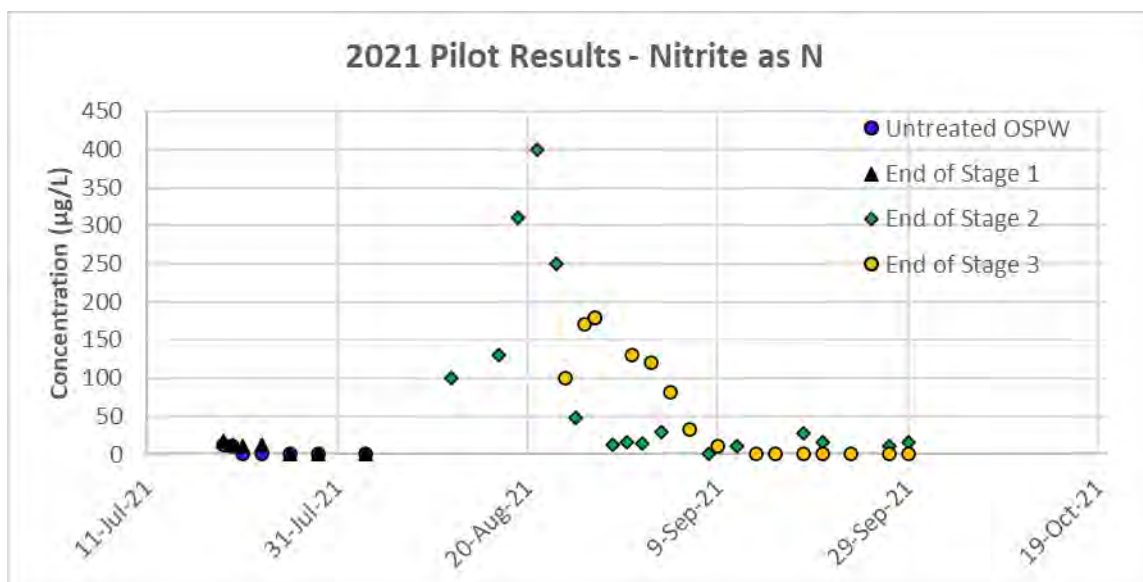


In untreated OSPW and after Stage 1, concentrations of nitrite and nitrate were present at low concentrations and primarily at levels less than laboratory detection limits (10  $\mu\text{g/L}$ ). Concentrations in the treated OSPW after Stages 2 and 3, although quite variable, did increase. However, based on the stoichiometry for the above noted oxidation reaction of ammonia, 1 mg/L of ammonia produces 3.44 mg/L of nitrate. As indicated in Figure 46, nitrate levels generally did not exceed 0.2 mg/L. This discrepancy is likely be accounted for because a portion of the ammonium ion was converted into cell tissue.





**Figure 47: Changes in Nitrate Concentrations in OSPW**



**Figure 48: Changes in Nitrite Concentrations in OSPW**



#### 4.1.4.3 Total Phosphorus

Phosphorus is an essential nutrient for the growth of algae and other forms of biomass. It is also a constituent of concern that is targeted for removal in sanitary wastewater treatment facilities due to eutrophication risks in receiving environments. It's in secondary treatment process of such facilities where it is removed via incorporation into cell biomass (Metcalf, Eddy, 2004).

Concentrations of phosphorus are shown in Figure 49 and generally decreased as OSPW progressed through the treatment process. In untreated OSPW and after Stage 1, concentrations averaged 170 and 163  $\mu\text{g/L}$ , respectively. After Stage 2, there was a slight reduction with concentrations averaging 138  $\mu\text{g/L}$ . The largest removal of phosphorus occurred in Stage 3. Concentrations averaged 81  $\mu\text{g/L}$  and relative to the untreated OSPW represent a reduction of about 52%. A photograph of the treated OSPW after Stage 3 is shown in Figure 50. The presence of algae is evident and accounts for the reduction in concentrations observed across Stage 3 of the treatment process.

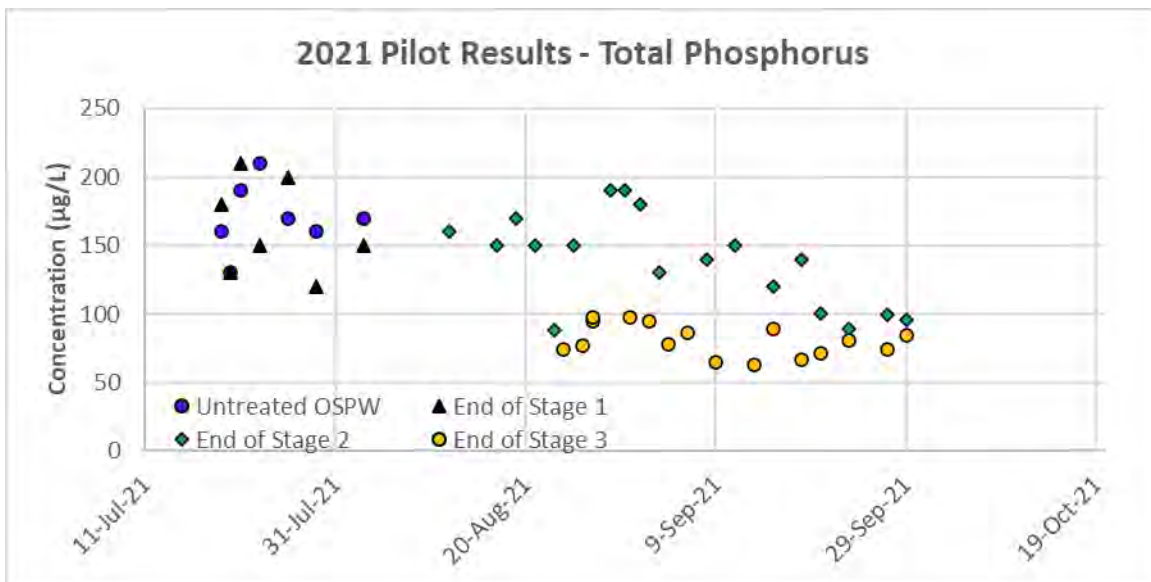


Figure 49: Changes in Total Phosphorus Concentrations in OSPW





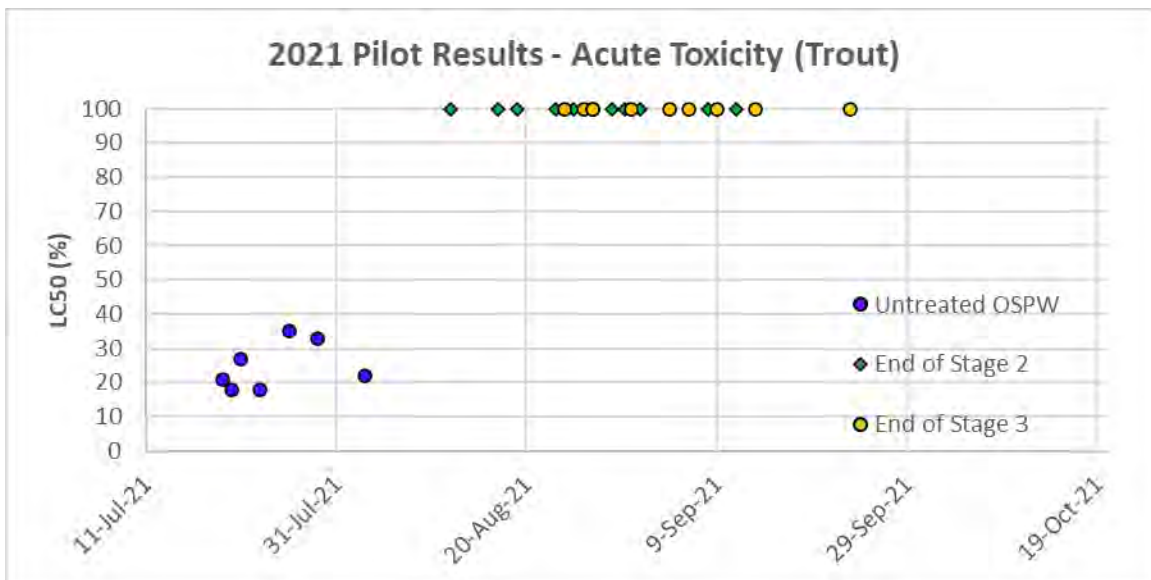
**Figure 50: Treated OSPW after Stage 3**



#### 4.1.5 ACUTE TOXICOLOGY

Selected samples of untreated OSPW and treated OSPW after Stages 2 and 3 were assessed for acute toxicity using three bioassays: fish (rainbow trout), zooplankton (daphnia magna), and bacteria (MicroTox™) based on the testing methods provided in Table 1. Testing times for trout and daphnia were 96 h and 48 h, respectively with lethality as the endpoint. MicroTox™ is a 15-minute test and uses marine bacteria (*Allivibrio fischeri*) that naturally luminesce. Light inhibition is the endpoint and is based on exposure of a toxin to bacteria will adversely affect metabolic processes and result in a decreased light output.

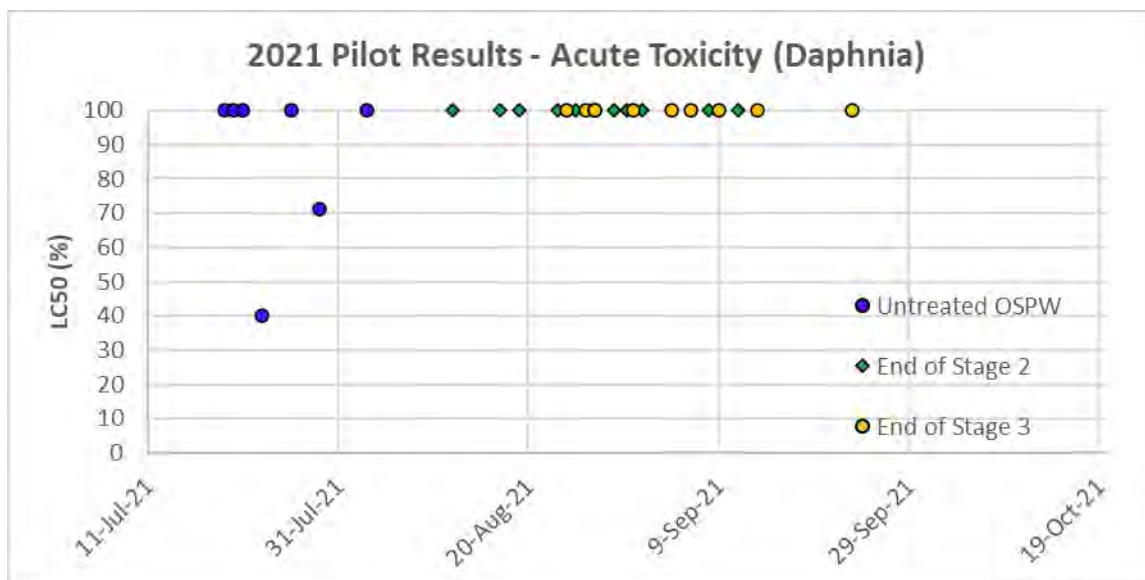
The results for the rainbow trout are shown in Figure 51 and indicate that untreated OSPW is acutely toxic. LC50s ranged between 18% and 35% with all samples resulting in 100% mortality. However, after Stage 2 and Stage 3 treatment, there was a major improvement in water quality. LC50s in the treated OSPW were all greater than 100% and with 0% fish mortality.



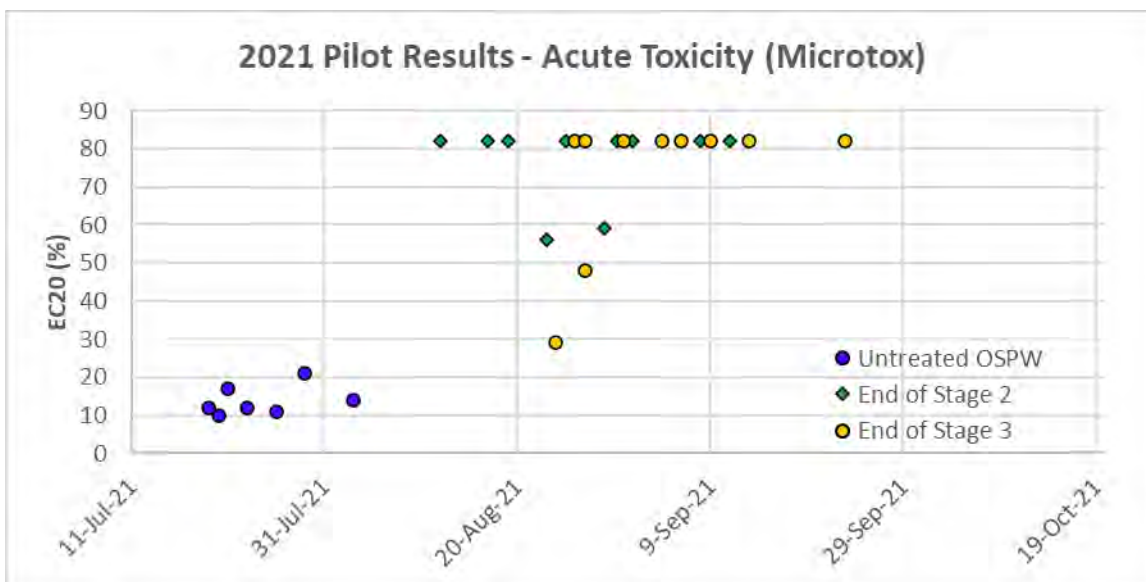
### Figure 51: Bioassay Results – Rainbow Trout

The toxicology results using daphnia magna are shown in Figure 52 and indicate there was some acute toxicity in the untreated OSPW. After Stage 2 and Stage 3 treatment, the OSPW was non-acutely toxic (LC50>100%) with 0% mortality. On a relative basis, the Daphnia Magna is relatively robust to concentrations of organic and inorganic constituents present in OSPW. These results are consistent with Syncrude's annual OSPW monitoring program which often reports LC50>100% for daphnia magna in OSPW sourced from operationally active tailings structures.









**Figure 54: Bioassay Results – Luminescent Bacteria (EC20)**

The results of the three bioassays indicate the daphnia magna is relatively robust to concentrations of organic and inorganic constituents present in OSPW. These findings are consistent with a 1991/92 investigation that assessed the acutely toxic fractions of OSPW (Verbeek et al, 1993). The study reported MicroTox™ was about 2.5 times more sensitive than daphnia magna. Rainbow trout were found to be three and seven times more sensitive than MicroTox™ and daphnia magna, respectively.



## 4.2 ECOTOXICITY ASSESSMENT

For the purposes of executing the second component of the program – a sublethal/ecotoxicity study - it was a necessary project objective that the treated OSPW be non-acutely toxic based on the 96-h rainbow trout bioassay. If the treatment process was not able to achieve this requirement, it would have been deemed to have failed expectations and subsequent work components would have been terminated. However, the treatment process did produce treated OSPW that was not acutely toxic, therefore the full sublethal/ecotoxicity study did proceed to completion.

This work incorporated both laboratory and on-site testing of treated OSPW sourced from Stage 3 and included a chronic toxicity testing program using a mobile testing facility and the use of mesocosms inoculated with periphyton and benthic macroinvertebrate assemblages from the Athabasca River watershed.

The complete study report detailing the methods and results of the sublethal/ecotoxicity study is provided in Appendix B. Key findings of the work are summarized in Table 2, which is adapted from Table 24 in the study report, and summarized briefly as follows:

- There was some mortality in the 7 and 28-day fathead minnow tests in the 100% OSPW. However, results were confounded by microbial effects. Toxicological effects were substantially reduced after anti-microbial treatments were applied (i.e., addition of copper ion).
- The laboratory controls for the walleye tests only exhibited 16% post-hatch survival and 13% by the end of the tests. Therefore, the effects of treated OSPW on walleye are not considered reliable. Furthermore, the walleye test was difficult to execute because it could only be completed at certain times of the year subject to species availability. This necessitated the storage of Treated OSPW from Stage 3 over the winter months to enable testing in the Spring, 2022. The walleye tests did not show any sublethal effects of 100% Treated OSPW.
- For the fingernail clam, there was no mortality or effects based on dry weight and length at dilutions of up to and including 56%. However, at 100% treated OSPW, mortality was observed.
- At Treated OSPW dilutions exceeding 32% there were no sub-lethal effects observed based on fathead minnow (growth), green algae (growth), ceriodaphnia dubia (reproduction), fingernail clams (growth) and walleye (growth).
- At 32% treated OSPW, and relative to Athabasca river water, there was a reduction in ceriodaphnia reproduction and alga growth. However, relative to laboratory control water, there was no difference in algae growth rates.
- There were no measurable effects on invertebrate abundance or similarity at Treated OSPW concentrations less than 10%.
- The most sensitive endpoints were periphyton growth rates and biomass at a Treated OSPW concentration of 3.2% and higher. At doses of 3.2% Treated OSPW or less many endpoints showed small stimulatory effects on growth, biomass, and abundance.



- Potential causes of sub-lethal effects observed in Stage 3 include pH, salinity (i.e., osmotic stresses), and vanadium concentrations. However, pH adjustment of samples and subsequent testing using fathead minnow and ceriodaphnia dubia indicated the pH in stage 3 (mean pH value ~ 9.2) was not a factor. Rather the cause is likely related to OSPW salinity (OSPW is approximately an order of magnitude more saline than river water) and/or vanadium concentrations. At the time of testing, vanadium levels did exceed some published chronic effects thresholds for algae, ceriodaphnia dubia and the fathead minnow. It is possible sub-lethal endpoints were exacerbated by synergistic effects between salinity and vanadium concentrations present at the time of testing.
- General testing observations include:
  - Long-term tests (28-30 day) performed similarly to short-term (7 day) tests.
  - Extended fathead minnow tests undertaken on-site and, in the laboratory, gave comparable results.
  - Toxicity tests using native species were similar or less sensitive than tests using standard laboratory species.
  - Fathead minnows were more sensitive to Treated OSPW than walleye.
  - Ceriodaphnia dubia were more sensitive than freshwater bivalves.
  - Native species were more prone to culture/control failures and much more difficult with respect to planning and testing.



**Table 2: Summary of ecotoxicity endpoints: Treated OSPW mixed with River Water**

		Treated OSPW concentration in Athabasca River water							
		0%	0.32%	1%	3.2%	10%	32%	56%	100%
<b>Survival endpoints (LC50)</b>									
	Rainbow trout	O	O	O	O	O	O	O	O
	Daphnia magna	O	O	O	O	O	O	O	O
	Fathead minnow early life-stage (28d)	O	O	O	O	O	O	O	●*
	Fathead minnow juvenile (28d)	O	O	O	O	O	O	O	●*
	Fathead minnow Juvenile (7d)	O	O	O	O	O	O	O**	●*
	Ceriodaphnia dubia	O	O	O	O	O	O	O	●
	<i>Hyalella azteca</i>	O	O	O	O	O	O	O	O
	Clam EC50 (28d)	O	O	O	O	O	O	O	●
	Mussel EC50 (48h)	O	O	O	O	O	O	O	●
	Walleye overall	O	O	O	O	O	O	O	●***
	Walleye post-hatch	O	O	O	O	O	O	O	O
<b>Sublethal endpoints (IC/EC25)</b>									
	Fathead minnow early life-stage	O	O	O	O	O	O	O	●
	Fathead minnow juvenile	O	O	O	O	O	O	O	●
	Fathead minnow 7-day	O	O	O	O	O	O	●	●
	Green alga growth****	O	O	O	O	O**	●	●	●
	C. dubia reproduction	O	O	O	O	O	●	●	●
	H. azteca growth	O	O	O	O	O	O	O	●
	clam growth (weight)	O	O	O	O	O	O	O	-
	clam growth (length)	O	O	O	O	O	O	O	-
	Walleye hatch success	O	O	O	O	O	O	O	O
	Walleye growth (weight)	O	O	O	O	O	O	O	O
	Walleye growth (length)	O	O	O	O	O	O	O	O
	Walleye development	O	O	O	O	O	O	O	O
<b>Mesocosm exposures (apparent effects on algal growth or community composition)</b>									
	Periphyton growth rate	O	O	O	●	●	●	-	●
	Periphyton biomass	O	O	O	●	●	●	-	●
	Invertebrate abundance	O	O	O	O	●	●	-	●
	Invertebrate richness	O	O	O	O	O	O	-	●
	Invertebrate community similarity	O	O	O	O	●	●	-	●

O No effect observed at the stated concentration

● Effect observed at stated concentration

\*Fathead minnow survival and reproduction endpoints affected by microbial growth in exposures in first half of study.

\*\*Calculated toxicological endpoint value (IC25 OR IC50) just above this exposure concentration

\*\*\*Walleye survival failure in control exposures

\*\*\*\*Growth inhibition observed relative to river water control but not relative to laboratory-water control



### 4.3 WATER QUALITY SUMMARY

Table 3 summarizes the approximate quality of OSPW and Treated OSPW after Stages 2 and 3. In the province of Alberta regulatory policy generally requires the treated effluence achieve an  $LC_{50} > 100\%$  at the end of pipe using rainbow trout or daphnia magna (AEP, 1995). Acid extractable organics – a form of dissolved organic matter - and the class of compounds associated with the acute toxicity of OSPW do not represent a single compound, but rather thousands of individual compounds (Han et al, 2009). Consequently, provincial, or federal guidance for these compounds is not available. However, the treatment process using PC which is based on the principles of adsorption did reduce concentrations of dissolved organic compounds such that the Treated OSPW was non-acutely toxic.

For comparison, Table 3 also includes Alberta's available water quality guidelines for the protection of freshwater aquatic life (GOA, 2018) and the Lower Athabasca Regional Plan (LARP) Surface Water Quality means and triggers at Old Fort (GOA, 2012b). The Province of Alberta's Surface Water Quality Guidelines are intended to provide general guidance for evaluating surface water quality. The guidelines can also be used for setting water quality-based approval limits for wastewater discharges. Values would be applicable near end-of-pipe or at the edge of a defined mixing zone. Guidance on effluent limits is provided in Alberta's policy document, titled, *Water Quality Based Effluent Limits Procedures Manual* (AEP, 1995).

The surface water quality triggers are based on statistical deviation from historical ambient concentrations and are applied at the Old Fort long term monitoring station for selected metals and general water quality indicators. If monitoring indicates a water quality trigger has been exceeded, Alberta has advised there will be a regional management response. This may include the preparation of management plans, further modeling or monitoring, and the use of best management practices. The LARP also acknowledges a commitment to ongoing monitoring, evaluation, and reporting of water quality if triggers are exceeded (GOA, 2012b).



**Table 3: Water Quality Summary**

Constituent	<sup>a</sup> Alberta Guideline(µg/L)		<sup>b</sup> LARP (µg/L)		<sup>c</sup> Approximate OSPW Chemistry (µg/L)		
	Short Term	Long Term	Surface Water Mean	Quality Trigger	Untreated	After Stage 2	After Stage 3
<b>Organics</b>							
Naphthenic Acids	-	-	-	-	60.6	9.1	9.3
Disolved Organic Carbon	-	-	-	-	52	17.7	20.7
Chemical Oxygen Demand	-	-	-	-	354	79	105
Biochemical Oxygen Demand <sub>5</sub>	-	-	-	-	20	< 5	5
F1 Hydrocarbons	150	-	-	-	< 100	< 100	< 100
F2 Hydrocarbons	110	-	-	-	3300	< 100	< 100
F3 Hydrocarbons	-	-	-	-	12900	< 100	< 100
Benzene	-	40	-	-	< 0.4	< 0.4	< 0.4
Toluene	-	0.5	-	-	0.64	< 0.4	< 0.4
Ethylbenzene	-	90	-	-	< 0.4	< 0.4	< 0.4
Xylenes	-	30	-	-	11.1	< 0.4	< 0.4
Phenols	-	4	-	-	42	1.73	< 1.5
<b>Polyaromatic Hydrocarbons</b>							
Total Parent PAHs	-	-	-	-	11.1	< detection limits	< detection limits
Total Alkylated PAHs	-	-	-	-	203	< detection limits	< detection limits
Acenaphthene	-	5.8	-	-	1.1	< 0.1	< 0.1
Anthracene	-	0.012	-	-	0.38	< 0.01	< 0.01
Benzo(a)anthracene	-	0.018	-	-	0.057	< 0.001	< 0.001
Benzo(a)pyrene	-	0.015	-	-	0.053	< 0.001	< 0.001
Fluoranthene	-	0.04	-	-	0.29	< 0.01	< 0.01
Fluorene	-	3	-	-	0.89	< 0.05	< 0.05
Quinoline	-	3.4	-	-	3.3	< 0.2	< 0.2
Naphthalene	-	1	-	-	0.39	< 0.1	< 0.1
Phenanthrene	-	0.4	-	-	2.4	< 0.05	< 0.05
Pyrene	-	0.025	-	-	0.82	< 0.02	< 0.02
<b>Trace Elements</b>							
Aluminum	100	50	16	49	131	131	69
Antimony	-	-	0.107	0.202	0.99	0.91	1.06
Arsenic	-	5	0.5	0.7	10.7	11.3	11.6
Barium	-	-	52.6	73.7	401	74	59
Beryllium	-	-	0.077	0.269	< 1	< 1	< 1
Boron	29000	1500	26	40	2142	2169	2150
Cadmium	2.1	0.16	0.0997	0.5151	0.023	0.15	0.15
Chromium (III)	-	8.9	0.41	0.65	< 1	< 1	< 1
Cobalt	-	1	0.07	0.11	0.46	< 0.3	0.3
Copper	16	7	1.6	3.6	1.8	0.36	0.56
Iron	-	300	185	372	< 60	< 60	< 60
Lead	-	3.2	0.56	0.56	< 0.2	< 0.2	< 0.2
Lithium	-	-	6	9	144.3	104	113
Manganese	-	-	12	36	51.4	68.1	7.7
Mercury	0.013	0.005	0.0051	0.0159	< 0.002	< 0.002	< 0.002
Molybdenum	-	73	0.7	1.2	109	775	744
Nickel	470	52	1.6	4.7	4.5	4.6	4.4
Selenium	-	2	0.229	0.409	17.4	1.8	3.3
Silver	-	0.25	0.0243	0.0677	< 0.1	< 0.1	< 0.1
Strontium	-	-	215	361	699	498	476
Thallium	-	0.8	0.0238	0.1137	< 0.2	< 0.2	< 0.2
Titanium	-	-	2	7	< 2	< 2	< 2
Uranium	15	33	0.313	0.381	7.5	7.5	7.7
Vanadium	-	-	0.45	0.698	21.4	1791	1963
Zinc	-	30	4.5	12.4	10.4	8.8	4.1
<b>General Water Quality</b>							
Ammonia	634	-	2430	50	9500	2200	80
Phosphorus	-	-	-	74	170	138.4	80.9
Chloride	640 000	120 000	100 000	20 200	404 300	381 700	394 400
Nitrate	124 000	3000	2935	92	< 10	122	75
Nitrite	600	200	-	-	< 10	92.4	111
Sodium	-	-	200 000	21 500	674 300	638 800	664 400
Sulphate	-	309 000	500 000	26 700	515 700	542 800	565 600
pH	6.5 - 9.0	-	-	-	8	8.5	9.2
Total Suspended Solids	-	-	-	-	94	< 1	16
Trout toxicity (96h)	-	-	-	-	LC <sub>50</sub> < 100%	LC <sub>50</sub> >100%	LC <sub>50</sub> >100%

<sup>a</sup>Government of Alberta. 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks.

(When applicable, guideline values based on OSPW hardness of 100 mg/L as CaCO<sub>3</sub>, pH = 8 and temp = 14°C)

<sup>b</sup>Lower Athabasca Regional Plan 2012-2022. Schedule B: Surface Water Quality Management Framework Limits and Triggers (diss.), GoA, Aug. 2012.

<sup>c</sup>Average values are dissolved concentrations and based on porewater residence times in Stage 2 between approximately 1 and 8 weeks.



## 5.0 KEY LEARNINGS

### 5.1 OPERATIONAL

The 2021 WRDP confirmed the technology did produce a quality of treated OSPW that was similar to the smaller scale field pilot completed by Syncrude in 2012 (Zubot et al, 2021). The majority of learning was related to the engineering design, operation, and associated scale-up of the WRDP to a size where meaningful quantities of OSPW could be treated; specifically, with the design and construction of Stage 2. Some key issues and rectification measures for potential future application are summarized as follows:

- Stage 1 pipeline: This should have been constructed as a single continuous loop around the filtration cell (Stage 2) for deposition of the coke slurry instead of a branched configuration to each side of the pond. This would have prevented a “dead leg” where coke could “sand-off” the pipeline when one of the two legs was closed.
- Stage 2 underdrain system. Future underdrain systems need to be designed and constructed in a manner such that will not be adversely impacted by coke placement. The current system was constructed using high density polyethylene pipe (HDPE); primarily, because the use of more robust and heavier carbon steel pipe was susceptible to corrosion. The HDPE underdrain pipes were prone to lifting and movement during coke placement. This resulted in an underdrain system that was not placed entirely on the base of the filtration cell. This, in turn, reduced the effective treatment volume of the filtration cell since the water below the under pipes is not accessible.
- Two block valves per pour location as opposed to a single block valve – coke tends to travel past the pour point unless blocked immediately downstream of the discharge spout. The use of two block valves would mitigate the risk of sanding the Stage 1 pipeline.
- The use of a larger pump to drain the water from the filtration cell (Stage 2). Future designs should ensure the pump is appropriately sized such that rate of water withdrawal balances the water inflow rate from Stage 1. This will ensure capacity exists to prevent the formation of a water cap and ensure acceptable coke placement over the underdrain pipes which can cover distances in the hundreds of meters. For the field pilot, this issue was rectified by utilizing additional centrifugal pumps to prevent formation of a water cap during discharge of the coke slurry from Stage 1.
- The manual valves for each of the 14 pour locations on the Stage 1 pipeline had to be manipulated frequently and were difficult to operate due to sandy conditions and coke sitting in the valve seat. For ease of operation, hydraulic valves would greatly decrease the risk of personnel injury due to repetitive strain.



## 5.2 TESTING RESULTS RELATIVE TO ALBERTA'S WATER RELEASE POLICY

Management of release of industrial and municipal wastewater discharges in the Province of Alberta is described in the *Water Quality Based Effluent Limits Procedures Manual* (AEP, 1995). The principles and procedures put forth in this document are based primarily on those used by the United States Environmental Protection Agency (US EPA) for regulating discharges in the United States. With respect to mixing zones, the Water Quality Based Effluent Limits (WQBEL) Procedures states: *Effluent discharges rarely mix instantaneously with a receiving stream. Mixing zones for initial dilution of the effluent plume are a practical necessity. Water quality-based limits setting allows, where necessary, limited mixing zones within which instream guidelines may be exceeded. These exceedance areas should be small enough so as not to interfere with beneficial uses. They should be established to ensure protection of the waterbody as a whole (chronic) and to limit acute lethality to organisms passing through the plume (acute).*

The WQBEL procedures manual further states that acute guidelines should be met at end-of-pipe unless adequate justification is provided for which case acute guidelines should be met at a distance 30 meters surrounding the outfall. Additionally, the treated effluent should achieve an  $LC_{50} > 100\%$  at the end of pipe using rainbow trout or daphnia magna. For the chronic mixing zone, chronic guidelines are preferably met by 10 times the stream width as a length restriction and  $\frac{1}{2}$  the stream width laterally. Assuming the width of the Athabasca River proximate to the Syncrude site during a low flow condition is approximately 200 m, the resulting chronic mixing zone would extend about 2 km.

Based on the water quality results presented in this document and summarized in Table 3, Individual substances in the Treated OSPW are present at concentrations less their respective acute guidance values. Importantly, the requirement of no lethality to rainbow trout and daphnia magna, is also met at the exit of Stage 3 which would be representative of end-of-pipe water quality. Additionally, most substances in the Treated OSPW are present at concentrations less than their respective chronic guidance value for the protection of aquatic life.

Based on the technical knowledge available to date, and Syncrude's present fluid coking capacity, there is potential the petroleum coke technology can treat between about 8 and 10  $Mm^3$  of OSPW per year. As indicated in Table 2, there were no chronic effects to fathead minnows, algae, ceriodaphnia dubai, hyalella azteca, fingernail clams, and walleye with Treated OSPW mixed with river water at dilution levels exceeding 10%. Assuming the technology was used to treat and release 8  $Mm^3$ /year from a side bank discharge into the Athabasca River at the low flow (1Q10) condition ( $\sim 99m^3/s$ ), modelling calculations using the Athabasca River Model (ARM) indicate a 10% dilution within the Athabasca River would be achieved between about 10 and 30 m downstream of the release point (Four Elements, 2022).

The most sensitive chronic endpoints were associated with periphyton growth rates and biomass at a Treated OSPW concentration of 3.2% and higher (Table 2). At dilution levels exceeding 3.2%, no effects were found using a battery of toxicity tests and mesocosm-scale experiment (Table 2). Using this as the most sensitive chronic endpoint and assuming the same release and river flow conditions as described above, ARM model calculations indicate a 3.2% dilution would be achieved between about 100 and 200 m downstream of the release point (Four Elements, 2022). This is about an order of magnitude more



conservative than the 2 km length restriction as per guidance recommended in the WQBEL procedures manual.

### 5.3 TOXICITY TESTING

To assess toxicity the use of standard and native (resident) species was used. For acute testing the standard species used included rainbow trout, daphnia magna, and luminescent bacteria (MicroTox™). For sublethal testing, the standard species used included ceriodaphnia dubia, hyalella azteca, fathead minnow, and green algae. Additional sublethal testing was completed using species native to the lower Athabasca River and included walleye, fingernail clams, and freshwater mussels.

A key learning of the ecotoxicity program (Section 4.5, Appendix B) was toxicity testing using native species was similar or less sensitive than the tests using standard species. Specifically, fathead minnows were more sensitive than walleye, and Ceriodaphnia dubia were more sensitive than freshwater mussels. In addition, native species testing was complicated because they were more prone to culture/control failures and availability of test organisms was problematic. For example, to complete the walleye tests, several cubic meters of Treated OSPW had to be stored over the winter months until the following May when walleye eggs were available.

These results are consistent with the views put forth by the US EPA which states, *“sometimes, regulatory agencies require testing on representative resident species under the assumption that such tests are needed to assess impacts to local biota. EPA considers it unnecessary to test resident species since standard test species have been shown to represent the sensitive range of all ecosystems analyzed. Resident species toxicity testing is strongly discouraged unless it is required by state statute or some other legally binding factor, or it has been determined that a unique resident species would be far more protective of the receiving water than the EPA surrogate species”* (US EPA, March 1991, p. 17)

Consequently, it is recommended that future toxicology testing programs to assess water treatment technologies rely on standard test species whose methods have been developed and published by reputable organizations such as Environment Canada. Environment Canada has published reference methods (Environment Canada, 2000, p. vi) for an array of biological testing using various organisms and such methods are favoured:

- For regulatory use in the environmental toxicity laboratories of federal and provincial agencies;
- For regulatory testing which is contracted out by Environment Canada or requested from outside agencies or industry;
- For incorporation in federal, provincial, or municipal environmental regulations or permits, as a regulatory monitoring program requirement; and
- As a foundation for the provision of very explicit instructions.



## **6.0 OUTCOMES AND IMPACTS**

### **6.1 PROJECT OUTCOMES AND IMPACTS**

The project results have confirmed the potential of the technology for potential future incorporation into the Syncrude project. A significant future opportunity exists via the hydraulic placement of the coke/OSPW slurry (Stage 1) into a dedicated in-pit tailings structure (Stage 2) which would serve as a commercial-scale water treatment facility. Implemented in an appropriate manner and over the life of the Syncrude project, the treatment technology has the potential to treat hundreds of millions of cubic meters of OSPW. This would impart engineered control over volumes of OSPW to improve long-term oil sands water management practices.

### **6.2 CLEAN ENERGY METRICS**

Table 4 in Schedule C of the Investment agreement identified three “Clean Energy” metrics: # of field pilots, # of new jobs created from project, and potential future investment. None of these metrics have materially changed since program inception. The pilot facility was initially commissioned in May 2019 with subsequent operation in the summer of 2021. The water quality testing program was completed in October 2021. The program has provided significant knowledge, particularly with respect to future potential commercialization from the perspective of engineering design and operation. The work program did create a significant number of jobs, particularly for the primary contractor, Bouchier Contracting, a 100% Indigenous owned company, based in Fort McKay, Alberta. The knowledge obtained as a result of the program has significantly advanced the technology with respect to future potential commercialization.

### **6.3 PROGRAM SPECIFIC METRICS**

Table 5 in Schedule C of the investment agreement identified two “project success” metrics: water quality and operational. The purpose of the technology is to produce treated OSPW such that it can be released to the Athabasca River in a manner protective of downstream uses. Based on the results of the WRDP assessed in the context of Alberta’s policy for industrial wastewater releases (AEP 1995), this metric was achieved. The quality of the Treated OSPW produced was non-acutely toxic and contains constituents at the end-of-pipe at concentrations less than Alberta’s acute guidance for freshwater aquatic life (GOA 2018). A comprehensive program to assess chronic (sublethal) effects indicate if the technology is commercialized at release rates of about 8 Mm<sup>3</sup>/year, requirements for the chronic mixing zone would comply with Alberta’s release policy. However, the release of treated OSPW is contingent on future regulatory clarity and approval by Provincial and Federal authorities.

The WRDP has provided significant operational learning for potential future commercial implementation into the Syncrude project. In addition to providing knowledge with respect to issues such as valve and pipeline placements, a major learning was realized by understanding how to place a petroleum coke slurry over relatively large distances to cover the underdrain pipes at the base of the Filtration Cell (Stage 2).



This was a technology necessity as it was required to cover the pipes with petroleum coke to form a filter bed. The solution is to pour the slurry and remove the overlying water at rates to prevent a water cap from forming. For the WRDP, this was achieved by using additional dewatering pumps to remove surface water accumulation at a rate to match the water inflow to prevent a water cap. This had the effect of creating a slurry flow that was similar to how lava flows overland. For future applications, this could be achieved by ensuring the underdrain pump that removes water from the Filtration Cell is appropriately sized such that a water cap is prevented from forming until an acceptable filter bed has formed.

## **6.4 PROJECT OUTPUTS**

Between 2019 and 2022, relevant media inquiry/interviews related to the WRDP are provided as follows:

- The Globe and Mail (May 8, 2019)
- The Daily Oil Bulletin (Nov. 28, 2019)
- The Canadian Energy Centre (Dec. 12, 2019)
- Reuters (March 11, 2020)
- The Globe & Mail (March 11, 2020)
- Reuters (May 6, 2020)
- CIM Magazine (July 16, 2020)

Links to media coverage:

- May 2019  
<https://www.mymcmurray.com/2019/05/23/syncrude-treating-water-petroleum-coke/>
- January 2020  
<https://www.canadianminingjournal.com/news/oilsands-alberta-developing-rules-for-release-of-process-water/>
- March 2021  
<https://energynow.ca/2021/03/large-scale-pilot-to-treat-oil-sands-process-water-set-to-resume-deborah-jaremko/>

Syncrude has also included external information on the corporate website ([www.syncrude.ca](http://www.syncrude.ca)) concerning the WRDP:

- May 17, 2019  
<https://syncrude.ca/2019/05/17/syncrude-preparing-to-commission-full-scale-closed-circuit-water-return-treatment-demonstration-project/>
- October 24, 2019  
<https://syncrude.ca/2019/10/24/construction-completed-at-syncrudes-commercial-water-release-project/>



- May 28, 2021  
<https://syncrude.ca/2021/05/28/warrens-innovation-will-help-reclaim-tailings-ponds-faster/>

Program results were externally communicated at the COSIA Mine Water Workshop, Edmonton, Alberta

- October 19, 2022  
<https://web.cvent.com/attendee-login?>

The WRDP was used to publicly communicate the specific technology and, the benefits of treating OSPW for release to the environment. This included communication/education to enable the public to better understand industry's water management practices and to build confidence and trust that OSPW can be treated and returned in a manner that protects downstream ecological and human health. In addition to media communications (Section 6.4), several on-site community tours (Figure 55) were held in 2019 and 2021 with local Metis/First Nation communities to visit the treatment and testing facilities. An intent of these tours was to educate community members on the treatment of OSPW safe release and why this would be beneficial to local communities, the industry, the province, and the country.



**Figure 55: Facility tour with Fort McKay Community Members.**



## **7.0 BENEFITS**

### **7.1 ECONOMIC**

The mineable oil sands industry is faced with two overarching challenges: ensuring the economics of bitumen production are competitive on the open market, and that development occurs in a societal acceptable manner. The WRDP address both challenges via the development of an economically viable low-energy treatment technology to permit the safe release of treated OSPW to the environment. This is necessary to improve industry's collective environmental performance which is necessary to maintain and improve social license which in turn is necessary to attract and retain new investments to ensure the industry continues to be a major contributor to the Canadian economy.

### **7.2 ENVIRONMENTAL**

Since 1967, oil sands companies have operated with a “zero-release” practice for OSPW. Water and fluid materials have been and continue to be stored in “out-of-pit” and “in-pit” tailings facilities.

Environmental benefits associated with the release of Treated OSPW include:

- reduce long-term storage requirements in tailings containment facilities,
- minimize landscape disturbances, and specifically the construction of out-of-pit tailings structures,
- expedite terrestrial and aquatic reclamation activities,
- mitigate OSPW salinization associated with highly efficient water recycle and reuse practices; and
- achieve mine closure outcomes.

### **7.3 SOCIAL**

Commercial scale oil production from the mineable oil sands industry has been occurring for over five decades. The business timeframes for existing projects are long and, in many cases, will extend into the latter part of the 21<sup>st</sup> century. The purpose of the WRDP is development of a technology to treat and release OSPW to realize the benefits described in Section 7.2. Operational incorporation of technology is necessary to drive continuous improvement activities to advance the practice including technology performance. Consequently, there are potential business opportunities for the R&D communities and technology entrepreneurs.

### **7.4 BUILDING INNOVATION CAPACITY**

The WRDP supported Alberta's water innovation community; specifically, the release of treated OSPW to the Athabasca River to improve water management within Alberta's mineable oil sands industry. It was



a joint industry project within the Water Environmental Priority Area (WEPA) of Canadian Oil Sands Innovation Alliance (COSIA).

The Government of Alberta's Oil Sands Process Water Science Team (OSPW-ST) collaboratively established a program to assess the quality of Treated OSPW. This included the design of an experimental plan that incorporated biological, chemical, and ecological endpoints to support future OSPW Treatment and release activities. Membership of the OSPW-ST included representatives from industry, the local communities, the provincial and federal governments, and academia. Information relating to the technology, the effectiveness, and the water quality results has been shared with industry, government, stakeholders, and the public.



## **8.0 RECOMMENDATIONS AND NEXT STEPS**

The WRDP was operating under Alberta's three phase approach to water treatment pilots. Phase 1 consisted of establishing context and design. Phase 2 was to operationalize and evaluate closed-circuit pilot-scale treatment projects. Finally, and provided Phases 1 and 2 were completed to the satisfaction of the government, a Phase 3 may have permitted to allow for up to two years of treated water release to the environment.

The WRDP was operating within Alberta's within Phase 2 of the above noted framework with the intention, and subject to acceptable results, to progress to Phase 3 which may have permitted a pilot scale release to the Athabasca River for up to two years to further progress the technology and to collect scientific evidence to ensure the release of treated OSPW is protective of the Athabasca River system downstream of the release point.

Although the WRDP objectives have not changed, industry was advised, in the summer of 2019, that releases of treated OSPW – either for commercial or Research and Development purposes (e.g., technology development applications) – will not be permitted until regulations are available under the Federal Fisheries Act.

It is Syncrude's understanding such regulations will not be available until 2025. Consequently, the project has been paused and additional activities such as construction of a pipeline from the WRDP facility to the river to progress to Phase 3 has been deferred/terminated until appropriate provincial and federal regulatory clarity is available. In the fall of 2022, a cap of treated OSPW using Stage 1 was placed over the Filtration Cell (Stage 2) to protect and preserve the asset for future potential use. Specifically, to prevent wind erosion of the dry coke that has been placed within the facility.



## 9.0 KNOWLEDGE DISSEMINATION

Syncrude has been assessing the WRDP technology for over a decade in accordance with a staged-gate development process. It is recognized the current zero-release practice is not sustainable for the mineable oil sands sector. The results of the WRDP are consistent with former work completed based on laboratory studies (Zubot, 2012) and a smaller field pilot completed in 2012. (Zubot, 2021). The technology is unique to the Syncrude operation because Syncrude is the only operator that currently employs Fluid Coking technology. The other operators who upgrade bitumen into synthetic crude oil are reliant on delayed coking technology and/or hydrocracking.

Syncrude recognizes the potential of this technology and the company's mine planning group is assessing potential future commercialization opportunities subject to federal and provincial regulatory clarity. A significant opportunity exists via hydraulic placement of the coke material in a dedicated mined out pit (in-pit), which would serve as a commercial-scale water treatment facility (i.e., Stage 2). Implemented in an appropriate manner and over the operating life of the Syncrude project, the technology has the potential to treat hundreds of millions of cubic meters of OSPW. This would impart engineering control over the operational inventory of OSPW to support long-term OSPW management.

The WRDP was the first large scale pilot in the industry with the objective of treating OSPW for release to the Athabasca River. The results have been shared with industry via COSIA whose members are the future proponents to incorporate appropriate water treatment technologies into their operations. COSIA members include Suncor Energy, Canadian Natural Resources Ltd., Imperial Oil Resources, Ltd., and Teck Resources Ltd.

The project has served as a venue to discuss, with local communities, and the general public, the water release practice, and specifically the technology basis of the WRDP. In addition, the project was supported by Alberta's OSPW Science Team which reported to Alberta's Chief Scientist. The purpose of this team was to provide technical steer to the project. Membership of the OSPW Science Team included Alberta Environment and Parks, Alberta Health, academia, industry, Environment Canada, and local indigenous communities.



## 10.0 CONCLUSIONS

The results of the WRDP support the commercialization potential to treat OSPW for return to the environment. Key findings are summarized as follows:

- The WRDP is a three-stage water treatment process and is based on established water-treatment practices based on the principles of adsorption, filtration, and biodegradation.
- The process is low energy and produces no treatment residuals or by-products.
- Petroleum coke is a by-product of Syncrude's upgrading operation based on the use of Fluid Coking™ technology.
- The treatment process shortens the time frames necessary for OSPW remediation.
- The treated water quality is a function of porewater residence time with the coke deposit (Stage 2.) For potential future commercialization, porewater residence time is an engineering design variable. As the technology is scaled-up and made larger, the water treatment performance improves. This relates to the kinetics of the adsorption process which are biphasic. Initially the removal rate is fast and is followed by a slower diffusion-controlled process. Stage 1 and 2 utilize the reaction kinetics to maximize removal of organic compounds. The kinetically fast reactions occur within the slurry transport pipeline (Stage 1); and the kinetically slow reactions occur within the PC deposit (Stage 2).
- The quality of the Treated OSPW reported in this study is based on porewater residence times in Stage 2 between about 2 weeks and 2 months. Previous work indicates if the coke bed was further developed, porewater residence times would increase which would improve removal of organic and inorganic constituents (Zubot et al, 2012).
- Treatment removal efficiencies for NAs, and COD were about 85% and 78%, respectively. Phenols and hydrocarbon components (F2/F3) were removed at efficiencies exceeding 95%. PAH compounds – parent and alkylated - were removed at efficiencies exceeding 99%.
- Filtration of OSPW through a PC deposit (Stage 2) significantly reduced concentrations of total suspended solids. The removal of total suspended solids exceeded 98%.
- There was no significant change in the electrical conductivity of the treated OSPW.
- Ammonia removal exceeded 98%.
- With the exception of vanadium, most trace elements did not significantly leach or mobilize from the PC into OSPW. Two additional constituents which did increase in concentrations were cadmium and molybdenum. Cadmium levels, however, did not exceed Alberta's freshwater aquatic life chronic guideline value of 0.16 µg/L. Although Molybdenum concentrations did exceed the Alberta guidance of 73 µg/L in both untreated and treated OSPW which is an interim guideline based on a 1999 CCME guideline, concentrations were far less than recently published BC and Saskatchewan guidelines of 7,600 and 31,000 µg/L, respectively (BC ENV 2021, GOS 2022).



- Vanadium concentrations were elevated (~2-4 mg/L) after initial PC/OSPW contact (i.e., Stage 1). However, after retention of the OSPW within the PC deposit (Stage 2), geochemical interactions between the ion and the PC resulted in concentration reductions over time. Previous studies (Zubot 2010, 2021) have confirmed the ion is treatable and can be reduced in concentration by increasing the porewater residence times in Stage 2 and/or the use of an adsorbent such as iron hydroxides.
- Trace elements that decreased in concentrations as a result of the treatment process included aluminum, barium, cobalt, copper, selenium, and strontium.
- Whole effluent toxicity testing using trout, zooplankton and luminescent bacteria confirms that OSPW before treatment was acutely toxic. After treatment, component concentrations were sufficiently reduced that the treated OSPW was non-acutely toxic.
- The sublethal water testing program found native species were similar or less sensitive than tests using standard laboratory species. Furthermore, fathead minnows were more sensitive to Treated OSPW than walleye and ceriodaphnia dubia were more sensitive than freshwater bivalves. The use of native species was difficult to execute because they were much more prone to culture/control failures. Additionally, native species testing was challenged with respect to planning and testing because of practical limitations. For example, the walleye test was could only be completed in the Spring because of species availability. These results are consistent with longstanding regulatory guidance put forth by the US EPA which strongly discourages the use of native species testing relative to standard species.
- The water quality assessment using standard and native species as well as mesocosms inoculated with periphyton and benthic invertebrates from the Athabasca River found the most sensitive endpoint was periphyton growth rates when Treated OSPW was mixed with Athabasca River water at concentrations of 3.2% and higher. At the time of testing, vanadium levels did exceed some published chronic effects thresholds for algae, ceriodaphnia dubia and the fathead minnow. Potential causes are likely salinity (i.e., osmotic stresses), and vanadium. It is possible sub-lethal endpoints were exacerbated by synergistic effects between salinity and vanadium concentrations present at the time of testing.
- Using periphyton growth rates as the most sensitive chronic endpoint and assuming a Treated OSPW release of 8 Mm<sup>3</sup>/year into the Athabasca River flowing at the 1Q10 flow condition (~99m<sup>3</sup>/s), modelling calculations indicate a 3.2% dilution would be achieved between about 100 and 200 m downstream of the release point. This is about an order of magnitude more conservative than the 2 km length restriction as per chronic mixing zone guidance recommended in Alberta's policy for industrial and municipal discharges.



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## **Appendix A**

### **Water Chemistry**



**Table A1: General Water Chemistry**

Sample ID	Sample Date	Sample Time	pH (units)	Conductivity (uS/cm)	Sodium (Na) (mg/L)	Potassium (K) (mg/L)	Magnesium (Mg) (mg/L)	Calcium (Ca) (mg/L)	Chloride (Cl) (mg/L)	Sulphate (SO4) (mg/L)	Bicarbonate (HCO3) (mg/L)	Carbonate (CO3) (mg/L)	Hydroxide (OH) (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Hardness (as CaCO3) (mg/L)	Alkalinity (PP as CaCO3) (mg/L)	Alkalinity (Total as CaCO3) (mg/L)	Ion Ratio (TAN/ Tcat) (meq/meq)
LOC1-20210719-1500	19-Jul-21	3:00 PM	8.03	3290	670	11	12	26	380	500	660	10	<1.0	96	1900	110	<1.0	540	1.02
LOC1-20210720-0905	20-Jul-21	9:05 AM	8.02	3280	650	11	12	25	400	500	670	10	<1.0	120	1900	110	<1.0	550	1.07
LOC1-20210721-0755	21-Jul-21	7:55 AM	7.88	3310	690	11	12	25	390	480	660	10	<1.0	110	1900	110	<1.0	540	0.99
LOC1-20210723-0751	23-Jul-21	7:51 AM	7.92	3310	730	11	11	23	410	500	660	10	<1.0	85	2000	100	<1.0	540	0.97
LOC1-20210726-0810	26-Jul-21	8:10 AM	7.56	3370	670	11	12	24	420	560	570	10	<1.0	110	2000	110	<1.0	470	1.05
LOC1-20210729-1000	29-Jul-21	10:00 AM	7.99	3380	660	11	11	22	410	560	630	10	<1.0	97	2000	99	<1	520	1.09
LOC1-20210803-0800	3-Aug-21	8:00 AM	8.11	3400	650	11	10	22	420	510	670	10	<1.0	40	2000	97	<1.0	550	1.08
LOC2-20210719-1600	19-Jul-21	4:00 PM	8.61	3260	660	13	9.9	22	410	500	570	25	<1.0	110	1900	95	21	510	1.04
LOC2-20210720-0820	20-Jul-21	8:20 AM	8.59	3300	650	13	11	22	400	510	610	13	<1.0	170	1900	100	10	520	1.06
LOC2-20210721-0715	21-Jul-21	7:15 AM	8.52	3290	650	14	12	24	400	490	610	15	<1.0	150	1900	110	12	520	1.04
LOC2-20210723-0710	23-Jul-21	7:10 AM	8.48	3280	710	13	11	22	420	470	580	14	<1.0	34	2000	100	12	500	0.95
LOC2-20210726-1145	26-Jul-21	11:45 AM	8.69	3400	710	13	10	22	430	570	530	14	<1.0	680	2000	98	12	460	1.00
LOC2-20210729-0910	29-Jul-21	9:10 AM	8.54	3390	690	13	10	21	420	580	560	16	<1.0	120	2000	95	13	490	1.04
LOC2-20210803-1200	3-Aug-21	12:00 PM	8.77	3400	690	12	9.1	20	410	510	610	31	<1.0	120	2000	88	26	550	1.04
LOC3-20210812-0815	12-Aug-21	8:15 AM	8.03	2910	600	11	9.3	19	340	520	460	5.5	<1.0	1.5	1700	87	4.6	380	1.00
LOC3-20210817-0745	17-Aug-21	7:45 AM	8.55	2980	620	11	9.2	20	370	520	460	11	<1.0	1.9	1800	87	9.3	390	1.01
LOC3-20210819-0600	19-Aug-21	6:00 AM	8.42	3050	625	11	11	21	400	540	450	13	<1.0	1.1	1800	77	11	390	1.03
LOC3-20210821-1000	21-Aug-21	10:00 AM	8.64	3220	630	12	10	21	420	550	470	20	<1.0	7.4	1900	93	16	410	1.07
LOC3-20210823-1030	23-Aug-21	10:30 AM	8.89	3240	640	12	10	20	420	570	400	25	<1.0	15	1900	91	38	410	1.06
LOC3-20210825-0700	25-Aug-21	7:00 AM	8.68	3200	655	11	9.5	18	390	570	510	18	<1.0	2.4	2000	83	15	440	1.04
LOC3-20210829-0821	29-Aug-21	8:21 AM	8.2	3020	590	11	9.1	19	330	510	460	5	<1.0	<1.0	1700	84	<1.0	380	1.00
LOC3-20210830-1700	30-Aug-21	5:00 PM	8.24	2980	600	11	9.1	19	380	530	440	8.3	<1.0	<1.0	1800	84	7	370	1.04
LOC3-20210901-0900	1-Sep-21	9:00 AM	8.35	2980	630	11	9.9	19	380	520	430	5.4	<1.0	<0.99	1800	89	4.5	360	0.98
LOC3-20210903-1500	3-Sep-21	3:30 PM	8.13	3090	640	11	9	16	380	550	470	5	<1.0	<1.0	1800	78	<1.0	380	1.01
LOC3-20210908-1230	8-Sep-21	12:30 PM	8.38	3040	640	12	9.4	17	380	530	440	6.5	<1.0	<1.0	1800	82	5.4	370	0.98
LOC3-20210911-0830	11-Sep-21	8:30 AM	8.36	3010	670	12	10	19	360	530	450	5.5	<1.0	<1.0	1800	89	4.6	380	0.95
LOC3-20210915-1111	15-Sep-21	11:11 AM	8.37	3210	675	12	9.6	17	390	560	460	9.6	<1.0	<1.0	2000	82	8	390	0.97
LOC3-20210918-1342	18-Sep-21	1:42 PM	8.53	3200	640	12	11	21	400	560	470	11	<1.0	<1.0	1900	98	9.6	410	1.03
LOC3-20210920-1635	20-Sep-21	4:35 PM	8.66	3190	640	12	10	20	370	550	480	6.8	<1.0	<1.0	1900	92	5.7	400	1.00
LOC3-20210923-0845	23-Sep-21	8:45 AM	8.63	3120	680	11	9.6	18	390	550	470	9	<1.0	<0.99	1900	85	7.5	400	0.97
LOC3-20210927-1100	27-Sep-21	11:00 AM	8.49	3160	660	11	9.6	16	400	560	440	12	<1.0	<0.99	1900	81	9.8	380	1.00
LOC3-20210929-0630	29-Sep-21	6:30 AM	8.5	3150	665	11	8.9	17	370	550	440	12	<1.0	<1.0	1800	79	9.7	380	0.97
LOC4-20210824-1100	24-Aug-21	11:00 AM	9.3	3130	620	11	11	15	400	540	290	84	<1.0	11	1800	83	70	380	1.04
LOC4-20210826-0700	26-Aug-21	7:00 AM	9.37	3230	625	12	11	15	400	590	290	32	<1.0	13	1900	81	77	390	1.06
LOC4-20210827-0720	27-Aug-21	7:20 AM	9.3	3290	680	12	11	16	400	600	310	84	<1.0	21	2000	87	70	390	1.00
LOC4-20210827-1215	27-Aug-21	12:15 PM	9.3	3260	670	12	11	16	390	590	320	79	<1.0	21	1900	87	66	390	1.00
LOC4-20210831-1445	31-Aug-21	2:45 PM	9.12	3210	660	12	10	14	420	570	320	81	<1.0	18	1900	77	67	390	1.03
LOC4-20210902-0900	2-Sep-21	9:00 AM	9.1	3130	680	11.5	10.5	15.5	390	540	280	94	<1.0	16	1900	86	78	390	0.95
LOC4-20210904-0908	4-Sep-21	9:08 AM	9.15	3060	655	11	10	15	370	550	280	87	<1.0	15	1900	79	72	370	0.97
LOC4-20210906-1815	6-Sep-21	6:15 PM	8.37	3040	660	12	10	16	390	560	270	94	<1.0	21	1900	82	79	380	0.99
LOC4-20210909-1010	9-Sep-21	10:10 AM	9.26	3180	690	11	10	15	410	560	280	90	<1.0	16	1900	80	75	380	0.97
LOC4-20210913-1615	13-Sep-21	4:15 PM	9.31	3170	700	12	10	15	410	570	300	81	<1.0	15	2000	81	67	380	0.96
LOC4-20210915-1100	15-Sep-21	11:00 AM	9.27	3160	680	12	11	16	390	560	290	85	<1.0	18	1900	83	70	380	0.96
LOC4-20210918-1338	18-Sep-21	1:38 PM	9.29	3160	640	11	11	16	390	570	350	51	<1.0	15	1900	84	41	370	1.01
LOC4-20210920-1637	20-Sep-21	4:37 PM	9.34	3160	660	11	11	17	400	570	320	63	<1.0	16	1900	87	53	370	0.99
LOC4-20210923-0900	23-Sep-21	9:00 AM	9.3	3160	690	11	10	16	380	560	320	71	<1.0	18	1900	80	59	380	0.95
LOC4-20210927-1115	27-Sep-21	11:15 AM	9.18	3130	650	11	9.1	18	400	570	330	56	<1.0	12	1800	79	47	370	1.01
LOC4-20210929-0635	29-Sep-21	6:35 AM	9.09	3080	670	11	9.7	16	370	550	340	48	<1.0	16	1800	81	40	360	0.95



**Table A2: Nutrients**

Sample ID	Sample Date	Sample Time	Dissolved Nitrate (NO3) (µg/L)	Dissolved Nitrate (N) (µg/L)	Dissolved Nitrite (NO2) (µg/L)	Dissolved Nitrite (N) (µg/L)	Total Ammonia (N) (mg/L)	Total Phosphorus (P) (µg/L)	Dissolved Nitrate plus Nitrite (N) (µg/L)	Total Nitrogen (N) (mg/L)	Total Kjeldahl Nitrogen (mg/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	<44	< 10	39	12	12	160	<10	14	14.4
LOC1-20210720-0905	20-Jul-21	9:05 AM	<44	< 10	36	11	12	130	<10	15	15.2
LOC1-20210721-0755	21-Jul-21	7:55 AM	<44	< 10	<33	<10	12	190	<10	14	14.3
LOC1-20210723-0751	23-Jul-21	7:51 AM	<44	< 10	<33	<10	13	210	<10	12	12
LOC1-20210726-0810	26-Jul-21	8:10 AM	<44	-	<33	<10	12	170	<14	14	14
LOC1-20210729-1000	29-Jul-21	10:00 AM	<44	< 10	34	<10	12	160	<10	16	15.7
LOC1-20210803-0800	3-Aug-21	8:00 AM	<44	< 10	35	<10	11	170	<14	14	13.8
LOC2-20210719-1600	19-Jul-21	4:00 PM	130	29	59	18	8.8	180	47	10	10.4
LOC2-20210720-0820	20-Jul-21	8:20 AM	75	17	39	12	9.5	130	29	12	11.6
LOC2-20210721-0715	21-Jul-21	7:15 AM	<44	<10	36	11	9.9	210	16	11	11.5
LOC2-20210723-0710	23-Jul-21	7:10 AM	57	13	40	12	11	150	25	13	12.5
LOC2-20210726-1145	26-Jul-21	11:45 AM	<44	-	<33	<10	8.9	200	<14	11	10.8
LOC2-20210729-0910	29-Jul-21	9:10 AM	<44	< 10	46	<10	9.4	120	19	12	12.2
LOC2-20210803-1200	3-Aug-21	12:00 PM	<44	< 10	42	<10	8.8	150	20	10	10.2
LOC3-20210812-0815	12-Aug-21	8:15 AM	230	51	430	100	2.7	160	180	3.1	2.87
LOC3-20210817-0745	17-Aug-21	7:45 AM	260	58	410	130	2.4	150	180	2.6	2.46
LOC3-20210819-0600	19-Aug-21	6:00 AM	980	-	1000	310	2.4	170	530	2.9	2.35
LOC3-20210821-1000	21-Aug-21	10:00 AM	2700	600	1300	400	1.9	150	990	3.2	2.19
LOC3-20210823-1030	23-Aug-21	10:30 AM	2500	560	830	250	1.7	88	820	3.6	2.77
LOC3-20210825-0700	25-Aug-21	7:00 AM	670	150	160	47	2.4	150	200	2.8	2.63
LOC3-20210829-0821	29-Aug-21	8:21 AM	54	12	39	12	2.7	190	24	3.1	3.04
LOC3-20210830-1700	30-Aug-21	5:00 PM	44	<10	49	15	2.6	190	25	3	3
LOC3-20210901-0900	1-Sep-21	9:00 AM	48	11	45	14	2.6	180	24	2.4	2.41
LOC3-20210903-1500	3-Sep-21	3:00 PM	76	17	97	29	2.2	130	47	2.4	2.35
LOC3-20210908-1230	8-Sep-21	12:30 PM	100	23	<33	<10	2	140	23	2.2	2.14
LOC3-20210911-0830	11-Sep-21	8:30 AM	<44	<10	35	11	2.1	150	16	2.3	2.29
LOC3-20210915-1111	15-Sep-21	11:11 AM	480	110	<33	<10	2.1	120	110	2.8	2.66
LOC3-20210918-1342	18-Sep-21	1:42 PM	310	70	88	27	2.3	140	97	2.4	2.31
LOC3-20210920-1635	20-Sep-21	4:35 PM	73	16	48	15	1.7	100	31	2.2	2.21
LOC3-20210923-0845	23-Sep-21	8:45 AM	97	22	<33	<10	1.6	89	22	3	2.94
LOC3-20210927-1100	27-Sep-21	11:00 AM	61	14	35	11	1.7	99	24	2.4	2.35
LOC3-20210929-0630	29-Sep-21	6:30 AM	<44	<10	48	15	1.8	96	20	2.3	2.31
LOC4-20210824-1100	24-Aug-21	11:00 AM	320	72	340	100	0.028	74	180	1.9	1.68
LOC4-20210826-0700	26-Aug-21	7:00 AM	780	176	570	170	0.13	77	350	2	1.64
LOC4-20210827-0720	27-Aug-21	7:20 AM	810	183	580	180	0.15	95	360	2.3	1.94
LOC4-20210827-1215	27-Aug-21	12:15 PM	820	185	580	180	0.14	98	360	2.3	1.96
LOC4-20210831-1445	31-Aug-21	2:45 PM	730	165	440	130	0.073	98	300	2	1.68
LOC4-20210902-0900	2-Sep-21	9:00 AM	630	142	390	120	0.035	95	260	1.9	1.62
LOC4-20210904-0908	4-Sep-21	9:08 AM	270	61	270	81	0.088	78	140	1.6	1.43
LOC4-20210906-1815	6-Sep-21	6:15 PM	<44	<10	110	32	0.058	86	42	2	1.93
LOC4-20210909-1010	9-Sep-21	10:10 AM	50	11	36	11	0.077	65	22	1.7	1.73
LOC4-20210913-1615	13-Sep-21	4:15 PM	88	20	<33	<10	0.082	63	20	1.6	1.57
LOC4-20210915-1100	15-Sep-21	11:00 AM	110	25	<33	<10	0.073	89	24	1.7	1.69
LOC4-20210918-1338	18-Sep-21	1:38 PM	81	18	<33	<10	0.1	67	18	1.6	1.6
LOC4-20210920-1637	20-Sep-21	4:37 PM	80	18	<33	<10	0.041	71	-	1.5	1.53
LOC4-20210923-0900	23-Sep-21	9:00 AM	75	17	<33	<10	<0.015	81	17	2.2	2.21
LOC4-20210927-1115	27-Sep-21	11:15 AM	75	17	<33	<10	0.037	74	17	1.9	1.88
LOC4-20210929-0635	29-Sep-21	6:35 AM	75	17	<33	<10	0.026	84	17	2.2	2.16



**Table A3: Dissolved Organic Compounds**

Sample ID	Sample Date	Sample Time	True Colour (PtCo units)	COD (mg/L)	BOD <sub>5</sub> (mg/L)	Total Phenols (µg/L)	Dissolved Organic Carbon (mg C/L)	TPH (mg/L)	F1 (C <sub>6</sub> -C <sub>10</sub> ) - BTEX (µg/L)	F2 (C <sub>10</sub> -C <sub>14</sub> ) (mg/L)	F3 (C <sub>14</sub> -C <sub>34</sub> ) (mg/L)	Benzene (µg/L)	Ethylbenzene (µg/L)	Toluene (µg/L)	o-Xylene (µg/L)	m & p-Xylene (µg/L)	Xylenes (Total) (µg/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	57	313	16	40	55	15.1	<100	3.1	12	<0.40	<0.40	<0.40	3.4	3.6	7
LOC1-20210720-0905	20-Jul-21	9:05 AM	77	315	20	40	44	20.8	<100	3.8	17	<0.40	<0.40	<0.40	3.8	2.2	6
LOC1-20210721-0755	21-Jul-21	7:55 AM	69	384	20	40	42	16.1	<100	3.1	13	<0.40	<0.40	<0.40	7.4	3.4	11
LOC1-20210723-0751	23-Jul-21	7:51 AM	54	445	21	43	50	20.2	<100	4.2	16	<0.40	<0.40	0.85	11	8	19
LOC1-20210726-0810	26-Jul-21	8:10 AM	54	317	22	40	54	9.2	<100	2.4	6.8	<0.40	<0.40	0.42	7.4	4.1	11
LOC1-20210729-1000	29-Jul-21	10:00 AM	48	351	23	46	47	20.6	<100	3.6	17	<0.40	<0.40	<0.40	6.9	3.3	10
LOC1-20210803-0800	3-Aug-21	8:00 AM	67	355	16	45	72	11.4	<100	2.7	8.7	<0.40	0.41	<0.40	9.3	4.3	14
LOC2-20210719-1600	19-Jul-21	4:00 PM	11	474	<4.0	<5	19	0.59	<100	<0.10	0.59	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC2-20210720-0820	20-Jul-21	8:20 AM	23	285	<5.2	<5	37	1.61	<100	0.31	1.3	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC2-20210721-0715	21-Jul-21	7:15 AM	18	363	<6.0	<2	23	0.92	<100	0.25	0.67	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC2-20210723-0710	23-Jul-21	7:10 AM	14	252	< 2.7	3.9	35	0.66	<100	0.13	0.53	<0.40	<0.40	<0.40	<0.40	<0.80	<0.89
LOC2-20210726-1145	26-Jul-21	11:45 AM	11	94	< 2.7	<2	22	0.19	<100	<0.10	0.19	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC2-20210729-0910	29-Jul-21	9:10 AM	15	100	< 4.5	<2	21	0.41	<100	<0.10	0.41	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC2-20210803-1200	3-Aug-21	12:00 PM	14	120	< 3.7	<2	36	0.63	<100	0.1	0.53	<0.40	<0.40	<0.40	<0.40	<0.80	<0.89
LOC3-20210812-0815	12-Aug-21	8:15 AM	6.3	75	5.7	1.7	14	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC3-20210817-0745	17-Aug-21	7:45 AM	6.4	80	<2.0	1.5	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.40	<0.80	<0.80
LOC3-20210819-0600	19-Aug-21	6:00 AM	40	74	<2.0	2.4	14	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210821-1000	21-Aug-21	10:00 AM	6.5	87	<2.6	3.6	20	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210823-1030	23-Aug-21	10:30 AM	10	80	6.3	3.3	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210825-0700	25-Aug-21	7:00 AM	7.8	116	<2	1.5	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210829-0821	29-Aug-21	8:21 AM	7.6	75	< 4.0	1.5	16	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210830-1700	30-Aug-21	5:00 PM	5.5	75	<2.0	1	16	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210901-0900	1-Sep-21	9:00 AM	2.5	70	<2.0	1.5	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210903-1500	3-Sep-21	3:00 PM	6.3	68	<2.0	1.5	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210908-1230	8-Sep-21	12:30 PM	7.7	71	<2.0	1	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210911-0830	11-Sep-21	8:30 AM	6.9	77	<2.0	1	17	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210915-1111	15-Sep-21	11:11 AM	2	82	<2.0	1	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210918-1342	18-Sep-21	1:42 PM	6.8	77	<3.2	<1.5	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210920-1635	20-Sep-21	4:35 PM	11	79	<2.0	<1.5	20	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210923-0845	23-Sep-21	8:45 AM	5.9	76	<2.0	<1.5	15	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210927-1100	27-Sep-21	11:00 AM	6	76	<2.3	<1.5	18	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC3-20210929-0630	29-Sep-21	6:30 AM	6.2	81	<2.5	<1.5	18	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210824-1100	24-Aug-21	11:00 AM	18	101	< 2	<2	17	-	<100	<0.10	<100	<0.40	<0.80	<0.40	<0.40	<0.40	<100
LOC4-20210826-0700	26-Aug-21	7:00 AM	18	108	6	<2	22	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210827-0720	27-Aug-21	7:20 AM	20	109	<3.8	2.9	22	0.12	<100	<0.10	0.12	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210827-1215	27-Aug-21	12:15 PM	26	108	<2.7	2.5	22	0.1	<100	<0.10	0.11	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210831-1445	31-Aug-21	2:45 PM	17	110	4.6	<1.5	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210902-0900	2-Sep-21	9:00 AM	14	106	< 6.3	<1.5	21	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210904-0908	4-Sep-21	9:08 AM	14	106	<2.0	<1.5	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210906-1815	6-Sep-21	6:15 PM	14	116	5.5	<1.5	20	0.37	<100	0.14	0.23	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210909-1010	9-Sep-21	10:10 AM	15	115	4	<1.5	24	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210913-1615	13-Sep-21	4:15 PM	11	107	7.7	<1.5	19	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210915-1100	15-Sep-21	11:00 AM	18	97	8.3	<1.5	22	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210918-1338	18-Sep-21	1:38 PM	14	101	<3.5	<1.5	22	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210920-1637	20-Sep-21	4:37 PM	14	112	5.2	<1.5	22	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210923-0900	23-Sep-21	9:00 AM	16	73	8.1	<1.5	20	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210927-1115	27-Sep-21	11:15 AM	16	102	<4.0	<1.5	20	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80
LOC4-20210929-0635	29-Sep-21	6:35 AM	20	106	5.1	<1.5	20	<0.1	<100	<0.10	<0.10	<0.40	<0.40	<0.40	<0.80	<0.40	<0.80



**Table A4: Naphthenic Acids (Method of FTIR)**

Naphthenic Acids (FTIR)				Naphthenic Acids (FTIR)				Naphthenic Acids (FTIR)				Naphthenic Acids (FTIR)				Naphthenic Acids (FTIR)			
Sample ID	Sample Date	Sample Time	(mg/L)	Sample ID	Sample Date	Sample Time	(mg/L)	Sample ID	Sample Date	Sample Time	(mg/L)	Sample ID	Sample Date	Sample Time	(mg/L)	Sample ID	Sample Date	Sample Time	(mg/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	47.8	LOC2-20210719-1455	19-Jul-21	2:55 PM	15.0	LOC3-20210811-1435	11-Aug-21	2:35 PM	9.4	LOC3-20210924-1010	24-Sep-21	10:10 AM	9.5	LOC4-20210824-1100	24-Aug-21	11:00 AM	10.4
LOC1-20210720-0905	20-Jul-21	9:05 AM	51.9	LOC2-20210719-1600	19-Jul-21	4:00 PM	14.5	LOC3-20210812-0815	12-Aug-21	8:15 AM	8.7	LOC3-20210925-0850	25-Sep-21	8:50 AM	9.4	LOC4-20210825-1615	25-Aug-21	4:15 PM	9.8
LOC1-20210721-0755	21-Jul-21	7:55 AM	61.4	LOC2-20210720-0820	20-Jul-21	8:20 AM	21.0	LOC3-20210813-1005	13-Aug-21	10:05 AM	9.2	LOC3-20210926-0930	26-Sep-21	9:30 AM	8.9	LOC4-20210826-0700	26-Aug-21	7:00 AM	10.0
LOC1-20210723-0751	23-Jul-21	7:51 AM	52.7	LOC2-20210720-1200	20-Jul-21	12:00 PM	20.6	LOC3-20210814-1005	14-Aug-21	10:05 AM	9.7	LOC3-20210927-1100	27-Sep-21	11:00 AM	9.0	LOC4-20210827-0720	27-Aug-21	7:20 AM	9.7
LOC1-20210726-0810	26-Jul-21	8:10 AM	53.0	LOC2-20210721-0715	21-Jul-21	7:15 AM	24.3	LOC3-20210815-1500	15-Aug-21	3:00 PM	9.5	LOC3-20210928-1040	28-Sep-21	10:40 AM	9.9	LOC4-20210827-1215	27-Aug-21	12:15 PM	9.4
LOC1-20210727-0825	27-Jul-21	8:25 AM	48.2	LOC2-20210721-1210	21-Jul-21	12:10 PM	21.2	LOC3-20210816-1200	16-Aug-21	12:00 PM	8.6	LOC3-20210929-0630	29-Sep-21	6:30 AM	10.8	LOC4-20210828-0915	28-Aug-21	9:15 AM	10.4
LOC1-20210728-0850	28-Jul-21	8:50 AM	46.3	LOC2-20210721-1730	21-Jul-21	5:30 PM	17.7	LOC3-20210817-0745	17-Aug-21	7:45 AM	9.5	LOC3-20210930-0630	30-Sep-21	6:30 AM	8.6	LOC4-20210831-1445	31-Aug-21	2:45 PM	10.1
LOC1-20210729-1000	29-Jul-21	10:00 AM	52.4	LOC2-20210722-0745	22-Jul-21	7:45 AM	15.6	LOC3-20210819-0600	19-Aug-21	6:00 AM	9.2	LOC3-20211001-0630	1-Oct-21	6:30 AM	9.4	LOC4-20210901-1115	1-Sep-21	11:15 AM	9.1
LOC1-20210730-0825	30-Jul-21	8:25 AM	61.3	LOC2-20210722-1200	22-Jul-21	12:00 PM	13.3	LOC3-20210820-1200	20-Aug-21	12:00 PM	10.1	LOC3-20211002-1500	2-Oct-21	3:00 PM	9.0	LOC4-20210902-0900	2-Sep-21	9:00 AM	9.4
LOC1-20210803-0800	3-Aug-21	8:00 AM	57.2	LOC2-20210722-1615	22-Jul-21	4:15 PM	14.5	LOC3-20210821-1000	21-Aug-21	10:00 AM	10.0	LOC3-20211003-1800	3-Oct-21	6:00 PM	8.4	LOC4-20210903-1500	3-Sep-21	3:00 PM	9.7
				LOC2-20210723-0710	23-Jul-21	7:10 AM	19.4	LOC3-20210822-1100	22-Aug-21	11:00 AM	10.5	LOC3-20211004-1145	4-Oct-21	11:45 AM	8.6	LOC4-20210904-0908	4-Sep-21	9:08 AM	9.0
				LOC2-20210723-1150	23-Jul-21	11:50 AM	17.5	LOC3-20210823-1030	23-Aug-21	10:30 AM	9.9	LOC3-20211005-1144	5-Oct-21	11:44 AM	8.9	LOC4-20210905-1625	5-Sep-21	4:25 PM	9.5
				LOC2-20210724-1330	24-Jul-21	1:30 PM	18.8	LOC3-20210824-1045	24-Aug-21	10:45 AM	8.9	LOC3-20211006-1145	6-Oct-21	11:45 AM	8.6	LOC4-20210906-1815	6-Sep-21	6:15 PM	7.5
				LOC2-20210725-1305	25-Jul-21	1:05 PM	16.2	LOC3-20210825-0700	25-Aug-21	7:00 AM	9.2	LOC3-20211007-1200	7-Oct-21	12:00 PM	8.6	LOC4-20210907-1545	7-Sep-21	3:45 PM	8.8
				LOC2-20210726-1145	26-Jul-21	11:45 AM	12.3	LOC3-20210826-0715	26-Aug-21	7:15 AM	10.4	LOC3-20211008-1200	8-Oct-21	12:00 PM	8.7	LOC4-20210908-1215	8-Sep-21	12:15 PM	8.7
				LOC2-20210726-1903	26-Jul-22	7:03 PM	20.5	LOC3-20210827-1300	27-Aug-21	1:00 PM	10.0	LOC3-20211009-1130	9-Oct-21	11:30 AM	9.5	LOC4-20210909-1010	9-Sep-21	10:10 AM	7.5
				LOC2-20210727-0700	27-Jul-21	7:00 AM	15.2	LOC3-20210829-0821	29-Aug-21	8:21 AM	8.6	LOC3-20211010-1145	10-Oct-21	11:45 AM	9.9	LOC4-20210910-1400	10-Sep-21	2:00 PM	10.1
				LOC2-20210727-1055	27-Jul-21	10:55 AM	13.1	LOC3-20210830-1700	30-Aug-21	5:00 PM	8.6	LOC3-20211011-1200	11-Oct-21	12:00 PM	9.7	LOC4-20210912-0830	12-Sep-21	8:30 AM	8.8
				LOC2-20210727-1620	27-Jul-21	4:20 PM	11.5	LOC3-20210831-1430	31-Aug-21	2:30 PM	8.5	LOC3-20211012-1145	12-Oct-21	11:45 AM	9.0	LOC4-20210913-1615	13-Sep-21	4:15 PM	8.6
				LOC2-20210728-0650	28-Jul-21	6:50 AM	13.3	LOC3-20210901-0900	1-Sep-21	9:00 AM	8.1	LOC3-20211013-1035	13-Oct-21	10:35 AM	9.5	LOC4-20210914-0950	14-Sep-21	9:50 AM	9.2
				LOC2-20210728-1600	28-Jul-21	4:00 PM	14.7	LOC3-20210902-0920	2-Sep-21	9:20 AM	8.9					LOC4-20210915-1100	15-Sep-21	11:00 AM	9.7
				LOC2-20210729-0910	29-Jul-21	9:10 AM	12.8	LOC3-20210903-1500	3-Sep-21	3:00 PM	9.3					LOC4-20210916-1000	16-Sep-21	10:00 AM	9.2
				LOC2-20210729-1152	29-Jul-21	11:52 AM	13.2	LOC3-20210904-0905	4-Sep-21	9:05 AM	9.6					LOC4-20210917-1552	17-Sep-21	3:50 PM	9.2
				LOC2-20210729-1800	29-Jul-21	6:00 PM	22.9	LOC3-20210905-1617	5-Sep-21	4:17 PM	9.1					LOC4-20210918-1338	18-Sep-21	1:38 PM	9.0
				LOC2-20210730-0830	30-Jul-21	8:30 AM	14.2	LOC3-20210906-1830	6-Sep-21	6:30 PM	9.7					LOC4-20210919-1703	19-Sep-21	5:05 PM	9.0
				LOC2-20210730-1300	30-Jul-21	1:00 PM	20.4	LOC3-20210907-1542	7-Sep-21	3:42 PM	7.3					LOC4-20210920-1637	20-Sep-21	4:37 PM	9.4
				LOC2-20210730-1750	30-Jul-21	5:50 PM	21.5	LOC3-20210908-1230	8-Sep-21	12:30 PM	9.3					LOC4-20210921-1745	21-Sep-21	5:45 PM	9.9
				LOC2-20210731-0840	31-Jul-21	8:40 AM	18.4	LOC3-20210909-1000	9-Sep-21	10:00 AM	8.4					LOC4-20210923-0900	23-Sep-21	9:00 AM	9.0
				LOC2-20210731-1250	31-Jul-21	12:50 PM	19.9	LOC3-20210910-1405	10-Sep-21	2:05 PM	8.5					LOC4-20210924-1025	24-Sep-21	10:25 AM	9.0
				LOC2-20210731-1730	31-Jul-21	5:30 PM	18.2	LOC3-20210911-0830	11-Sep-21	8:30 AM	8.5					LOC4-20210925-0840	25-Sep-21	8:40 AM	9.5
				LOC2-20210801-0845	1-Aug-21	8:45 AM	16.9	LOC3-20210913-1630	13-Sep-21	1:30 AM	8.3					LOC4-20210926-0940	26-Sep-21	9:40 AM	9.6
				LOC2-20210801-1400	1-Aug-21	2:00 PM	16.5	LOC3-20210914-1010	14-Sep-21	10:10 AM	8.3					LOC4-20210927-1115	27-Sep-21	11:15 AM	9.8
				LOC2-20210801-1755	1-Aug-21	5:55 PM	19.8	LOC3-20210915-1111	15-Sep-21	11:11 AM	7.6					LOC4-20210928-1045	28-Sep-21	10:45 AM	9.5
				LOC2-20210802-0900	2-Aug-21	9:00 AM	20.4	LOC3-20210916-1010	16-Sep-21	10:10 AM	8.7					LOC4-20210929-0635	29-Sep-21	6:35 AM	8.9
				LOC2-20210802-1315	2-Aug-21	1:15 PM	19.8	LOC3-20210917-1545	17-Sep-21	3:45 PM	8.6								
				LOC2-20210802-1800	2-Aug-21	6:00 PM	19.5	LOC3-20210918-1342	18-Sep-21	1:42 PM	8.9								
				LOC2-20210803-1200	3-Aug-21	12:00 PM	19.1	LOC3-20210919-1706	19-Sep-21	5:06 PM	8.7								
				LOC2-20210803-1750	3-Aug-21	5:50 PM	19.8	LOC3-20210920-1635	20-Sep-21	4:35 PM	9.5								
				LOC2-20210804-1335	4-Aug-21	1:35 PM	21.2	LOC3-20210921-1750	21-Sep-21	5:50 PM	8.8								
								LOC3-20210922-0803	22-Sep-21	8:03 AM	9.9								
								LOC3-20210923-0845	23-Sep-21	8:45 AM	8.4								



**Table A5: Trace Elements - Dissolved**

Sample ID	Sample Date	Sample Time	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Be (ug/L)	B (ug/L)	Cd (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Li (ug/L)	Mn (ug/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	46	1.1	12	410	<1	2200	<0.02	<1	0.49	2	<60	<0.20	150	48
LOC1-20210720-0905	20-Jul-21	9:05 AM	60	0.96	12	420	<1	2100	<0.02	<1	0.45	1.9	<60	<0.20	120	45
LOC1-20210721-0755	21-Jul-21	7:55 AM	41	1	12	420	<1	2200	<0.02	<1	0.39	0.86	<60	<0.20	180	46
LOC1-20210723-0751	23-Jul-21	7:51 AM	110	0.78	12	430	<1	2200	<0.02	<1	0.42	1.8	<60	<0.20	140	45
LOC1-20210726-0810	26-Jul-21	8:10 AM	190	1.3	6.9	410	<1	2100	0.02	<1	0.6	<0.2	<60	<0.20	140	70
LOC1-20210729-1000	29-Jul-21	10:00 AM	260	0.87	7.9	410	<1	2100	0.025	<1	0.5	0.7	<60	<0.20	140	58
LOC1-20210803-0800	3-Aug-21	8:00 AM	210	0.98	12	370	<1	2100	<0.02	<1	0.39	3.6	<60	<0.20	140	48
LOC2-20210719-1600	19-Jul-21	4:00 PM	610	1.4	18	300	<1	2100	0.077	<1	<0.30	0.27	<60	<0.20	120	23
LOC2-20210720-0820	20-Jul-21	8:20 AM	220	1.4	16	310	<1	2100	0.04	<1	<0.30	<0.20	<60	<0.20	140	27
LOC2-20210721-0715	21-Jul-21	7:15 AM	240	1.6	16	280	<1	2100	0.047	<1	<0.30	0.45	<60	<0.20	150	27
LOC2-20210723-0710	23-Jul-21	7:10 AM	450	1.1	14	310	<1	2200	0.03	<1	<0.30	<0.20	<60	<0.20	150	33
LOC2-20210726-1145	26-Jul-21	11:45 AM	870	1.9	15	300	<1	2100	0.092	<1	<0.30	<0.2	<60	<0.20	160	31
LOC2-20210729-0910	29-Jul-21	9:10 AM	550	1.7	14	260	<1	2300	0.089	<1	<0.30	<0.2	<60	<0.20	150	43
LOC2-20210803-1200	3-Aug-21	12:00 PM	510	1.5	16	240	<1	2200	0.066	<1	<0.30	<0.2	<60	<0.20	160	26
LOC3-20210812-0815	12-Aug-21	8:15 AM	200	1.3	11	86	<1	2000	0.11	<1	<0.30	0.57	60	<0.20	110	76
LOC3-20210817-0745	17-Aug-21	7:45 AM	190	1.1	12	89	<1	2100	0.1	<1	<0.30	0.66	73	<0.20	100	80
LOC3-20210819-0600	19-Aug-21	6:00 AM	150	1.1	13	100	<1	2300	0.1	<1	<0.30	0.23	<60	<0.20	140	47
LOC3-20210821-1000	21-Aug-21	10:00 AM	200	1.3	15	110	<1	2400	0.21	<1	<0.30	0.6	<60	<0.20	120	46
LOC3-20210823-1030	23-Aug-21	10:30 AM	220	1.2	14	110	<1	2400	0.2	<1	<0.30	1.4	<60	<0.20	120	46
LOC3-20210825-0700	25-Aug-21	7:00 AM	160	1.3	13	85	<1	2400	0.099	<1	<0.30	0.7	<60	<0.20	120	58
LOC3-20210829-0821	29-Aug-21	8:21 AM	170	0.81	13	82	<1	2100	0.11	<1	<0.30	0.23	<60	<0.20	110	87
LOC3-20210830-1700	30-Aug-21	5:00 PM	160	0.97	13	83	<1	2100	0.12	<1	<0.30	0.34	96	<0.20	110	81
LOC3-20210901-0900	1-Sep-21	9:00 AM	180	1.1	13	78	<1	1500	0.22	<1	<0.30	0.2	<60	<0.20	91	80
LOC3-20210903-1500	3-Sep-21	3:00 PM	130	1.2	13	71	<1	2200	0.16	<1	<0.30	0.28	66	<0.20	110	56
LOC3-20210908-1230	8-Sep-21	12:30 PM	130	0.61	11	71	<1	2100	0.19	<1	<0.30	0.2	60	<0.20	100	74
LOC3-20210911-0830	11-Sep-21	8:30 AM	140	0.81	12	79	<1	2300	0.19	<1	<0.30	0.2	66	<0.20	98	88
LOC3-20210915-1111	15-Sep-21	11:11 AM	130	1	12	70	<1	2300	0.17	<1	<0.30	0.27	60	<0.20	110	64
LOC3-20210918-1342	18-Sep-21	1:42 PM	130	0.87	13	80	<1	2200	0.14	<1	<0.30	0.2	74	<0.20	110	99
LOC3-20210920-1635	20-Sep-21	4:35 PM	120	0.92	12	70	<1	2100	0.16	<1	<0.30	0.28	62	<0.20	100	85
LOC3-20210923-0845	23-Sep-21	8:45 AM	120	0.6	9.2	61	<1	1900	0.14	<1	<0.30	0.2	160	<0.20	110	82
LOC3-20210927-1100	27-Sep-21	11:00 AM	120	0.76	11	69	<1	2300	0.14	<1	<0.30	0.43	84	<0.20	120	71
LOC3-20210929-0630	29-Sep-21	6:30 AM	110	0.8	10	75	<1	2300	0.14	<1	<0.30	<0.20	<0.30	<0.20	110	74
LOC3-20210930-0630	30-Sep-21	6:30 AM	96	0.6	10	64	<1	2100	0.098	<1	<0.30	0.45	<60	<0.20	99	<4
LOC3-20211001-0630	1-Oct-21	6:30 AM	99	0.6	10	63	<1	1900	0.13	<1	<0.30	<0.20	<60	<0.20	86	<4
LOC3-20211002-1500	2-Oct-21	3:00 PM	100	1.4	11	63	<1	2200	0.14	<1	<0.30	0.33	<60	<0.20	99	<4
LOC3-20211003-1800	3-Oct-21	6:00 PM	100	1	11	64	<1	2200	0.12	<1	<0.30	0.26	<60	<0.20	98	47
LOC3-20211004-1145	4-Oct-21	11:45 AM	80	0.6	8.9	64	<1	2200	0.11	<1	<0.30	0.42	<60	<0.20	98	61
LOC3-20211005-1144	5-Oct-21	11:44 AM	100	0.6	10	65	<1	2200	0.13	<1	<0.30	0.36	<60	<0.20	99	68
LOC3-20211006-1145	6-Oct-21	11:45 AM	98	0.6	10	65	<1	2200	0.12	<1	<0.30	0.22	<60	<0.20	98	71
LOC3-20211007-1200	7-Oct-21	12:00 PM	100	0.6	9.7	66	<1	2200	0.13	<1	<0.30	0.21	<60	<0.20	98	72
LOC3-20211008-1200	8-Oct-21	12:00 PM	110	<0.60	9.9	63	<1	2200	0.19	<1	<0.30	0.41	<60	<0.20	100	20
LOC3-20211009-1130	9-Oct-21	11:30 AM	110	<0.60	10	64	<1	2200	0.18	<1	<0.30	0.33	<60	<0.20	97	40
LOC3-20211010-1145	10-Oct-21	11:45 AM	110	<0.60	10	67	<1	2200	0.18	<1	<0.30	0.2	<60	<0.20	100	72
LOC3-20211011-1200	11-Oct-21	12:00 PM	110	<0.60	10	66	<1	2200	0.2	<1	<0.30	0.2	<60	<0.20	99	75
LOC3-20211012-1145	12-Oct-21	11:45 AM	110	<0.60	10	67	<1	2200	0.18	<1	<0.30	0.33	64	<0.20	100	79
LOC3-20211013-1035	13-Oct-21	10:35 AM	110	<0.60	10	65	<1	2200	0.18	<1	<0.30	0.2	<60	<0.20	99	78
LOC4-20210824-1100	24-Aug-21	11:00 AM	110	1.3	12	67	<1	2300	0.12	<1	<0.3	1.6	<60	<0.20	110	8.2
LOC4-20210826-0700	26-Aug-21	7:00 AM	100	1.2	12	68	<1	2300	0.094	<1	<0.30	0.66	<60	<0.20	110	9.7
LOC4-20210827-0720	27-Aug-21	7:20 AM	81	1.2	12	71	<1	2300	0.11	<1	<0.30	0.44	<60	<0.20	120	11
LOC4-20210827-1215	27-Aug-21	12:15 PM	80	1.2	12	69	<1	2200	0.095	<1	<0.30	0.44	<60	<0.20	110	9.8
LOC4-20210831-1445	31-Aug-21	2:45 PM	58	1.2	13	64	<1	2300	0.11	<1	<0.30	0.54	<60	<0.20	110	8.4
LOC4-20210902-0900	2-Sep-21	9:00 AM	67	1.2	12	64	<1	1500	0.13	<1	<0.30	0.25	<60	<0.20	110	5.7
LOC4-20210904-0908	4-Sep-21	9:08 AM	64	1.3	12	64	<1	2100	0.14	<1	<0.30	0.59	<60	<0.20	110	4
LOC4-20210906-1815	6-Sep-21	6:15 PM	64	1.2	12	64	<1	2200	0.15	<1	<0.30	0.57	<60	<0.20	120	4.1
LOC4-20210909-1010	9-Sep-21	10:10 AM	71	0.89	12	59	<1	2200	0.18	<1	<0.30	0.39	<60	<0.20	95	6
LOC4-20210913-1615	13-Sep-21	4:15 PM	67	0.89	12	62	<1	1500	0.26	<1	<0.30	0.47	<60	<0.20	110	4.2
LOC4-20210915-1100	15-Sep-21	11:00 AM	68	0.95	11	62	<1	2100	0.15	<1	<0.30	0.58	<60	<0.20	115	5.2
LOC4-20210918-1338	18-Sep-21	1:38 PM	50	0.9	9.8	48	<1	2400	0.15	<1	<0.30	0.35	<60	<0.20	110	4
LOC4-20210920-1637	20-Sep-21	4:37 PM	100	1.1	12	49	<1	2400	0.18	<1	0.36	0.26	<60	<0.20	110	8.5
LOC4-20210923-0900	23-Sep-21	9:00 AM	46	0.5	10	42	<1	2000	0.17	<1	0.34	0.22	<60	<0.20	110	4.4
LOC4-20210927-1115	27-Sep-21	11:15 AM	47	1	11	46	<1	2300	0.15	<1	0.36	0.89	<60	<0.20	140	15
LOC4-20210929-0635	29-Sep-21	6:35 AM	41	0.99	10	50	<1	2300	0.14	<1	0.32	0.7	<0.30	<0.20	110	15



**Table A5: Trace Elements – Dissolved (Con't)**

Sample ID	Sample Date	Sample Time	Hg (ug/L)	Mo (ug/L)	Ni (ug/L)	Se (ug/L)	Si (ug/L)	Ag (ug/L)	Sr (ug/L)	S (ug/L)	Ti (ug/L)	Sn (ug/L)	Ti (ug/L)	U (ug/L)	V (ug/L)	Zn (ug/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	<0.002	100	4.4	17	4500	<0.10	730	170	<0.20	<1	<1.0	7.4	20	<3
LOC1-20210720-0905	20-Jul-21	9:05 AM	<0.002	110	4.5	17	4100	<0.10	740	180	<0.20	<1	<1.0	7.5	31	<3
LOC1-20210721-0755	21-Jul-21	7:55 AM	0.0021	110	4.4	16	3200	<0.10	730	170	<0.20	<1	1.2	7.1	27	20
LOC1-20210723-0751	23-Jul-21	7:51 AM	0.0037	110	4.5	20	4700	<0.10	780	180	<0.20	<1	1.6	7.6	27	<3
LOC1-20210726-0810	26-Jul-21	8:10 AM	0.0019	110	5.2	19	4600	<0.10	710	200	<0.20	<1	<1	7.5	15	4.5
LOC1-20210729-1000	29-Jul-21	10:00 AM	<0.002	110	4.7	16	4600	<0.10	640	190	<0.20	<1	<1	7.6	12	7
LOC1-20210803-0800	3-Aug-21	8:00 AM	<0.002	110	4.1	17	4700	<0.10	640	170	<0.20	<1	<1	7.9	16	10
LOC2-20210719-1600	19-Jul-21	4:00 PM	<0.002	500	7	22	4000	<0.10	710	170	<0.20	<1	1.6	8.1	3200	<3
LOC2-20210720-0820	20-Jul-21	8:20 AM	<0.002	330	8	18	3900	<0.10	730	170	<0.20	<1	1.3	7.7	2000	<3
LOC2-20210721-0715	21-Jul-21	7:15 AM	<0.002	360	8.5	20	3500	<0.10	700	170	<0.20	<1	<1	8	2200	3.9
LOC2-20210723-0710	23-Jul-21	7:10 AM	<0.002	390	7.9	23	4700	<0.10	760	190	<0.20	<1	<1	8	2300	<3
LOC2-20210726-1145	26-Jul-21	11:45 AM	<0.002	520	7.9	15	8800	<0.10	700	200	<0.20	<1	<1	8.1	3100	<3
LOC2-20210729-0910	29-Jul-21	9:10 AM	<0.002	470	7.8	17	5700	<0.10	650	200	<0.30	<1	<1	7.9	2600	4
LOC2-20210803-1200	3-Aug-21	12:00 PM	0.003	400	7.6	21	5500	<0.10	640	170	<0.20	<1	1.7	8.9	2200	<3
LOC3-20210812-0815	12-Aug-21	8:15 AM	0.0024	650	3.8	2.9	3500	<0.10	510	160	<0.20	<1	2.1	6.5	2400	<3
LOC3-20210817-0745	17-Aug-21	7:45 AM	<0.002	660	3.9	2.9	4800	<0.10	520	170	<0.20	<1	1.7	8	2300	<3
LOC3-20210819-0600	19-Aug-21	6:00 AM	<0.002	710	4	3.6	5600	<0.10	600	190	<0.20	<1	1.1	7.7	2400	<3
LOC3-20210821-1000	21-Aug-21	10:00 AM	<0.002	710	4.7	7.1	6000	<0.10	620	190	<0.20	<1	<1	7.3	2600	<3
LOC3-20210823-1030	23-Aug-21	10:30 AM	<0.002	700	4.9	7.4	5900	<0.10	610	200	<0.20	<1	1.6	7.2	2500	<3
LOC3-20210825-0700	25-Aug-21	7:00 AM	<0.002	770	5.2	3.7	4900	<0.10	560	190	<0.2	<1	1	7.7	2300	<3
LOC3-20210829-0821	29-Aug-21	8:21 AM	<0.002	830	4.7	1.6	5000	<0.10	520	170	<0.20	<1	1	6.7	2200	<3
LOC3-20210830-1700	30-Aug-21	5:00 PM	<0.002	830	4.8	1.2	6500	<0.10	530	170	<0.20	<1	1.8	6.6	2200	<3
LOC3-20210901-0900	1-Sep-21	9:00 AM	<0.002	840	5.4	2	4400	<0.10	510	120	<0.20	<1	1.8	7	2200	<3
LOC3-20210903-1500	3-Sep-21	3:00 PM	<0.002	800	5.7	3.4	3500	<0.10	490	180	<0.20	<1	1.1	8.2	2100	<3
LOC3-20210908-1230	8-Sep-21	12:30 PM	<0.002	800	5	1.2	4100	<0.10	480	170	<0.20	<1	1	7.2	1900	<3
LOC3-20210911-0830	11-Sep-21	8:30 AM	<0.002	810	4.6	0.95	4500	<0.10	510	180	<0.20	<1	1	7.5	2000	<3
LOC3-20210915-1111	15-Sep-21	11:11 AM	<0.002	830	5.4	3.2	3400	<0.10	490	190	<0.20	<1	1	8	2100	<3
LOC3-20210918-1342	18-Sep-21	1:42 PM	<0.002	700	3.9	1.3	3600	<0.10	520	180	<0.20	<1	1.3	9.2	1600	<3
LOC3-20210920-1635	20-Sep-21	4:35 PM	<0.002	710	4	1.6	3100	<0.10	470	180	<0.20	<1	1.6	8.7	1700	<3
LOC3-20210923-0845	23-Sep-21	8:45 AM	<0.002	650	4	1.2	2800	<0.10	420	160	<0.20	<1	1	7.4	1400	<3
LOC3-20210927-1100	27-Sep-21	11:00 AM	<0.002	780	5	0.74	3400	<0.10	510	200	<0.20	<1	1.2	8.3	1600	<3
LOC3-20210929-0630	29-Sep-21	6:30 AM	<0.002	790	4.6	0.71	3200	<0.10	510	200	<0.20	<1	1.4	8	1400	<3
LOC3-20210930-0630	30-Sep-21	6:30 AM	<0.0019	730	3.7	1.4	3000	<0.10	470	170	<0.20	<1	<1	7.4	1500	17
LOC3-20211001-0630	1-Oct-21	6:30 AM	<0.0019	710	4.2	1.8	3000	<0.10	460	160	<0.20	<1	<1	6.9	2000	5
LOC3-20211002-1500	2-Oct-21	3:00 PM	<0.0019	780	4.5	0.91	2800	<0.10	460	170	<0.20	<1	<1	7.5	1500	10
LOC3-20211003-1800	3-Oct-21	6:00 PM	<0.0019	800	4.8	0.6	2800	<0.10	460	170	<0.20	<1	<1	7.4	1500	15
LOC3-20211004-1145	4-Oct-21	11:45 AM	<0.0019	630	3.8	0.73	2900	<0.10	460	170	<0.20	<1	<1	6.3	1300	<3
LOC3-20211005-1144	5-Oct-21	11:44 AM	<0.0019	780	4.5	0.65	2800	<0.10	460	170	<0.20	<1	<1	7.3	1400	13
LOC3-20211006-1145	6-Oct-21	11:45 AM	<0.0019	780	4.4	0.59	2900	<0.10	460	170	<0.20	<1	1.4	7.1	1400	6.5
LOC3-20211007-1200	7-Oct-21	12:00 PM	<0.0019	800	4.3	0.57	2900	<0.10	460	170	<0.20	<1	<1	7.3	1400	5.8
LOC3-20211008-1200	8-Oct-21	12:00 PM	<0.002	840	4.8	0.52	3500	<0.10	470	190	<0.20	<1	<1	7.7	1400	<3
LOC3-20211009-1130	9-Oct-21	11:30 AM	<0.002	850	5	0.44	3300	<0.10	470	180	<0.20	<1	<1	7.7	1400	<3
LOC3-20211010-1145	10-Oct-21	11:45 AM	<0.002	860	5	0.47	3400	<0.10	480	190	<0.20	<1	<1	7.7	1400	<3
LOC3-20211011-1200	11-Oct-21	12:00 PM	<0.002	850	4.8	0.49	3500	<0.10	480	190	<0.20	<1	<1	7.6	1400	<3
LOC3-20211012-1145	12-Oct-21	11:45 AM	<0.002	860	4.7	0.57	3500	<0.10	480	190	<0.20	<1	<1	7.7	1400	3.2
LOC3-20211013-1035	13-Oct-21	10:35 AM	<0.002	860	4.8	0.46	3200	<0.10	470	190	<0.20	<1	<1	7.6	1400	3.5
LOC4-20210824-1100	24-Aug-21	11:00 AM	<0.0019	730	4.6	3.9	4300	<0.1	500	180	<0.2	<1	1.1	8.4	2300	<3
LOC4-20210826-0700	26-Aug-21	7:00 AM	<0.002	720	4.2	4.3	4300	<0.10	490	190	<0.20	<1	1	7.9	2200	<3
LOC4-20210827-0720	27-Aug-21	7:20 AM	<0.002	720	4.3	4.4	4800	<0.10	510	190	<0.20	2.1	1.2	7.9	2200	<3
LOC4-20210827-1215	27-Aug-21	12:15 PM	<0.002	720	4.5	4.4	4500	<0.10	490	190	<0.20	1.6	1	7.9	2200	<3
LOC4-20210831-1445	31-Aug-21	2:45 PM	<0.002	750	4.7	4.3	3000	<0.10	460	190	<0.20	<1	1.4	7.9	2200	<3
LOC4-20210902-0900	2-Sep-21	9:00 AM	<0.002	760	4.2	4.2	2000	<0.10	490	120	<0.20	2.6	1.5	7.8	2100	<3
LOC4-20210904-0908	4-Sep-21	9:08 AM	<0.002	740	4.4	3.7	2800	<0.10	460	170	<0.20	<1	<1	7.7	2100	5
LOC4-20210906-1815	6-Sep-21	6:15 PM	<0.002	730	4.6	3.7	3100	<0.10	480	180	<0.20	1.1	<1	7.8	2000	<3
LOC4-20210909-1010	9-Sep-21	10:10 AM	<0.002	750	4	4.3	2900	<0.10	450	180	<0.20	<1	<1	7.5	2000	3.1
LOC4-20210913-1615	13-Sep-21	4:15 PM	<0.002	770	4.2	3	2300	<0.10	490	130	<0.20	<1	1	6.8	2000	<3
LOC4-20210915-1100	15-Sep-21	11:00 AM	<0.002	760	4.6	2.5	3100	<0.10	470	175	<0.20	<1	1.4	7.5	1900	<3
LOC4-20210918-1338	18-Sep-21	1:38 PM	<0.002	670	4.1	2.1	1950	<0.10	470	185	<0.20	<1	<1	6.8	1600	<3
LOC4-20210920-1637	20-Sep-21	4:37 PM	<0.002	810	4.8	2.1	2400	<0.10	470	180	<0.20	<1	1	8.2	1800	<3
LOC4-20210923-0900	23-Sep-21	9:00 AM	<0.002	720	4.2	2.1	2200	<0.10	420	170	<0.20	<1	<1	7.1	1600	<3
LOC4-20210927-1115	27-Sep-21	11:15 AM	<0.002	800	4.5	2	1700	<0.10	480	200	<0.20	<1	1.1	7.7	1600	<3
LOC4-20210929-0635	29-Sep-21	6:35 AM	<0.002	750	4.6	1.7	2000	<0.10	480	200	<0.20	<1	1.3	7.6	1600	<3



Table A6: Trace Elements - Total

Sample ID	Sample Date	Sample Time	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Be (ug/L)	B (ug/L)	Cd (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Li (ug/L)	Mn (ug/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	800	0.95	15	400	<1	2100	59	1.4	1.2	8.1	930	2.1	120	76
LOC1-20210720-0905	20-Jul-21	9:05 AM	1400	0.88	16	420	<1	2100	53	3.4	1.8	6	1400	2.4	120	85
LOC1-20210721-0755	21-Jul-21	7:55 AM	1100	0.97	16	420	<1	2100	56	2.2	1.5	4.2	1200	1.9	130	78
LOC1-20210723-0751	23-Jul-21	7:51 AM	1100	1.3	17	430	<1	2200	49	2.9	1.8	8.9	1400	2.9	140	84
LOC1-20210726-0810	26-Jul-21	8:10 AM	1400	0.71	14	410	<1	2100	46	3.1	1.7	3	2700	1.6	140	110
LOC1-20210729-1000	29-Jul-21	10:00 AM	2900	1.2	15	360	<1	2200	60	8.6	1.6	8.9	2200	2.7	130	96
LOC1-20210803-0800	3-Aug-21	8:00 AM	4200	1.1	14	370	<1	2100	37	5.7	1.3	11	1500	2.7	140	81
LOC2-20210719-1600	19-Jul-21	4:00 PM	3400	1.7	20	270	<1	2200	210	6.5	5.2	5.6	5200	6.6	150	150
LOC2-20210720-0820	20-Jul-21	8:20 AM	2000	1.4	18	310	<1	2100	140	4	2.6	2.9	2200	2.8	140	82
LOC2-20210721-0715	21-Jul-21	7:15 AM	2200	1.5	19	310	<1	2100	160	3.9	2.8	3.4	2300	3	140	86
LOC2-20210723-0710	23-Jul-21	7:10 AM	2000	1.6	19	310	<1	2200	92	3.8	2.5	2.6	2300	3.1	150	78
LOC2-20210726-1145	26-Jul-21	11:45 AM	4200	1.2	17	300	<1	2100	190	8.5	6.2	7.1	6500	10	160	200
LOC2-20210729-0910	29-Jul-21	9:10 AM	680	2	19	260	<1	2300	98	3.3	1.8	4.9	2200	2.6	150	87
LOC2-20210803-1200	3-Aug-21	12:00 PM	1800	1.6	17	260	<1	2200	85	3.6	2	2.2	1900	2.3	160	73
LOC3-20210812-0815	12-Aug-21	8:15 AM	230	0.98	12	86	<1	2000	170	<1	<0.3	0.49	91	<0.2	110	79
LOC3-20210817-0745	17-Aug-21	7:45 AM	210	1.1	13	89	<1	2100	89	<1	<0.3	3.6	93	<0.2	100	87
LOC3-20210819-0600	19-Aug-21	6:00 AM	240	0.88	12	100	<1	2300	160	<1	<0.3	0.78	130	<0.2	140	95
LOC3-20210821-1000	21-Aug-21	10:00 AM	480	1.3	17	110	<1	2400	210	1	0.33	2.9	220	0.49	120	62
LOC3-20210823-1030	23-Aug-21	10:30 AM	530	1.4	16	110	<1	2400	200	1	0.31	1.3	200	0.2	120	57
LOC3-20210825-0700	25-Aug-21	7:00 AM	220	0.7	14	85	<1	2400	120	1.4	<0.3	0.74	170	<0.2	120	70
LOC3-20210829-0821	29-Aug-21	8:21 AM	150	0.7	12	82	<1	2100	150	<1	<0.3	0.35	120	<0.2	110	82
LOC3-20210830-1700	30-Aug-21	5:00 PM	170	0.7	14	83	<1	2100	150	<1	<0.3	0.27	130	<0.2	110	86
LOC3-20210901-0900	1-Sep-21	9:00 AM	140	0.7	13	78	<1	1500	180	2.5	<0.3	0.56	77	<0.2	91	52
LOC3-20210903-1500	3-Sep-21	3:00 PM	120	0.7	12	71	<1	2200	160	<1	<0.3	0.56	66	<0.2	110	56
LOC3-20210908-1230	8-Sep-21	12:30 PM	120	0.87	10	71	<1	2100	150	<1	<0.3	0.97	89	<0.2	100	67
LOC3-20210911-0830	11-Sep-21	8:30 AM	160	0.71	13	79	<1	2300	200	<1	<0.3	0.6	110	<0.2	98	88
LOC3-20210915-1111	15-Sep-21	11:11 AM	110	1.3	13	70	<1	2300	110	<1	<0.3	0.5	73	<0.2	110	60
LOC3-20210918-1342	18-Sep-21	1:42 PM	150	0.92	12	79	<1	2200	180	1.2	<0.3	0.62	120	0.2	100	94
LOC3-20210920-1635	20-Sep-21	4:35 PM	130	1.3	11	70	<1	2100	180	<1	<0.3	0.67	85	<0.2	100	77
LOC3-20210923-0845	23-Sep-21	8:45 AM	130	0.84	10	61	<1	1900	150	<1	<0.3	0.38	78	<0.2	110	72
LOC3-20210927-1100	27-Sep-21	11:00 AM	120	0.64	9.3	69	<1	2100	100	<1	<0.3	0.32	84	<0.2	110	72
LOC3-20210929-0630	29-Sep-21	6:30 AM	130	0.67	9.9	69	<1	2100	110	<1	<0.3	0.2	110	<0.2	120	77
LOC3-20210930-0630	30-Sep-21	6:30 AM	110	<0.6	10	69	<1	2200	130	<1	<0.3	10	83	0.45	110	71
LOC3-20211001-0630	1-Oct-21	6:30 AM	120	<0.6	11	71	<1	2100	120	<1	<0.3	0.99	98	<0.2	110	74
LOC3-20211002-1500	2-Oct-21	3:00 PM	100	<0.6	10	69	<1	2300	130	<1	<0.3	0.97	120	<0.2	110	74
LOC3-20211003-1800	3-Oct-21	6:00 PM	100	<0.6	9.9	69	<1	2300	170	<1	<0.3	0.58	92	<0.2	120	73
LOC3-20211004-1145	4-Oct-21	11:45 AM	80	<0.6	10	67	<1	2300	150	<1	<0.3	7.2	91	0.34	110	72
LOC3-20211005-1144	5-Oct-21	11:44 AM	100	<0.6	10	69	<1	2300	130	<1	<0.3	0.38	110	<0.2	120	76
LOC3-20211006-1145	6-Oct-21	11:45 AM	110	<0.6	9.9	70	<1	2400	110	<1	<0.3	11	100	0.29	120	77
LOC3-20211007-1200	7-Oct-21	12:00 PM	110	<0.6	9.9	70	<1	2400	130	<1	<0.3	0.2	100	<0.2	120	76
LOC3-20211008-1200	8-Oct-21	12:00 PM	120	<0.6	11	67	<1	2200	230	<1	<0.3	<0.2	60	<0.2	100	58
LOC3-20211009-1130	9-Oct-21	11:30 AM	120	<0.6	11	65	<1	2200	210	<1	<0.3	0.75	110	<0.2	99	77
LOC3-20211010-1145	10-Oct-21	11:45 AM	110	<0.6	10	67	<1	2200	190	<1	<0.3	0.31	80	<0.2	100	79
LOC3-20211011-1200	11-Oct-21	12:00 PM	120	<0.6	11	69	<1	2300	210	<1	<0.3	0.62	87	<0.2	100	81
LOC3-20211012-1145	12-Oct-21	11:45 AM	100	<0.6	10	67	<1	2200	210	<1	<0.3	0.35	60	<0.2	100	77
LOC3-20211013-1035	13-Oct-21	10:35 AM	110	<0.6	10	65	<1	2100	200	<1	<0.3	2.7	81	<0.2	97	78
LOC4-20210824-1100	24-Aug-21	11:00 AM	250	1	12	67	<1	2300	230	<1	<0.3	1.7	130	<0.2	110	32
LOC4-20210826-0700	26-Aug-21	7:00 AM	250	1.4	13	68	<1	2300	230	<1	0.37	0.71	210	<0.2	110	35
LOC4-20210827-0720	27-Aug-21	7:20 AM	500	1.1	14	71	<1	2300	120	<1	0.56	0.81	300	0.36	120	34
LOC4-20210827-1215	27-Aug-21	12:15 PM	460	1	13	69	<1	2200	120	<1	0.45	0.54	240	0.26	110	32
LOC4-20210831-1445	31-Aug-21	2:45 PM	190	1.3	14	64	<1	2300	130	<1	0.35	0.5	94	0.21	110	29
LOC4-20210902-0900	2-Sep-21	9:00 AM	67	1.1	12	64	<1	1500	190	<1	<0.3	0.89	60	<0.2	110	7.2
LOC4-20210904-0908	4-Sep-21	9:08 AM	130	1.2	12	64	<1	2100	140	<1	<0.3	0.97	85	<0.2	110	25
LOC4-20210906-1815	6-Sep-21	6:15 PM	170	1.1	11	64	<1	2200	140	<1	0.49	0.62	260	0.24	120	28
LOC4-20210909-1010	9-Sep-21	10:10 AM	190	<0.6	13	59	<1	2200	190	<1	0.41	0.83	170	<0.2	95	24
LOC4-20210913-1615	13-Sep-21	4:15 PM	150	0.78	13	62	<1	1500	190	<1	0.4	0.59	120	<0.2	110	21
LOC4-20210915-1100	15-Sep-21	11:00 AM	200	1.2	13	59	<1	2300	210	1.1	0.4	0.75	310	1	110	29
LOC4-20210918-1338	18-Sep-21	1:38 PM	210	1.1	12	50	<1	2400	190	1.2	0.54	0.73	330	0.3	110	30
LOC4-20210920-1637	20-Sep-21	4:37 PM	230	1.2	12	49	<1	2400	210	1.2	0.58	0.49	280	0.21	110	29
LOC4-20210923-0900	23-Sep-21	9:00 AM	140	1	11	42	<1	2000	200	<1	0.53	0.94	250	0.21	110	23
LOC4-20210927-1115	27-Sep-21	11:15 AM	100	0.77	11	46	<1	2300	110	<1	0.44	0.66	190	<0.2	130	21
LOC4-20210929-0635	29-Sep-21	6:35 AM	130	0.74	9.9	48	<1	2200	100	<1	0.46	0.85	900	<0.2	120	31



**Table A6: Trace Elements – Total (Con't)**

Sample ID	Sample Date	Sample Time	Hg (ug/L)	Mo (ug/L)	Ni (ug/L)	Se (ug/L)	Si (ug/L)	Ag (ug/L)	Sr (ug/L)	S (ug/L)	Tl (ug/L)	Sn (ug/L)	Ti (ug/L)	U (ug/L)	V (ug/L)	Zn (ug/L)
LOC1-20210719-1500	19-Jul-21	3:00 PM	0.007	110	6.2	36	4200	<0.1	710	170000	<0.2	<1	15	6.7	27	60
LOC1-20210720-0905	20-Jul-21	9:05 AM	0.0077	110	8.3	36	5300	<0.1	740	180000	<0.2	<1	32	7	42	60
LOC1-20210721-0755	21-Jul-21	7:55 AM	0.0066	110	7.4	36	4900	<0.1	740	180000	<0.2	<1	29	7.2	39	63
LOC1-20210723-0751	23-Jul-21	7:51 AM	0.0067	120	9.3	33	4700	<0.1	780	180000	<0.2	<1	25	8.8	42	64
LOC1-20210726-0810	26-Jul-21	8:10 AM	0.0024	100	7.2	26	4600	<0.1	710	200000	<0.2	<1	20	8.1	29	44
LOC1-20210729-1000	29-Jul-21	10:00 AM	<0.002	110	7.9	28	4500	<0.1	640	190000	<0.2	<1	290	8.4	31	28
LOC1-20210803-0800	3-Aug-21	8:00 AM	0.007	120	7.3	27	4700	<0.1	640	170000	<0.2	<1	250	8.6	29	40
LOC2-20210719-1600	19-Jul-21	4:00 PM	0.0024	550	83	28	7900	<0.1	730	170000	<0.2	<1	62	8.3	3600	69
LOC2-20210720-0820	20-Jul-21	8:20 AM	0.0051	350	34	27	5800	<0.1	710	170000	<0.2	<1	39	7.6	2200	44
LOC2-20210721-0715	21-Jul-21	7:15 AM	0.0037	360	39	27	6400	<0.1	700	170000	<0.2	<1	38	7.8	2300	57
LOC2-20210723-0710	23-Jul-21	7:10 AM	0.0031	430	34	25	5800	<0.1	760	190000	<0.2	<1	41	8.9	2600	38
LOC2-20210726-1145	26-Jul-21	11:45 AM	0.0024	480	100	11	8800	<0.1	700	200000	<0.2	<1	82	7.6	3100	180
LOC2-20210729-0910	29-Jul-21	9:10 AM	<0.002	510	31	19	5700	<0.1	650	200000	<0.2	<1	29	8.6	3100	43
LOC2-20210803-1200	3-Aug-21	12:00 PM	0.0025	420	31	21	5500	<0.1	640	170000	<0.2	<1	30	9.6	2400	46
LOC3-20210812-0815	12-Aug-21	8:15 AM	<0.002	720	4.3	3.5	4500	<0.1	510	160000	<0.2	<1	2.9	6.9	2900	4.2
LOC3-20210817-0745	17-Aug-21	7:45 AM	<0.002	660	4.8	2.8	4800	<0.1	520	170000	<0.2	<1	3.2	7.9	2300	>3
LOC3-20210819-0600	19-Aug-21	6:00 AM	<0.002	700	4.3	3.3	5600	<0.1	600	190000	<0.2	<1	1.1	7.5	2300	10
LOC3-20210821-1000	21-Aug-21	10:00 AM	<0.002	740	6.5	7.7	6000	<0.1	620	190000	<0.2	<1	29	7.5	2700	4.3
LOC3-20210823-1030	23-Aug-21	10:30 AM	<0.002	720	6.8	7.5	5900	<0.1	610	200000	<0.2	<1	6.8	6.7	2600	3.8
LOC3-20210825-0700	25-Aug-21	7:00 AM	<0.002	790	6.2	3.8	4900	<0.1	560	190000	<0.2	<1	4.9	8	2200	4.5
LOC3-20210829-0821	29-Aug-21	8:21 AM	<0.002	800	4.1	1.5	5000	<0.1	520	170000	<0.2	<1	1.6	6.6	2000	4.7
LOC3-20210830-1700	30-Aug-21	5:00 PM	<0.002	890	4.5	1.4	6500	<0.1	530	170000	<0.2	<1	2.5	7.3	2400	<3
LOC3-20210901-0900	1-Sep-21	9:00 AM	<0.002	850	4.9	1.9	4400	<0.1	510	120000	<0.2	<1	2	6.8	2200	5.6
LOC3-20210903-1500	3-Sep-21	3:00 PM	<0.002	760	5.3	2.9	3500	<0.1	490	180000	<0.2	<1	1.7	7.9	1900	3.8
LOC3-20210908-1230	8-Sep-21	12:30 PM	<0.002	710	4.6	1.3	4100	<0.1	480	170000	<0.2	<1	1.6	6.7	1600	9.9
LOC3-20210911-0830	11-Sep-21	8:30 AM	<0.002	880	5.2	1.1	4500	<0.1	510	180000	<0.2	<1	1.2	8.3	2100	4
LOC3-20210915-1111	15-Sep-21	11:11 AM	<0.002	830	5.5	3	3400	<0.1	490	190000	<0.2	<1	2.2	7.8	2300	<3
LOC3-20210918-1342	18-Sep-21	1:42 PM	<0.002	690	4	1.3	3600	<0.1	520	170000	<0.2	<1	1.2	9.2	1600	<3
LOC3-20210920-1635	20-Sep-21	4:35 PM	<0.002	690	4.3	1.6	3100	<0.1	470	180000	<0.2	<1	1.9	8.2	1600	<3
LOC3-20210923-0845	23-Sep-21	8:45 AM	<0.002	700	4.6	1.1	2800	<0.1	420	165000	<0.2	<1	1.7	7.8	1400	<3
LOC3-20210927-1100	27-Sep-21	11:00 AM	<0.002	630	4.2	1.1	3100	<0.1	460	170000	<0.2	<1	1.3	6.4	1300	4.1
LOC3-20210929-0630	29-Sep-21	6:30 AM	<0.002	690	4.3	1.1	3000	<0.1	480	180000	<0.2	<1	1.3	6.7	1300	3.5
LOC3-20210930-0630	30-Sep-21	6:30 AM	0.0025	740	4.5	1.5	4300	<0.1	470	200000	<0.2	<1	1	7.7	1600	26
LOC3-20211001-0630	1-Oct-21	6:30 AM	<0.002	700	5.3	1.9	4300	<0.1	480	200000	<0.2	<1	1.1	7.4	1900	6.8
LOC3-20211002-1500	2-Oct-21	3:00 PM	<0.002	760	4.8	0.94	3900	<0.1	470	210000	<0.2	<1	1.3	7.5	1500	10
LOC3-20211003-1800	3-Oct-21	6:00 PM	<0.002	760	4.8	0.92	3900	<0.1	470	210000	<0.2	<1	1.5	7.3	1500	10
LOC3-20211004-1145	4-Oct-21	11:45 AM	<0.002	770	4.8	0.83	3800	<0.1	460	200000	<0.2	<1	1.1	7.4	1400	7.7
LOC3-20211005-1144	5-Oct-21	11:44 AM	<0.002	780	4.7	0.66	4100	<0.1	470	210000	<0.2	<1	2.5	7.6	1400	7.7
LOC3-20211006-1145	6-Oct-21	11:45 AM	<0.002	780	4.6	0.65	5000	<0.1	480	210000	<0.2	<1	1.8	7.6	1400	11
LOC3-20211007-1200	7-Oct-21	12:00 PM	<0.002	780	4.5	0.56	4100	<0.1	480	210000	<0.2	<1	1.4	7.6	1400	5.5
LOC3-20211008-1200	8-Oct-21	12:00 PM	<0.002	940	5.2	0.56	3400	<0.1	480	180000	<0.2	<1	<1	8.4	1600	5
LOC3-20211009-1130	9-Oct-21	11:30 AM	<0.002	920	5.5	0.53	4000	<0.1	460	180000	<0.2	<1	1.1	8.3	1500	4
LOC3-20211010-1145	10-Oct-21	11:45 AM	<0.002	860	5	0.52	4400	<0.1	470	180000	<0.2	<1	<1	7.8	1400	5
LOC3-20211011-1200	11-Oct-21	12:00 PM	<0.002	890	4.9	0.63	4400	<0.1	490	190000	<0.2	<1	<1	7.9	1500	4
LOC3-20211012-1145	12-Oct-21	11:45 AM	<0.002	860	5.1	0.49	3500	<0.1	480	180000	<0.2	<1	<1	7.8	1400	4.6
LOC3-20211013-1035	13-Oct-21	10:35 AM	<0.002	870	5.2	0.44	3700	<0.1	460	180000	<0.2	<1	<1	7.9	1400	5
LOC4-20210824-1100	24-Aug-21	11:00 AM	<0.0019	700	4.5	3.8	4300	<0.1	500	180000	<0.2	<1	5	7	2200	<3
LOC4-20210826-0700	26-Aug-21	7:00 AM	<0.002	790	5.1	4.2	4300	<0.1	490	190000	<0.2	<1	4	8.5	2300	4.5
LOC4-20210827-0720	27-Aug-21	7:20 AM	<0.002	770	6.1	4.5	4800	<0.1	510	190000	<0.2	<1	11	8.3	2300	7.4
LOC4-20210827-1215	27-Aug-21	12:15 PM	<0.002	740	5.4	4.5	4500	<0.1	490	190000	<0.2	<1	6.7	8.2	2300	<3
LOC4-20210831-1445	31-Aug-21	2:45 PM	0.0026	790	5.3	4.6	3000	<0.1	460	190000	<0.2	<1	3.5	8.4	2300	<3
LOC4-20210902-0900	2-Sep-21	9:00 AM	<0.002	740	4.4	4	2000	<0.1	490	120000	<0.2	<1	1.2	7.4	2200	<3
LOC4-20210904-0908	4-Sep-21	9:08 AM	<0.002	730	4.5	3.6	2800	<0.1	460	170000	<0.2	<1	4.2	7.7	1900	<3
LOC4-20210906-1815	6-Sep-21	6:15 PM	0.0025	730	4.6	3.3	3100	<0.1	480	180000	<0.2	<1	5.3	7.6	1900	<3
LOC4-20210909-1010	9-Sep-21	10:10 AM	<0.002	850	5.8	3.5	2900	<0.1	450	180000	<0.2	<1	2.7	8.6	2200	10
LOC4-20210913-1615	13-Sep-21	4:15 PM	<0.002	830	5.6	3.5	2300	<0.1	490	130000	<0.2	<1	3.3	8.4	2300	<3
LOC4-20210915-1100	15-Sep-21	11:00 AM	<0.002	840	6.6	3	2500	<0.1	460	190000	<0.2	<1	5	8.2	2200	6.7
LOC4-20210918-1338	18-Sep-21	1:38 PM	<0.002	770	5.3	2.4	2600	<0.1	470	180000	<0.2	<1	2.9	7.7	1800	<3
LOC4-20210920-1637	20-Sep-21	4:37 PM	0.0035	840	5.7	2.6	2400	<0.1	470	180000	<0.2	<1	4.4	8.4	2000	10
LOC4-20210923-0900	23-Sep-21	9:00 AM	<0.002	790	5.3	2.3	2200	<0.1	420	170000	<0.2	<1	3.2	7.8	1650	<3
LOC4-20210927-1115	27-Sep-21	11:15 AM	0.0026	720	5.2	1	2500	<0.1	460	180000	<0.2	<1	2.1	6.6	1500	5.2
LOC4-20210929-0635	29-Sep-21	6:35 AM	0.003	690	4.9	0.94	2200	<0.1	460	180000	<0.2	<1	3.6	6.5	1400	43



Table A7: PAHs

Sample ID	Sample Date	Sample Time	Total PAH's ug/L	Total Parent PAH ug/L	Total Alkyl PAH ug/L	Quinoline ug/L	Naphthalene ug/L	1-Methyl naphthalene ug/L	2-Methyl naphthalene ug/L	C1- Naphthalene ug/L	C2- Naphthalene ug/L	C3- Naphthalene ug/L
LOC1-20210719-1500	19-Jul-21	3:00 PM	286.7	15.1	271.7	3.3	0.37	0.85	0.42	1.1	11	24
LOC1-20210720-0905	20-Jul-21	9:05 AM	179.6	7.2	172.5	3.4	<0.27	0.53	<0.27	0.7	5.4	12
LOC1-20210721-0755	21-Jul-21	7:55 AM	148.5	8.4	140.1	3.4	0.35	0.62	0.28	0.95	5.2	11
LOC1-20210723-0751	23-Jul-21	7:51 AM	441.6	21.2	420.4	3.5	0.46	0.98	0.77	0.98	15	40
LOC1-20210726-0810	26-Jul-21	8:10 AM	257.7	12.7	245.1	3.5	0.46	1	0.63	1.7	9.2	21
LOC1-20210729-1000	29-Jul-21	10:00 AM	109.1	7.8	101.4	3	0.35	0.79	0.51	1.4	6.4	12
LOC1-20210803-0800	3-Aug-21	8:00 AM	71.9	5.7	66.1	2.7	0.34	0.57	0.33	0.95	4.3	7
LOC2-20210719-1600	19-Jul-21	4:00 PM	0.5	-	0.5	<0.02	<0.27	<0.27	<0.02	<0.02	<0.02	<0.02
LOC2-20210720-0820	20-Jul-21	8:20 AM	3.4	-	3.4	<0.02	<0.27	<0.27	<0.02	<0.02	<0.02	0.36
LOC2-20210721-0715	21-Jul-21	7:15 AM	2.4	-	2.3	<0.20	<0.10	<0.10	<0.10	<0.10	0.12	0.27
LOC2-20210723-0710	23-Jul-21	7:10 AM	1.4	-	1.4	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.16
LOC2-20210726-1145	26-Jul-21	11:45 AM	1.5	-	1.5	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.17
LOC2-20210729-0910	29-Jul-21	9:10 AM	0.4	-	0.4	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
LOC2-20210803-1200	3-Aug-21	12:00 PM	0.3	-	0.3	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210812-0815	12-Aug-21	8:15 AM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210817-0745	17-Aug-21	7:45 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210819-0600	19-Aug-21	6:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210821-1000	21-Aug-21	10:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210823-1030	23-Aug-21	10:30 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210825-0700	25-Aug-21	7:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210829-0821	29-Aug-21	8:21 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210830-1700	30-Aug-21	5:00 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210901-0900	1-Sep-21	9:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210903-1500	3-Sep-21	3:00 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210908-1230	8-Sep-21	12:30 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210911-0830	11-Sep-21	8:30 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210915-1111	15-Sep-21	11:11 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210918-1342	18-Sep-21	1:42 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210920-1635	20-Sep-21	4:35 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210923-0845	23-Sep-21	8:45 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210927-1100	27-Sep-21	11:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC3-20210929-0630	29-Sep-21	6:30 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210824-1100	24-Aug-21	11:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.05	<0.10	<0.10
LOC4-20210826-0700	26-Aug-21	7:00 AM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210827-0720	27-Aug-21	7:20 AM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210827-1215	27-Aug-21	12:15 PM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210831-1445	31-Aug-21	2:45 PM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210902-0900	2-Sep-21	9:00 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210904-0908	4-Sep-21	9:08 AM	-	-	-	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210906-1815	6-Sep-21	6:15 PM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210909-1010	9-Sep-21	10:10 AM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210913-1615	13-Sep-21	4:15 PM	0.1	-	0.1	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210915-1100	15-Sep-21	11:00 AM	0.4	-	0.4	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
LOC4-20210918-1338	18-Sep-21	1:38 PM	0.0	-	0.0	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210920-1637	20-Sep-21	4:37 PM	0.4	-	0.4	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
LOC4-20210923-0900	23-Sep-21	9:00 AM	0.5	-	0.5	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
LOC4-20210927-1115	27-Sep-21	11:15 AM	0.2	-	0.2	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
LOC4-20210929-0635	29-Sep-21	6:35 AM	0.5	-	0.5	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.11



Table A7: PAHs (Con't)

Sample ID	Sample Date	Sample Time	C4- fluoranthene/ pyrene ug/L	Benzo(a)- anthracene ug/L	Chrysene ug/L	C1- benzo(a)- anthracene/ chrysene ug/L	C2- benzo(a)- anthracene/ chrysene ug/L	C3- benzo(a)- anthracene/ chrysene ug/L	C4- benzo(a)- anthracene/ chrysene ug/L	Retene ug/L	Benzo(e) pyrene ug/L	Benzo(b&j)- fluoranthene ug/L
LOC1-20210719-1500	19-Jul-21	3:00 PM	2.1	0.087	0.14	0.75	2.1	0.53	0.12	0.19	<0.13	0.044
LOC1-20210720-0905	20-Jul-21	9:05 AM	1.6	0.075	0.11	0.55	1.4	0.41	0.079	0.14	<0.13	0.032
LOC1-20210721-0755	21-Jul-21	7:55 AM	1	0.045	0.083	0.43	1	0.26	0.05	0.095	<0.05	0.024
LOC1-20210723-0751	23-Jul-21	7:51 AM	6	0.082	0.46	1.8	6	1.4	0.38	0.54	0.16	0.11
LOC1-20210726-0810	26-Jul-21	8:10 AM	1.6	0.071	0.16	12	41	19	5.4	0.17	0.066	0.045
LOC1-20210729-1000	29-Jul-21	10:00 AM	0.65	0.033	0.057	0.33	0.93	0.28	0.06	<0.05	<0.05	0.021
LOC1-20210803-0800	3-Aug-21	8:00 AM	0.37	0.0088	0.04	0.22	0.56	0.15	0.032	<0.050	<0.050	0.013
LOC2-20210719-1600	19-Jul-21	4:00 PM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
LOC2-20210720-0820	20-Jul-21	8:20 AM	0.15	<0.01	<0.01	<0.01	0.089	<0.02	<0.02	<0.02	<0.02	<0.01
LOC2-20210721-0715	21-Jul-21	7:15 AM	0.061	<0.01	<0.01	0.012	0.055	0.032	0.013	<0.01	<0.01	<0.01
LOC2-20210723-0710	23-Jul-21	7:10 AM	0.042	<0.01	<0.01	<0.01	0.028	0.016	<0.01	<0.050	<0.05	<0.01
LOC2-20210726-1145	26-Jul-21	11:45 AM	0.033	<0.01	<0.01	0.032	0.23	0.13	0.06	<0.02	<0.02	<0.01
LOC2-20210729-0910	29-Jul-21	9:10 AM	<0.02	<0.01	<0.01	<0.01	0.014	<0.01	<0.01	<0.02	<0.02	<0.01
LOC2-20210803-1200	3-Aug-21	12:00 PM	<0.02	<0.01	<0.01	<0.01	0.025	<0.01	<0.01	<0.02	<0.02	<0.01
LOC3-20210812-0815	12-Aug-21	8:15 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210817-0745	17-Aug-21	7:45 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210819-0600	19-Aug-21	6:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210821-1000	21-Aug-21	10:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210823-1030	23-Aug-21	10:30 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210825-0700	25-Aug-21	7:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210829-0821	29-Aug-21	8:21 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210830-1700	30-Aug-21	5:00 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210901-0900	1-Sep-21	9:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210903-1500	3-Sep-21	3:00 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210908-1230	8-Sep-21	12:30 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210911-0830	11-Sep-21	8:30 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210915-1111	15-Sep-21	11:11 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210918-1342	18-Sep-21	1:42 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210920-1635	20-Sep-21	4:35 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210923-0845	23-Sep-21	8:45 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210927-1100	27-Sep-21	11:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC3-20210929-0630	29-Sep-21	6:30 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210824-1100	24-Aug-21	11:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210826-0700	26-Aug-21	7:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210827-0720	27-Aug-21	7:20 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210827-1215	27-Aug-21	12:15 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210831-1445	31-Aug-21	2:45 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210902-0900	2-Sep-21	9:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210904-0908	4-Sep-21	9:08 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210906-1815	6-Sep-21	6:15 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210909-1010	9-Sep-21	10:10 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210913-1615	13-Sep-21	4:15 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210915-1100	15-Sep-21	11:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210918-1338	18-Sep-21	1:38 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210920-1637	20-Sep-21	4:37 PM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210923-0900	23-Sep-21	9:00 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210927-1115	27-Sep-21	11:15 AM	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.001
LOC4-20210929-0635	29-Sep-21	6:35 AM	<0.02	<0.001	<0.001	<0.001	0.0098	<0.001	<0.001	<0.05	<0.05	<0.001



Table A7: PAHs (Con't)

Sample ID	Sample Date	Sample Time	Benzo(k)- fluoranthene ug/L	C1- benzo(bjk)- fluoranthene/ benzo(a)pyrene ug/L	C2- benzo(bjk)- fluoranthene/ benzo(a)pyrene ug/L	Benzo- phenanthrene ug/L	Benzo(a) pyrene ug/L	Dibenz(a,h)- anthracene ug/L	Perylene ug/L	Benzo(g,h,i)- perylene ug/L	Indeno(1,2,3-cd)- fluoranthene ug/L	Indeno(1,2,3-cd)- Pyrene ug/L
LOC1-20210719-1500	19-Jul-21	3:00 PM	<0.02	0.26	0.17	<0.13	0.032	<0.02	<0.10	<0.02	<0.02	<0.02
LOC1-20210720-0905	20-Jul-21	9:05 AM	<0.02	0.18	0.11	<0.13	0.025	<0.02	<0.10	<0.02	<0.02	<0.02
LOC1-20210721-0755	21-Jul-21	7:55 AM	<0.01	0.12	0.095	<0.05	0.016	<0.01	<0.05	<0.01	<0.01	<0.01
LOC1-20210723-0751	23-Jul-21	7:51 AM	0.011	0.8	0.57	<0.05	0.23	0.021	0.073	0.058	0.025	<0.01
LOC1-20210726-0810	26-Jul-21	8:10 AM	<0.01	0.7	2.1	<0.05	0.03	<0.01	<0.05	0.02	<0.01	<0.01
LOC1-20210729-1000	29-Jul-21	10:00 AM	<0.01	0.13	0.1	<0.05	0.015	<0.01	<0.05	0.0086	<0.01	<0.01
LOC1-20210803-0800	3-Aug-21	8:00 AM	<0.01	0.079	0.057	<0.050	0.022	<0.01	<0.01	<0.01	<0.01	<0.01
LOC2-20210719-1600	19-Jul-21	4:00 PM	<0.01	<0.02	<0.02	<0.05	<0.01	<0.01	<0.05	<0.02	<0.02	<0.02
LOC2-20210720-0820	20-Jul-21	8:20 AM	<0.01	<0.02	<0.02	<0.05	<0.01	<0.01	<0.05	<0.02	<0.02	<0.02
LOC2-20210721-0715	21-Jul-21	7:15 AM	<0.01	0.014	0.015	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
LOC2-20210723-0710	23-Jul-21	7:10 AM	<0.01	<0.01	0.0086	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LOC2-20210726-1145	26-Jul-21	11:45 AM	<0.01	0.01	0.048	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
LOC2-20210729-0910	29-Jul-21	9:10 AM	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
LOC2-20210803-1200	3-Aug-21	12:00 PM	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
LOC3-20210812-0815	12-Aug-21	8:15 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210817-0745	17-Aug-21	7:45 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210819-0600	19-Aug-21	6:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210821-1000	21-Aug-21	10:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210823-1030	23-Aug-21	10:30 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210825-0700	25-Aug-21	7:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210829-0821	29-Aug-21	8:21 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210830-1700	30-Aug-21	5:00 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210901-0900	1-Sep-21	9:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210903-1500	3-Sep-21	3:00 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210908-1230	8-Sep-21	12:30 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210911-0830	11-Sep-21	8:30 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210915-1111	15-Sep-21	11:11 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210918-1342	18-Sep-21	1:42 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210920-1635	20-Sep-21	4:35 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210923-0845	23-Sep-21	8:45 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210927-1100	27-Sep-21	11:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC3-20210929-0630	29-Sep-21	6:30 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210824-1100	24-Aug-21	11:00 AM	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210826-0700	26-Aug-21	7:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210827-0720	27-Aug-21	7:20 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210827-1215	27-Aug-21	12:15 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210831-1445	31-Aug-21	2:45 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210902-0900	2-Sep-21	9:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210904-0908	4-Sep-21	9:08 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210906-1815	6-Sep-21	6:15 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210909-1010	9-Sep-21	10:10 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210913-1615	13-Sep-21	4:15 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210915-1100	15-Sep-21	11:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210918-1338	18-Sep-21	1:38 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210920-1637	20-Sep-21	4:37 PM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210923-0900	23-Sep-21	9:00 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210927-1115	27-Sep-21	11:15 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
LOC4-20210929-0635	29-Sep-21	6:35 AM	<0.001	<0.001	<0.001	<0.050	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001



**Table A8: Toxicity**

Sample ID	Sample Date	Sample Time	RT 96Hr LC50 (%) % vol/vol	RT % Mortality %	DM 48Hr LC50 (%) % vol/vol	DM % Mortality %	MTOX 15-min EC50 (%) % vol/vol	MTOX 15-min EC20 (%) % vol/vol
LOC1-20210719-1500	19-Jul-21	3:00 PM	21	100	>100	40	44	12
LOC1-20210720-0905	20-Jul-21	9:05 AM	18	100	>100	0	45	10
LOC1-20210721-0755	21-Jul-21	7:55 AM	27	100	>100	0	51	17
LOC1-20210723-0751	23-Jul-21	7:51 AM	18	100	40	100	32	12
LOC1-20210726-0810	26-Jul-21	8:10 AM	35	100	>100	0	45	11
LOC1-20210729-1000	29-Jul-21	10:00 AM	33	100	71	100	58	21
LOC1-20210803-0800	3-Aug-21	8:00 AM	22	100	>100	0	49	14
LOC3-20210812-0815	12-Aug-21	8:15 AM	>100	0	>100	0	>82	>82
LOC3-20210817-0745	17-Aug-21	7:45 AM	>100	0	>100	0	>82	>82
LOC3-20210819-0600	19-Aug-21	6:00 AM	>100	0	>100	0	>82	>82
LOC3-20210823-1030	23-Aug-21	10:30 AM	>100	0	>100	0	>82	56
LOC3-20210825-0700	25-Aug-21	7:00 AM	>100	0	>100	0	>82	>82
LOC3-20210829-0821	29-Aug-21	8:21 AM	>100	0	>100	0	>82	59
LOC3-20210830-1700	30-Aug-21	5:00 PM	>100	0	>100	0	>82	>82
LOC3-20210901-0900	1-Sep-21	9:00 AM	>100	0	>100	0	>82	>82
LOC3-20210908-1230	8-Sep-21	12:30 PM	>100	0	>100	0	>82	>82
LOC3-20210911-0830	11-Sep-21	8:30 AM	>100	0	>100	0	>82	>82
LOC4-20210824-1100	24-Aug-21	11:00 AM	>100	0	>100	0	61	29
LOC4-20210826-0700	26-Aug-21	7:00 AM	>100	0	>100	0	>82	>82
LOC4-20210827-0720	27-Aug-21	7:20 AM	>100	0	>100	0	>82	48
LOC4-20210827-1215	27-Aug-21	12:15 PM	>100	0	>100	0	>82	>82
LOC4-20210831-1445	31-Aug-21	2:45 PM	>100	0	>100	0	>82	>82
LOC4-20210904-0908	4-Sep-21	9:08 AM	>100	0	>100	0	>82	>82
LOC4-20210906-1815	6-Sep-21	6:15 PM	>100	0	>100	0	>82	>82
LOC4-20210909-1010	9-Sep-21	10:10 AM	>100	0	>100	0	>82	>82
LOC4-20210913-1615	13-Sep-21	4:15 PM	>100	0	>100	0	>82	>82
LOC4-20210923-0900	23-Sep-21	9:00 AM	>100	0	>100	0	>82	>82



## **Appendix B**

### **Ecotoxicity Assessment of Coke Treated Oil Sands Process Water**



# ECOTOXICITY ASSESSMENT OF COKE-TREATED OIL SANDS PROCESS-AFFECTED WATER

**November 2022**



*Prepared for:*

**Synchrude Canada Ltd.**

Edmonton, Alberta

**Hatfield Consultants LLP**

#200 – 850 Harbourside Drive  
North Vancouver, British Columbia, Canada V7P 0A3  
Tel: 1.604.926.3261 • Fax: 1.604.926.5389  
[www.hatfieldgroup.com](http://www.hatfieldgroup.com)







# ECOTOXICITY ASSESSMENT OF COKE-TREATED OIL SANDS PROCESS-AFFECTED WATER

*Final Report*

*Prepared for:*

**SYNCRUDE CANADA LTD.**  
EDMONTON, ALBERTA

*Prepared by:*

**HATFIELD CONSULTANTS LLP**  
200-850 HARBOURSIDE DR.  
NORTH VANCOUVER, BC  
CANADA V7P 0A3  
TEL: 1.604.926.3261 • [WWW.HATFIELDGROUP.COM](http://WWW.HATFIELDGROUP.COM)

**NOVEMBER 2022**

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Appendix A2	Laboratory Effects Assessment (Acute and Sublethal Toxicity): Detailed Methods and Results
Appendix A3	Biological Effects Assessment (Mesocosm Study): Supporting Data



## LIST OF ACRONYMS

<b>AEP</b>	Alberta Environment and Parks
<b>AFDW</b>	Ash-free dry weight
<b>ANCOVA</b>	Analysis of covariance
<b>ANOSIM</b>	Analysis of similarities
<b>ANOVA</b>	Analysis of variance
<b>BOD</b>	Biological oxygen demand
<b>BV</b>	Bureau Veritas (laboratory)
<b>CCME</b>	Canada Council of Ministers of the Environment
<b>COD</b>	Chemical oxygen demand
<b>DIN</b>	Dissolved organic nitrogen
<b>DOC</b>	Dissolved organic carbon
<b>EC</b>	Electrical conductivity
<b>ECCC</b>	Environment and Climate Change Canada
<b>EEM</b>	Environmental Effects Monitoring
<b>IC#/EC#</b>	Inhibition or effect concentration (concentration of effluent causing #% inhibition/effect)
<b>ICPMS</b>	Inductively Coupled Plasma Mass Spectroscopy
<b>LC#</b>	Lethal concentration (concentration of effluent causing #% mortality)
<b>LSI</b>	Liver somatic index
<b>MDL</b>	Method detection limit
<b>MDS</b>	Muti-dimensional scaling
<b>NA</b>	Naphthenic acids
<b>ND</b>	Non-detectable
<b>OSPW</b>	Oil sand process-affected water
<b>OWMW</b>	Oil sands mine water
<b>PAH</b>	Polycyclic aromatic hydrocarbons
<b>PAR</b>	Photosynthetically active radiation
<b>PC</b>	Petroleum coke
<b>PQL</b>	Practical quantification limit
<b>PRC</b>	Performance reference compound
<b>RPD</b>	Relative percent difference
<b>SD</b>	Standard deviation
<b>SPMD</b>	Semi-permeable membrane device
<b>TDP</b>	Total dissolved phosphorus
<b>TDS</b>	Total dissolved solids
<b>TIC</b>	Total inorganic carbon
<b>TIE</b>	Toxicity identification evaluation
<b>TN</b>	Total nitrogen
<b>TOC</b>	Total organic carbon
<b>TP</b>	Total phosphorus



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## AMENDMENT RECORD

This report has been issued and amended as follows:

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## 1.0 INTRODUCTION

Syncrude Canada Ltd. (Syncrude) has developed a novel technology to treat oil sand process-affected water (OSPW; in this case, water sourced from operationally active tailings ponds) using fresh fluid petroleum coke (PC) as an adsorbent (Zubot 2010). The purpose of the treatment is to improve the quality of OSPW, with an overall goal of making Treated OSPW safe for managed release to regional aquatic receiving environments such as the Athabasca River. Achieving this goal at an operational scale would allow Syncrude to manage OSPW volumes and quality on the regional landscape (Zubot and Buchanan 2013).

This treatment process uses PC produced from Syncrude's fluid cokers. PC displays properties similar to activated carbon and has sufficient adsorption potential to reduce concentrations of select chemical constituents from OSPW, particularly hydrocarbons and dissolved ionizable organics such as naphthenic acids which are known to cause toxicity to aquatic organisms (Zubot 2010). The treatment process includes three stages (Zubot et al. 2012):

- Stage 1 is a pipeline where fresh PC produced from Syncrude's fluid cokers mixes with untreated OSPW from tailings ponds. Treatment (i.e., chemical binding of OSPW constituents with "activated" carbon in petroleum coke) occurs in the pipeline as the PC/OSPW slurry is piped to Stage 2. The residence time of Stage 1 is approximately 30 minutes.
- Stage 2 is a large filtration cell, containing PC and equipped with engineered under-drainage, which acts as a filter bed to reduce suspended solids (e.g., clay particles), free-phase hydrocarbons and dissolved organic constituents (e.g., naphthenic acids). The residence time of Stage 2 can be controlled through pumping from under-drains and can extend from one week (comparable to 2021 operation of the pilot-scale facility described below) to multiple years.
- Stage 3 is an open-air polishing pond with sufficient residence time to reduce concentrations of ammonia present in Stage 2 effluent. The Stage 3 treatment is intended to eliminate potential ammonia toxicity to fish. The Stage 3 residence time in the pilot-scale facility described below was eight (8) days.

In this study, effluent from Stage 3 is referred to as Treated OSPW.

After various laboratory-scale trials and studies (Zubot et al. 2012), Syncrude constructed a pilot-scale treatment facility at their Mildred Lake operations, which operated in summer-fall 2021 to facilitate running ecotoxicology experiments described in this report. Untreated OSPW sourced from Syncrude's operational inventory of OSPW was treated in a closed-circuit process, with Treated OSPW leaving Stage 3 pumped back to the tailings pond. Effluent from Stage 3 was subject to a broad ecotoxicity assessment, which is the focus of this report. Overall goals of this assessment were to determine the efficacy of Syncrude's treatment system to remove aquatic toxicity and to contribute technical information to support future return-to-river releases.

This ecotoxicity assessment collected and considered multiple lines of evidence to assess effects of full-strength and diluted Treated OSPW on aquatic biota, conceptually following the "triad" weight-of-evidence approach originally proposed by Chapman (1992). Elements of the triad included:



- **Exposure endpoints:** Assessment of the water quality of Treated OSPW relative to Athabasca River water (including various mixtures of both) and to published environmental benchmarks; as well as concentrations of metals in tissues of test organisms exposed to these mixtures in both laboratory and mesocosm settings (see below).
- **Laboratory effects endpoints:** Assessment of acute toxicity and sublethal effects on a wide variety of test organisms representing multiple trophic levels in paired on-site and laboratory exposures using both short- and long-term exposures. Both standard and non-standard (native) test species were used. Toxicity Identification Evaluation (TIE) procedures were applied to assess the potential contribution of pH to toxicity.
- **Biological (community-level) effects endpoints:** Assessment of benthic invertebrate and periphyton communities exposed to various dilutions of Treated OSPW (Stage 3 effluent) in Athabasca River water using an on-site, flow-through mesocosm.

Study design was developed through extensive collaboration among several parties, including Syncrude, members of the Province of Alberta's OSPW Science Team (which includes provincial and federal scientists and regulators, and technical representatives from Indigenous communities in the oil-sands region and industry), Innotech Alberta, Hatfield Consultants (Hatfield), Limnotek Research and Development (Limnotek), and Nautilus Environmental Company Inc (Nautilus). Hatfield, Nautilus and Limnotek led the detailed design and implementation of the program, with specific technical input to preliminary program design from Innotech Alberta (see Cude et al. 2017) and from Environment and Climate Change Canada (ECCC) scientists specializing in mesocosm design and implementation (particularly Dr. AJ Alexander-Trusiak).

This report presents the results of the ecotoxicity assessment, which was undertaken in September 2021 with additional toxicity tests undertaken in spring-summer 2022 due to constraints on test-organism availability. For purposes of efficiency in review, this main report presents a summary of water quality and toxicity results, with full results and raw data presented in component-specific appendices, as follows:

- Appendix A1 includes detailed results, quality control assessment, raw data and other supporting information for the exposure assessment, primarily focused on water and tissue chemistry;
- Appendix A2 presents detailed methods, results and raw data for the laboratory-effects assessment (produced by Nautilus); and
- Appendix A3 presents supporting information and raw data for the biological-effects assessment (mesocosm experiment).

This report does not present engineering details of the treatment system itself or results of chemistry assessments across the treatment train (e.g., Stage 1 or Stage 2 chemistry), except in specific cases where this was useful for interpretation of ecotoxicity results. These treatment-system performance results are presented in a separate Syncrude report (W. Zubot, pers. comm., 2022). Generally, however, Treated OSPW exhibited, relative to untreated OSPW:



- Reduced or negligible concentrations of OSPW constituents such as colour, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (parent and alkylated) and dissolved organics, primarily naphthenic acids;
- Reductions in concentrations of total suspended solids (TSS);
- Reductions in several dissolved and total metals content, and small or negligible changes in others;
- Small or negligible changes in total dissolved solids, electrical conductivity and concentrations of major ions (i.e., Ca, Mg, Na, K, SO<sub>4</sub>, HCO<sub>3</sub> and Cl); and
- Elimination of acute toxicity to rainbow trout, the waterflea *Daphnia magna*, and the bioluminescent bacteria, *Allivibrio fischeri* (i.e., Microtox test).



## 2.0 METHODS

Detailed, component-specific methods are presented in Appendices A1 to A3, respectively, for exposure, toxicity, and mesocosm components of the ecotoxicity assessment, and are summarized below, along with commonalities of design across components that were used to maximize comparability of results and conclusions across all study components.

### 2.1 COMMON DESIGN ELEMENTS

#### 2.1.1 Dilution Series

A consistent dose-response design was implemented across all study components, with matching dilutions of Treated OSPW and Athabasca River water. The dilutions reflected a geometric series of concentrations that were adjusted through discussions with the OSPW Science Team to include more high-dilution exposures that would better reflect partially or fully mixed concentrations of effluent were it discharged to the Athabasca River. The exposures were 0% Treated OSPW (=100% Athabasca River water); 0.32%, 1.0%, 3.2%, 10%, 32%, and 100% Treated OSPW (=0% Athabasca River water). Toxicity tests performed at the Nautilus laboratory included an additional 56% concentration for the extended fathead minnow test and native species tests (i.e., walleye, fingernail clam, and freshwater mussel). Supporting water quality and tissue testing programs measured samples from specific dilutions across this full dilution series.

Standard sublethal tests of algae, invertebrates and fish used the dilution series dictated by the published protocol, typically 0%, 1.6%, 3.2%, 6.3%, 12.5%, 25%, 50%, and 100%.

#### 2.1.2 Study Schedule

Following initial commissioning and start-up of the treatment facility, the ecotoxicity study actively ran tests using samples collected from early September to early October 2021. After full setup of on-site mesocosm and toxicity testing programs, flow of the Treated OSPW began to these testing facilities on September 4, 2021. For the mesocosm experiment, routine operational checks, water quality sampling, and periphyton sampling occurred over the following 21 days, ending on September 25, 2021. Final sampling of water, periphyton, and benthos was done on September 25-26, 2021.

Mobile-laboratory exposures of fathead minnow juveniles began on September 4 and proceeded for 28 days, with weekly samples of Treated OSPW and river water delivered to the Nautilus laboratory in Calgary for standard acute and sublethal testing from September 7 to October 4.

Because certain toxicity tests (i.e., walleye and bivalve exposures) could not be conducted in fall 2021 due to constraints associated with test-organism availability, Treated OSPW was collected and stored at the end of Week 5 of the 2021 trial and used in exposures undertaken in spring-summer 2022.

#### 2.1.3 On-Site Testing / Effluent and Water Sources

On-site toxicity testing and the mesocosm experiment were run on property of Bouchier Contracting, located north of Syncrude operations. Facilities included a mobile lab trailer for toxicity tests (Figure 1), the mesocosm apparatus (Figure 2), power, office trailer, and wastewater handling. All supply water was pumped to polyethylene tanks mounted on trucks dedicated to each of river water or treated OSPW; river water was taken from the Syncrude water intake where it discharges into a sedimentation pond (Figure 3).



**Figure 1** Outside and inside of mobile toxicity-testing trailer.



**Figure 2** Mesocosm exposure tables, with and without shade cover. Holding tanks for treated OSPW and river water shown on left of first image.



**Figure 3** Pump station supplying water from the Athabasca River to the Syncrude plant (left image). River water for experiments was withdrawn from a sedimentation pond within 100 m of the pumphouse (right image).





Water and Treated OSPW deliveries occurred at the beginning and end of each day during experiments. Water and Treated OSPW were distributed from head tanks to the mesocosm and toxicity trailer as needed. To avoid potential contamination, all water deliveries were performed by separate trucks, each fitted with clean, unused tanks, and new, unused stainless-steel pumps and hoses. All tanks, pumps, and hoses were new and only used for the toxicity and mesocosm studies. Additional toxicity tests run at the Nautilus laboratory in Calgary used the same Treated OSPW and river water, which were shipped weekly from the Bouchier site.

Wastewater from the mesocosms and toxicity trailer was captured in a 1,000-gallon tank and transferred daily to Syncrude's operational inventory of OSPW (i.e., tailings) to ensure no Treated OSPW release to the environment.

## **2.2 SAMPLING PROGRAM**

### **2.2.1 Exposure Assessment**

To support the mesocosm and toxicity-testing components, water samples were collected from each head tank and each mesocosm exposure table and delivered to Bureau Veritas (BV) laboratories for chemical analysis. These samples were in addition to routine (i.e., daily or continuous), field-based measurements of water quality and other environmental variables (e.g., air and water temperatures, water velocities in mesocosms, insolation, etc.) used to support and maintain on-site exposure studies within optimal operating parameters. At the end of the study, tissue samples of periphyton and invertebrates from the mesocosms, and of fathead minnows from long-term test exposures were collected and subject to chemical analysis.

Full water and tissue chemistry results for the exposure component, as well as a qualitative QAQC assessment, appear in Appendix A1.

#### **2.2.1.1 Water Quality**

Water samples were collected weekly (i.e., n=5 sampling events) from Treated OSPW, river water, and mesocosm tables and tested at BV Labs for an extensive range of water quality analytes (Table 1). Water samples were collected from mesocosm streams by closing a one-way valve on a given stream inflow line, disconnecting the feed line and directing flow into the BV labs' bottle set. Samples for analysis of dissolved fractions were field-filtered using a peristaltic pump with a 0.45-µm membrane filter. Field blanks and duplicates were collected in conjunction with each sampling event. Samples were shipped with ice packs by courier to BV labs in Calgary for analysis.

To supplement laboratory measurements of polycyclic aromatic hydrocarbons (PAHs) in Treated OSPW and river water, additional measurements of ultra-trace concentrations of PAHs were undertaken using semipermeable membrane devices (SPMDs). These devices include triolein-impregnated polyethylene, which accumulated PAHs from surrounding waters to an equilibrium concentration. The devices allowed for precise, ultra-trace measurements (i.e., pg/L levels) of PAHs in solution. SPMDs were deployed in the Treated OSPW head tank and the three river-water head tanks for the duration of the 21-day mesocosm trial. SPMDs were provided by EST of Saint Joseph, MO and analyzed following exposure by SGS AXYS, Sidney BC.



**Table 1**      **Supporting weekly water chemistry analyses conducted on all exposure dilutions during the mesocosm study, September 2021.**

<b>Test Group</b>	<b>Analytes</b>
<b>Conventional Variables</b>	pH, conductivity, total suspended solids, total dissolved solids, chemical/biological oxygen demand, colour, turbidity
<b>Major Ions</b>	Calcium, magnesium, sodium, potassium, hydroxide, fluoride, chloride, sulphate, carbonate/bicarbonate, alkalinity, hardness
<b>Nutrients</b>	Ammonia (ionized and unionized), total N, nitrate-N, nitrite-N, total/dissolved/ortho-P, total/dissolved organic carbon, total inorganic carbon
<b>Total and Dissolved Metals</b>	Arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, molybdenum, nickel, selenium, silicon, silver, strontium, tellurium, tin, titanium, uranium, vanadium, zinc, zirconium
<b>Volatile Organics</b>	F1+BTEX compounds, chlorinated and brominated methanes/ethanes/propanes, vinyl chloride, carbon tetrachloride, chloroform,
<b>Misc. Organics</b>	Naphthenic acids (FTIR method)
<b>Extractable Petroleum Hydrocarbons</b>	F1 (C6-C10), F2 (C10-C16), F3 (C160C34), F4 (C34-C50) hydrocarbons
<b>Polycyclic Aromatic Hydrocarbons (PAHs)</b>	55 parent and alkylated PAH species
<b>Phenols</b>	Phenol, cresol, plus 19 species of chlorinated, methylated or nitrogenated phenols

Quality assurance and quality control (QAQC) protocols for the water chemistry assessment are described in Appendix A1. Quality assurance (QA) deals with the management and technical aspects of a project, to ensure that the data generated are of consistently high quality. Quality control (QC) is an aspect of QA and includes the procedures used to measure and evaluate data quality, and to take corrective actions when data quality objectives are not met. QA procedures included development of detailed Field Work Instructions, using standardized methods where possible, in advance of any field program, use of appropriate sampling methods based on relevant scientific methods and literature, properly calibrated equipment, standardized field sheets and digital records management, chain-of-custody tracking, and daily tailgate and health and safety meetings.

For water quality samples, field blanks and duplicates were collected and analyzed throughout the September 2021 sampling program, with at least one set of QAQC samples collected during each sampling program targeting laboratory analysis. The analytical laboratory also followed its own set of QAQC procedures. Generally, field blanks showed no quantifiable (i.e., >5 x method detection limit [MDL]) concentrations of any of the 234 analytes measured in each sample, with the exception of a few metals (i.e., aluminum, barium, copper, lead, strontium, and zinc) that were detected at >5 x MDL in some samples (see Appendix A1). Duplicate samples were typically within 20% relative percent difference of one another, with most duplicate samples showing fewer than 10% of observations with >20% relative percent difference; analytes with frequent >20% differences in duplicates included those often found in field blanks, particularly aluminum, barium, and zinc. Overall, the QAQC assessment indicated that data generated from the water quality program were of acceptable quality and adequate to address objectives of the study.



### 2.2.1.2 Tissue Chemistry

Fathead minnows from extended toxicity tests, bulk samples of benthic invertebrates and periphyton scrapings from the mesocosms, were collected at the end of the study and assessed for metals concentrations (Table 2). Pooled samples from each exposure dilution (i.e., 0 to 100% Treated OSPW) were tested separately.

**Table 2** Tissue residue tests (performed for all exposure dilutions) conducted during the aquatic toxicity study, September 2021.

Test or Analyte	Frequency
Fathead minnow tissue chemistry (metals)	At end of on-site juvenile exposure (28d)
	At end of laboratory early-life stage exposure (28d)
Benthic invertebrate tissue chemistry (metals)	At end of study (21d)
Periphyton tissue chemistry (metals)	At end of study (21d)

At the end of the mesocosm experiment, 5 grams of periphyton tissue were collected from each stream and stored at -20°C in 50 mL falcon tubes. These samples were shipped to ALS Environmental in Calgary for metals and mercury analysis (CRC ICPMS, EPA 200.3/6020B (mod); CVAAS EPA 200.3/1631E).

Early-life stage and juvenile fathead minnow were euthanized and stored at -20°C in 50 mL falcon tubes and were shipped to ALS Environmental for metals and mercury analysis (CRC ICPMS, EPA 200.3/6020B (mod); CVAAS EPA 200.3/1631E). After Biologica Environmental Services finished taxonomic assessment (see Section 2.2.3.3), invertebrate community samples (pooled organisms; one sample per treatment) were sent to TrichAnalytics Inc., Saanichton, BC for analysis of moisture content and metals tissue analysis using NWR-213 laser ablation (esi) and iCAP RQ series ICPMS (ThermoFisher Scientific). Use of a laser-ablation technique was required to allow invertebrate tissue analysis to proceed, given the small mass of these tissue samples.

## 2.2.2 Toxicity Assessment

### 2.2.2.1 Standard and Non-Standard Toxicity Tests

Nautilus assessed the acute and sublethal toxicity of mixtures of Treated OSPW and Athabasca River water using both off-site laboratory testing, and on-site sublethal toxicity testing (the off-site and on-site programs occurred simultaneously). Additional tests on non-standard organisms (freshwater bivalves and walleye) were completed by Nautilus following test protocols derived from relevant research studies. A summary of the toxicity tests is presented in Table 3. Detailed information on test conditions and procedures for the toxicity component are included in the Nautilus study report in Appendix A2.

Where possible, tests followed standard, published protocols; where this was not possible (e.g., for novel tests using native species), laboratory tests used methods that followed published research (Table 3). All short-term tests (i.e., 7 days or less) included control exposures using laboratory control water in addition to river water, to allow comparison of organism performance in Athabasca River water relative to this laboratory water.



**Table 3 Toxicity tests of Treated OSPW conducted during the aquatic toxicity study.**

Species	Test Type	Test Method	Frequency
<b>Standard Tests Conducted at Nautilus Lab (tested concurrent with mesocosm study, September 2022)</b>			
Rainbow trout ( <i>O. mykiss</i> )	96h Acute toxicity	ECCC EPS 1/RM/13	Weekly (x5)
Water flea ( <i>D. magna</i> )	48h Acute toxicity	ECCC EPS 1/RM/14	Weekly (x 5)
Water flea ( <i>C. dubia</i> )	7d Survival & reproduction	ECCC EPS 1/RM/21	Weekly (x 5)
Fathead minnow ( <i>P. promelas</i> )	7d Survival & growth	ECCC EPS 1/RM/22	Weekly (x 5)
Green alga ( <i>P. subcapitata</i> )	7d Growth inhibition	ECCC EPS 1/RM/25	Weekly (x 5)
Amphipod ( <i>H. azteca</i> )	7d Survival & growth	ECCC EPS 1/RM/33	Weekly (x 5)
Fathead minnow ( <i>P. promelas</i> )	32d Early life-stage, 0-30d	USEPA (1996); ASTM (2013)	Once
Fathead minnow ( <i>P. promelas</i> )	28d Juvenile-adult, 60-88d	Adapted from ASTM (2013)	Once
<b>On-site Exposure (September 2022)</b>			
Fathead minnow ( <i>P. promelas</i> )	28d Juvenile-adult, 60-88d	Adapted from ASTM (2013)	Once
<b>Native Species Tests (tested in 2022 on stored effluent collected in September 2021)</b>			
Bivalve ( <i>Lampsilis cardium</i> ) glochidia	48h Viability	ASTM (2022)	Once
Bivalve ( <i>Sphaerium</i> sp.) juveniles	28d Survival & growth	Adapted from Wang et al. (2007)	Once
Walleye ( <i>S. vitreus</i> ) embryo	30d Early life-stage	Raine et al. (2017)	Once

\* Juvenile Fathead minnow test undertaken in duplicate: in on-site mobile laboratory; and concurrently at Nautilus lab in Calgary.

### 2.2.2.2 Preliminary Assessment of Acute Toxicity

On commissioning of the treatment system and first production of Treated OSPW from Stage 3, the effluent was tested for acute toxicity to rainbow trout and *Daphnia magna*, two species typically used to determine acute toxicity of effluents for regulatory purposes. Following the study design, if these screening tests indicated that the Treated OSPW was acutely toxic (i.e., LC50<100%), a preliminary, screening-level TIE process would have been conducted to attempt to identify the cause of the observed acute toxicity, and if the treatment process was unable to remove acute toxicity, it would have been deemed to have failed expectations, and the remainder of the ecotoxicity study would be terminated.

Given the treatment process from Stage 3 produced Treated OSPW with no acute toxicity to rainbow trout or *D. magna* (a treatment objective), the full ecotoxicity study proceeded to completion.

### 2.2.2.3 On-Site Fathead Minnow Testing with Laboratory Duplication

The fathead minnow juvenile-adult test, conducted in both on-site and lab settings, characterized effects on survival, length, weight, and body condition factor. These tests were initiated with fish that were approximately 75-days old post-hatch, with a duration of 28 days. The purpose of the duplicate laboratory test was to provide a backup in the event of an on-site mobile trailer test failure, as well as to assess whether tests conducted on-site provide a higher level of sensitivity as compared to laboratory tests (for example, if



toxicity were to dissipate while the samples were in transit to the laboratory). In addition to assessing the effects of Treated OSPW on the survival, length, weight and condition factor of fish as with the on-site test, fish (n=5, where possible from each concentration) from the laboratory testing were also dissected for livers to calculate a liver somatic index (LSI) value, which describes relative liver weight as liver weight divided by total weight.

The fathead minnow early-life stage test was undertaken in the Calgary laboratory only. An early-life stage test with fathead minnows was also planned to be conducted in the mobile toxicity testing trailer; however, it was not possible to obtain import permits for these organisms because the mobile testing trailer did not have a permanent address. Organisms would need to be transported directly to the mobile testing trailer to initiate the test at the appropriate stage; therefore, the early-life stage test was not initiated.

Juvenile adults (30-d old post-hatch) were ordered from Aquatic Research Organisms (Hampton, NH, USA) with associated health certificates as required by the import permit. A subset of fish (~300) was shipped and delivered by ground courier to the mobile toxicity testing trailer in Fort MacKay, AB on September 2, 2021. Fish were then acclimated to trailer conditions before testing began on September 4, 2021.

#### **2.2.2.4 Additional Testing Added During the Experiment**

Additional toxicity tests were initiated during the study in response to observations during testing, including the high pH of Treated OSPW, and clear signs of biological activity and algal growth in the Stage 3 pond (i.e., samples were brownish-green in appearance, versus the clear appearance of Stage 2 effluent). These efforts included additional weekly tests (i.e., green algae, *C. dubia*, fathead minnow, and *Hyalella azteca*) of pH-adjusted Treated OSPW effluent and using Stage 2 effluent (Table 4). Partly treated OSPW from Stage 2 was clear and colorless and had a lower pH (mean=8.5) than Treated OSPW from Stage 3 (mean=9.2). The increase in pH through the Stage 3 pond was accompanied by a decline in dissolved bicarbonate/carbonate, which suggests biological activity (i.e., algal growth) in Stage 3 was consuming inorganic carbon and therefore reducing buffering capacity and increasing pH (W. Zubot, Syncrude, pers. comm., 2022).

The pH of Stage 3 Treated OSPW remained consistently high over the five-week testing period. To determine if high pH contributed to adverse effects observed, additional screening tests were performed using the *C. dubia* and 7-day fathead minnow tests during the last week of testing (Week 5) at Nautilus in Calgary, AB. The pH in these tests was lowered using 1 N HCl, with daily adjustment taking place prior to each test solution replenishment.



**Table 4 Additional toxicity tests undertaken during the aquatic toxicity study to support Toxicity Identification Evaluation (TIE), September 2021.**

Species	Test Schedule	Nature and Purpose of Test
Water flea ( <i>C. dubia</i> )	Week 4	Test of Stage 2 effluent, to assess potential effects of differences in sublethal response to Stage 2 effluent, to standard (weekly) test species.
Fathead minnow ( <i>P. promelas</i> )		
Green alga ( <i>P. subcapitata</i> )		
Amphipod ( <i>H. azteca</i> )		
Water flea ( <i>C. dubia</i> )	Week 5	Test of Stage 3 effluent with HCl addition to lower pH from 8.6-9.0 to 8.2, to assess whether the high pH of Stage 3 effluent was the cause of adverse effects observed to these test species at high Treated OSPW concentrations.
Fathead minnow ( <i>P. promelas</i> )		

\* Juvenile Fathead minnow test undertaken in duplicate: in on-site mobile laboratory; and concurrently at Nautilus lab in Calgary.

### 2.2.2.5 Anti-Microbial Treatment for Fathead Minnow Tests

The initial study design (Hatfield 2019) identified a potential concern of microbial growth in fathead minnow exposures, related to the high water temperatures required for these tests (i.e., 25±2°C) and unrelated to effluent exposure; mortality associated with microbial growth is commonly observed in fathead minnow tests with ambient water samples (Groth and Johnson 1996, Kszos et al. 1997). Microbial growth was observed in the 7-day fathead minnow tests in Weeks 1 and 2 of the trial, which potentially contributed to low observed survival. A trial treatment of 50 and 100% Treated OSPW exposures in the Week 3 test with 20 µg/L dissolved copper proved effective to reduce microbial growth. This prophylactic anti-microbial treatment was applied to all dilutions in the Week 4 and 5 fathead minnow tests.

To reduce microbial growth in the 7-day fathead minnow tests, 20 µg/L of copper was added to the site control water and the 50 and 100% test concentrations of Stage 3 sample during Week 3 of testing at Nautilus in Burnaby, BC. The copper additions proved successful in reducing mortality in the fathead minnow test in the site control and 50% test concentration, and were subsequently added to the site control and all test concentrations during Week 4 and 5 testing.

Copper was not applied to the juvenile-adult tests (either on-site or at the laboratory). The effectiveness of the copper treatment is specific to the period from about 2 days to 10 days post hatch, so would be expected to help the 7-day test (which tests from 1 to 8 days post-hatch) and the 28-day early-life-stage test (which tests from two days prior to hatch to about 26 days post-hatch). Therefore, a potential influence of microbial growth on the juvenile-adult tests, independent of exposure to Treated OSPW, cannot be discounted.

### 2.2.2.6 QAQC Protocols

Quality assurance and quality control protocols followed by Nautilus are described in Appendix A2, and included the following standardized test procedures of ECCC, ATSM and USEPA, assessment of test processes and performance against test control acceptability, and the use of reference toxicants to assess test-organism response and performance under the same test conditions as those used for experimental treatments.



Through the study, few QAQC issues were encountered. Those that were encountered included: exceedance of sample holding times (usually by one day) for a subset of tests, associated with shipping to the Nautilus Burnaby lab rather than the Calgary lab; <80% survival in some site (river-water) controls for fathead minnow without anti-microbial (copper) treatment; minor deviations from test protocols, such as longer aeration of some samples, occasional missing water quality measurements in the laboratory, and a forgotten water change during a *Hyalella azteca* test (which did not result in any measurable differences in water quality).

None of these identified and flagged QAQC issues is considered to have affected the quality of the data generated by the toxicity assessment.

## **2.2.3 Mesocosm Assessment**

Mesocosms allow separation and replication of treatments to test hypotheses of change among biological assemblages relative to physical and chemical conditions, with a high degree of control of potentially confounding experimental factors. Multiple test environments, whether flow-through flumes (Bothwell 1989), or circular streams (Culp et al. 2003) with plumbing to control flows and chemical additions, allow for control of multiple stressors applied to realistic and representative aquatic invertebrate and periphyton assemblages that are derived from the actual river of interest. This capability provides direct environmental relevance in a manner that is not achievable in standard toxicity tests that are run in laboratories using non-endemic organisms. Results can be used to build models of functional response to ranges of doses of chemicals or physical change.

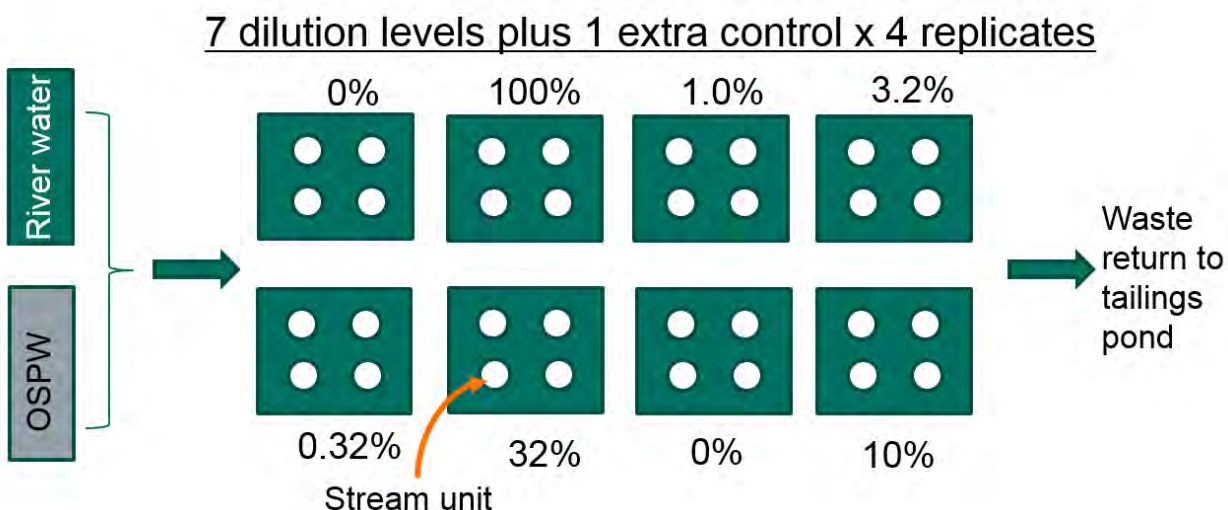
The 2021 mesocosm experiment assessed the response of periphyton and benthic invertebrates found in the Athabasca River watershed to a range of dilutions of Treated OSPW, from 0.32 to 100%.

### **2.2.3.1 Mesocosm Design and Construction**

The mesocosm was similar to that reported by Culp et al. (2003) and Alexander et al. (2016), with modifications. It consisted of eight 1.2 m x 1.2 m x 1.2 m tables; each hosting a given dilution of Treated OSPW distributed among four replicate circular streams (Figure 4).



**Figure 4** Mesocosm layout showing stream units, treatment tables, dilutions, and direction of water.



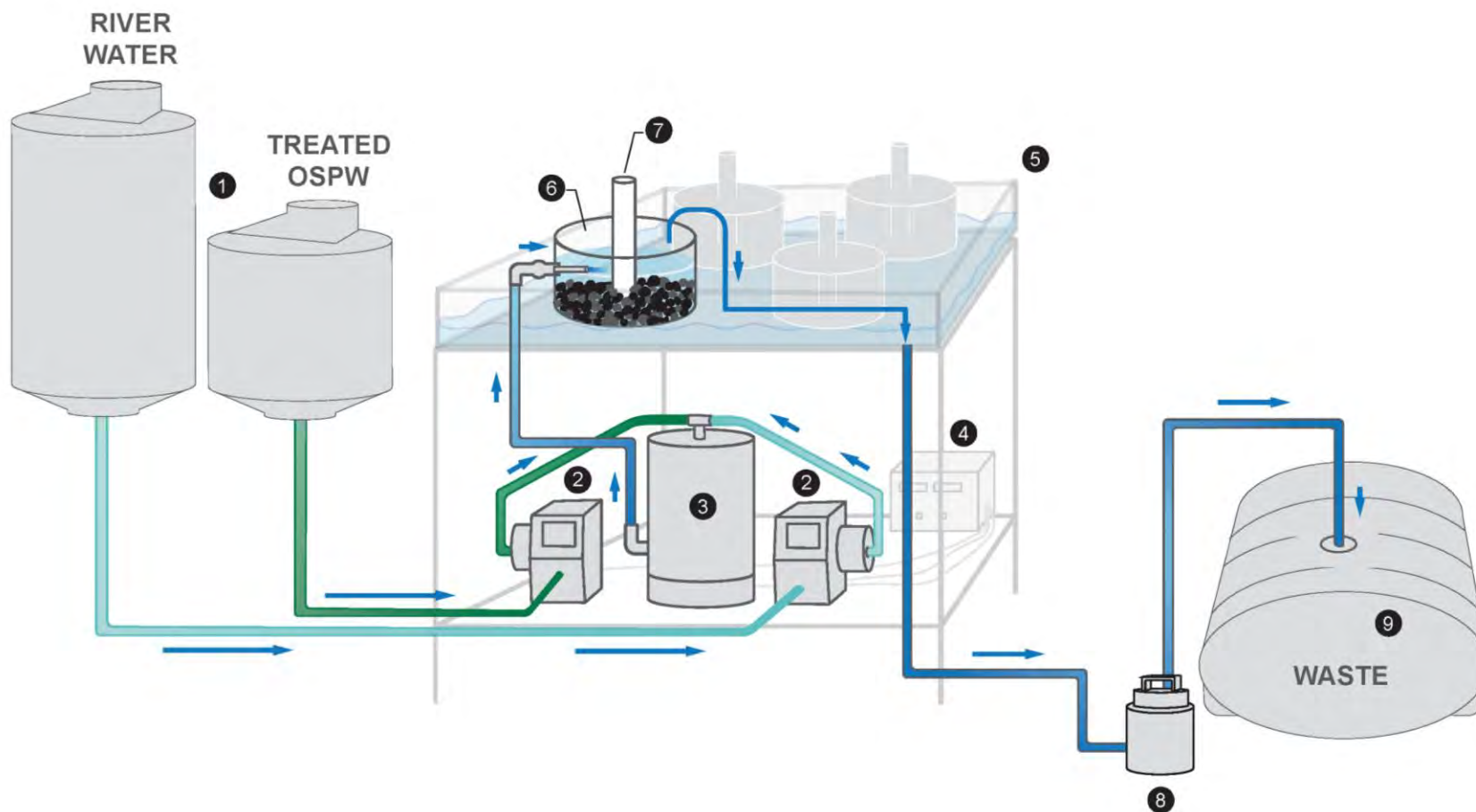
The tables were constructed with slotted angle steel, with painted plywood used for a top and shelf. Each table was mounted on a standard pallet that allowed for transport and site placements using a forklift. The streams were placed inside a 1.15 m X 1.15 m X 0.18 m polyethylene tray laid on the tabletop. Black shade cloth rated to limit irradiance by 40% and thus control heating was supported over top of each table using  $\frac{3}{4}$  inch Pex pipe. The shelf supported pumps, a mixing manifold, and power supplies to drive fluid delivery and water velocity in each stream. Each stream was 29 cm in diameter with a wetted surface area of 0.065 m<sup>2</sup> and held a volume of 10.3 L. Water depth (bottom to the rim) in each stream was 15 cm.

River water and Treated OSPW were delivered daily to on-site polyethylene holding tanks (Zeebest Plastics, Edmonton, Alberta) (Figure 5). Three 575-gallon cone-bottom tanks contained river water and one 330-gallon tank contained the Treated OSPW. Two-inch PVC pipe and valves were installed to turn flow on or off to the mesocosm tables. Plumbing included bypass lines to waste and to outlets to supply the on-site toxicity experiments. The holding tanks were covered in thermal wrap to limit temperature fluctuation.

Flow from the holding tanks was distributed to the mesocosm tables using 2-inch PVC pipe from which a manifold split the line to supply the mesocosm tables. There was one manifold for the Treated OSPW and one for the river water. Each manifold split the outflow into separate lines of vinyl tubing to service each table. Flow to each stream was controlled using a Watson Marlow QDOS60 precision peristaltic pump calibrated to achieve the desired dilution of Treated OSPW in river water. Mixing of river water and the Treated OSPW was achieved in a 5-L manifold located on the shelf of each table. That manifold received output from the river water and Treated OSPW pumps via  $\frac{1}{4}$ -inch vinyl tubing and discharged via a single  $\frac{1}{4}$ -inch vinyl line to each stream (Figure 5). Flow passed a stream bulkhead using a valved spigot and bulkhead fitting. One-way valves were installed to prevent backflow and  $\frac{1}{4}$ -inch quick-disconnects were placed in the tubing to facilitate water sampling. Pump flow rates were adjusted to achieve complete water turnover in 1.5 hours in each stream for the duration of the experiment. Resulting daily demand for the Treated OSPW and river water among all streams was 985 L and 4,392 L respectively.



**Figure 5** Schematic illustration of mesocosm design and operation.



**Legend:**

- |                         |                                        |                      |
|-------------------------|----------------------------------------|----------------------|
| 1. Reservoir head tanks | 4. Voltage regulator                   | 7. Circulating motor |
| 2. Supply pumps         | 5. Mesocosm table (1 of 8)             | 8. Sump              |
| 3. Mixing baffle        | 6. Mesocosm stream (1 of 4 replicates) | 9. Waste water tank  |



Water in the streams was circulated using a custom fabricated rotating vertical drum with blades that was powered by a 12VDC 120RPM 15oz-in GHM-02 Spur Gear Head Motor and controlled using a Circuit Test single output linear (0-30VDC@3A) power supply to create and maintain water velocities near 0.10 m/s. Each motor was wired in series to the power supply so that amperage adjustment controlled all four motors the same way. Velocities were confirmed from daily measurements using a Marsh-McBirney velocity sensor immersed to a depth 5 cm above installed substrata.

Discharge flowed over the rim of each stream to the tabletop holding tray, which flowed via a barb fitting to a central, 4-inch PVC waste line using 1-inch plastic hose. That hose was inserted into holes drilled into the central waste line. A 400-µm mesh screen was fastened to the upper lip of each stream to prevent macroinvertebrates from escaping. Wastewater in the 4-inch line flowed to a sump where it was pumped to a 1,000-gallon wastewater tank that was emptied twice daily for disposal to a Syncrude tailings pond.

Electrical power was supplied from the Alberta grid via Bouchie Contracting and backup power was installed using equipment from United Rentals Ltd. Power was delivered to a distribution table from which standard extension cords were used to power the pumps and power controllers on each table.

The mesocosm streams mimicked erosional habitat conditions (i.e., cobble and gravel substrates) and were inoculated with benthic assemblages collected from erosional habitat of the Athabasca River. Although it was recognized that the Athabasca River in the vicinity of a future water-return location is dominated by sandy substrates, benthic communities of cobble/gravel habitats (typically sensitive species of Ephemeroptera, Plecoptera and Trichoptera, plus chironomids and a host of rarer taxa) are generally more diverse and sensitive to disturbance than the more robust community that occupies sandy substrates (i.e., typically chironomids and worms). Therefore, stony substrata were selected for the mesocosm to provide a worse-case scenario regarding the potential effects on benthic invertebrate and periphyton communities chronically exposed to Treated OSPW. (It should be noted that it was not possible to include both stony substrata and fine sediments in the same mesocosm chamber because the fine sediments would embed the coarser substrate and greatly impact micro-habitat availability required by the sensitive benthos species colonizing the stony substrata.)

### **2.2.3.2 Mesocosm Inoculation and Operation**

Operation of the mesocosm involved three sequential phases:

1. Substrate collection and inoculation with periphyton and invertebrates;
2. Daily operations and data collection; and
3. Termination and final sampling.

#### ***Substrate Collection and Biota Inoculation***

Following guidance from ECCC, approximate proportions of three size fractions were established by conducting preliminary sediment collections from representative erosional areas of the Athabasca River prior to the formal experiment. The preliminary sediment collection ensured that small substrate conditions in the experimental streams would match that of the benthic invertebrate collection site in the Athabasca River as closely as possible.



Following removal of the substrate armour layer, a spade and bucket were used to collect a total of 10 L of small substrate from multiple locations at the benthic invertebrate collection site, which was located upstream of the Regional Municipality of Fort McMurray water-treatment plant (UTM coordinate: 12V 474992E 6286294N). Sediment was sieved and separated into three fractions: 1 to 2.5 mm (sand); 2.5 to 5 mm (gravel); and 5 to 10 mm (pebble). This preliminary sampling yielded approximate proportions of 51.2% pebble, 37.6% gravel, and 11.2% sand.

One week prior to the formal start of the experiment, an additional volume (enough for 32 L total; 1 L per stream) of small sediment was collected from the same Athabasca River location, sieved, and layered into each stream, based on the proportions observed in preliminary sampling (i.e., 512 mL pebble, 376 mL gravel, and 112 mL sand).

The testing facility was inoculated with local Athabasca River periphyton five days prior to the formal start of experiment to allow time for the assemblage to establish and stabilize in the artificial streams. Palm-sized cobbles (approximately 5 to 8 cm diameter) were collected from the benthic invertebrate collection site and transported to the facility location in coolers filled with Athabasca River water. Invertebrates found on the cobbles were removed prior to transport. A total of 192 cobbles were collected—six per stream—and placed evenly around the circumference of each stream. This substrata structure and installation method followed recommendations from Dr. AJ Alexander-Trusiak (Research Scientist, ECCC, Fredericton, NB, pers. comm.) based on her experience running similar mesocosm experiments.

Following placement of the cobbles, the Athabasca River water holding tank valve was opened and all pumps and stirrers activated to initiate continuous flow through the mesocosms.

Three days prior to the formal start of the experiment, benthic macroinvertebrates were collected from the Athabasca River using a triangular kicknet (following CABIN protocol; see Environment Canada 2012a), along a ~100-m stony bottom segment of river approximately 800 m upstream of the Regional Municipality water treatment plant (start 12V 474992E 6286294N; end 12V 474677E 6286364N). Each kick-sample replicate was collected over a 5-minute continuous duration, while zig-zagging in an upstream direction. The kick sampler was a certified CABIN trainer, to ensure effort was consistent throughout the sampling. The approximate width of the zig-zag sample area was up to 20 m, from shore (left bank) to the edge of the safe wading area (as judged by the sampler).

Following collection of a kick replicate, the sample was decanted into a 5-gallon bucket and rocks and detritus were removed using a series of successively smaller sieves (1 cm to 1 mm). At each sieve size, the sample was carefully inspected to ensure no invertebrates were excluded except large (>1.5 cm) instars (typically stonefly [Plecoptera] and dragonfly [Odonata: Anisoptera]) which were discarded back to the river. The large individuals were removed to prevent anomalous predation by a few individuals and produce unequal distributions of low numbers of large individuals among subsamples.

Each sieved sample was placed (separately) in a sample splitter and mixed, separating each kick sample into four equal subsamples. Each subsample was randomly assigned to a stream and transferred into a 1-L, wide-mouth plastic jar containing Athabasca River water and stored in a cooler with ice packs for transport to the facility. At least one subsample from each kick was retained for taxonomic analysis of pre-experiment assemblage. Benthic invertebrate taxonomy samples were sent to Biologica Environmental Services Ltd. in Victoria, BC for identification and enumeration.



Gravel collection and placement into streams was done from August 16 to 27, 2021. Cobble collection and placement into streams occurred on August 30, 2021, following the start of river water flow to all streams on August 28, 2021. Benthos was collected from the Athabasca River and placed into streams on September 1, 2021.

### ***Mesocosm Operation***

Routine checks, water sampling, and periphyton sampling occurred over 21 days, ending on September 25, 2021. A crew of one to three Hatfield and Limnotek environmental specialists performed daily operational checks during experimental exposure along with scheduled sampling of water and periphyton (Table 5). Daily checks were conducted to ensure all components of the facility were operating correctly and included:

- Peristaltic pump functionality and water delivery (on/off);
- Presence/absence of air bubbles in the water supply tubing;
- Stream stirrer motor/power supply status (voltage/current);
- Water level and temperature checks on river water and Treated OSPW tanks;
- Random (one stream per table) *in situ* water quality measurements (temperature, pH (Oakton pH 45)), specific conductance (Oakton cond 150), and dissolved oxygen (Thermoscientific Orion multimeter); and
- General observations every day of experimental operation, including presence of exuviae (moulded exoskeletons) or adults, notable differences in the condition of streams and tables, and weather.

### ***Stream Velocity***

Stream flow measurement were taken throughout the experiment operation and power supplies were adjusted to maintain water velocities of 0.1 m/s.

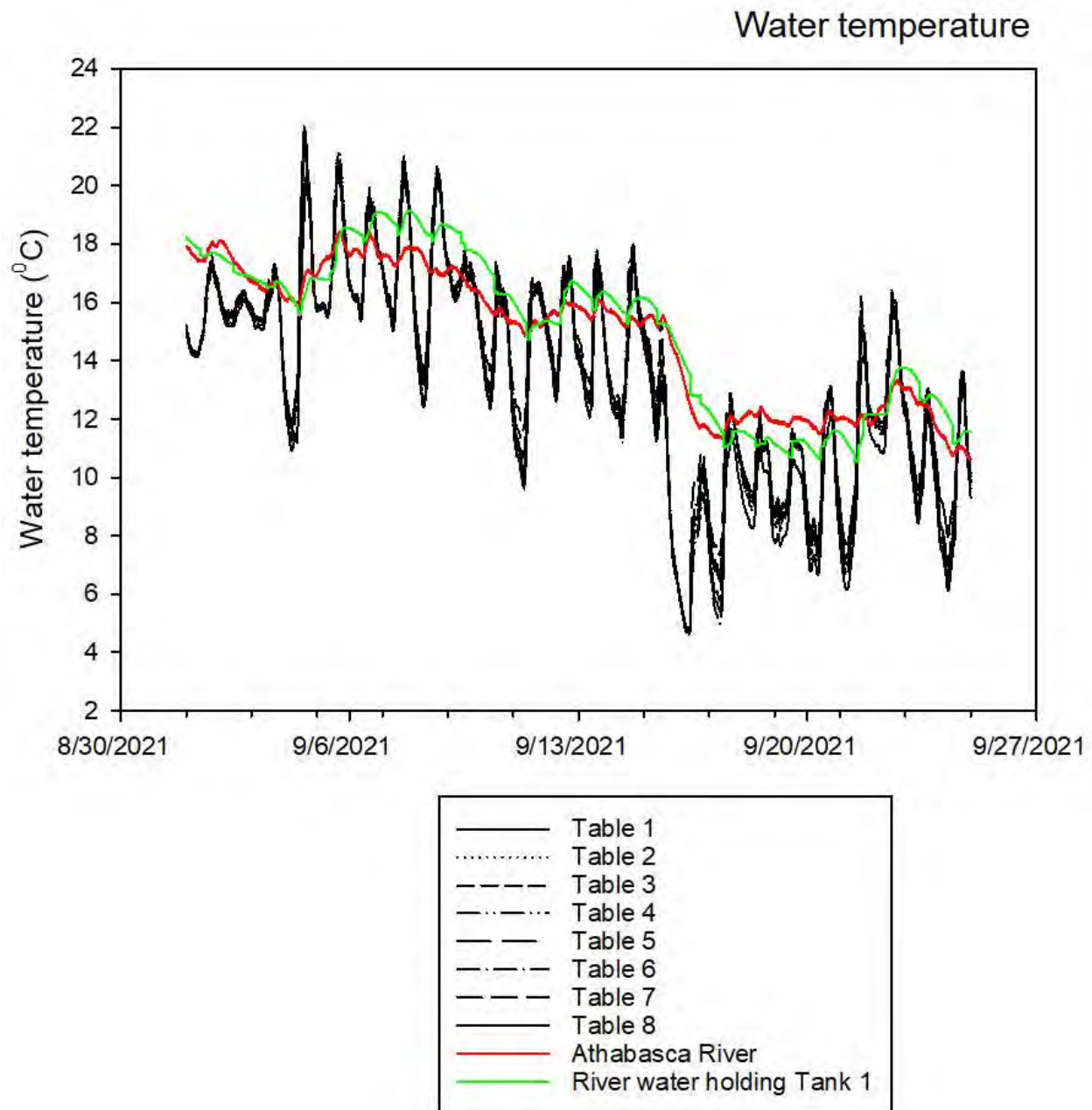
### ***Light and Temperature Control***

The shade cloth removed 81 to 88% of unrestricted photosynthetically available radiation (PAR) in air. This removal corresponded with 12-19% of unrestricted PAR from reaching the benthic communities in the streams.

Water temperatures in the mesocosm, in the Athabasca River at the location of water collection for the study, and in one of the river water holding tanks ranged from 5 to 22°C during the experiment. All streams had similar temperatures (Figure 6). Diurnal temperature variation was greater in the streams than in the river and water holding tanks. With the Reflectix™ insulation applied to their exteriors, the tanks closely maintained river temperatures. Therefore, any temperature variation in the streams was due to warming and cooling in the streams themselves despite the presence of shade cloth to inhibit temperature variation, and not related to temperature changes in the holding tanks.





**Figure 6** Water temperature recorded every 5 minutes in a mesocosm stream of each table (black lines), in the Athabasca River at the Syncrude water intake (red line), and in river-water holding Tank #1 at the mesocosm site.





**Table 5**      **Schedule of daily data and sample collection for the mesocosm study.**

Experiment Day	Date	Water Sampling	Periphyton	In-Situ Water Quality	Stream Velocity	PAR in Mesocosm Streams	PAR In River Water
0	Sept 4, 2021						
1	Sept 5, 2021						
2	Sept 6, 2021						
3	Sept 7, 2021						
4	Sept 8, 2021						
5	Sept 9, 2021						
6	Sept 10, 2021						
7	Sept 11, 2021						
8	Sept 12, 2021						
9	Sept 13, 2021						
10	Sept 14, 2021						
11	Sept 15, 2021						
12	Sept 16, 2021						
13	Sept 17, 2021						
14	Sept 18, 2021						
15	Sept 19, 2021						
16	Sept 20, 2021						
17	Sept 21, 2021						
18	Sept 22, 2021						
19	Sept 23, 2021						
20	Sept 24, 2021						
21	Sept 25, 2021						

 Dark shading indicates physical samples were collected.  
 Light shading indicates measurements were collected.

### *Periphyton Sampling During Test Exposures*

An increase in periphyton biomass on substrata over time is called algal accrual, which is a function of cell colonization, cell growth, and losses associated with senescence, invertebrate grazing, and sloughing. There can be differences in the amount of biomass accruing on different substrata because of variation in surface texture. To avoid that surface effect, a standard artificial substratum, Styrofoam, was used for measurements of biomass accrual, based on its successful application in a mesocosm by Bothwell (1989) and in open streams by Perrin et al. (1987). Eight open-cell, 2.5-cm diameter Styrofoam balls were clipped onto the side walls of each stream using stainless-steel tablecloth clips and cable ties. There was no contact



with stream substrata, thus preventing exposure of accrued periphyton to grazing by benthic invertebrates. Use of the clips also standardized exposure of the balls to irradiance among all streams. The balls were clipped onto the streams when flow of OSPW was started on September 4, 2021. One ball with attached periphyton was removed every two to four days over the experiment duration of 24 days, placed into a labelled plastic vial and immediately frozen at -15°C. This frequency produced seven samples during the experiment for each stream. Once all balls for the experiment were collected, they were shipped cold to the lab for analysis of chl-a concentration using extractions in acetone followed by analysis of chl-a concentration by fluorometry (Arar and Collins 1997). The laboratory reported results as µg chl-a per sample, which were corrected to areal units (µg/cm<sup>2</sup> chl-a) using the ball surface area of 19.6 cm<sup>2</sup>.

### 2.2.3.3 Mesocosm Termination and Final Sampling

Final sampling of water, periphyton, and benthos was completed on September 25 and 26, 2021.

#### *Periphyton*

On the final sampling date (September 25, 2021), the eighth ball from each stream was removed and preserved in Lugol's solution for later identification and enumeration of cells by species. At the Biologicala laboratory, cells were removed from the Styrofoam using a fine spray of deionized water from a dental cleaning instrument inside the sample vial. Samples were then sonicated for 7 minutes using a CO-Z Digital Ultrasonic Cleaner (40 kHz), and 0.5 mL sub-samples were dispensed into Utermohl settling chambers, topped up with distilled water, and gravity settled for a minimum of 10 hours. Sub-samples were systematically scanned using a Zeiss Axio Vert A.1 inverted phase-contrast microscope at 400x magnification. All algal cells were counted in a series of randomly located fields of view (FOV) until 300 algal units were enumerated or until 80 FOV were scanned. The entire chamber was then scanned at 100x magnification, and all taxa not encountered in the FOVs were counted. Algal units represented single cells, colonies, or filaments.

The mean number of cells per unit (= 1 for single cells, >1 for all other algal forms) were estimated for all taxa and used to calculate total densities. Only “viable” cells (those with living chloroplasts) were identified and enumerated. Loricas (shell casings) of Chrysophytes also were counted (US EPA 2003). Algae were identified to genus, where possible, following the most up-to-date taxonomic references and collaborations with international and local algal taxonomic experts. Species-level identifications were only given to identifiable taxa for which there are reliable taxonomic references available that encompass the species-level morphological diversity in North America. This approach ensured the long-term consistency of data sets and is in accordance with the trend in algal taxonomic practice to be more conservative with the delineation of species. Species-level identifications for some taxa are problematic due to widespread phenotypic plasticity that can artificially inflate species richness (Wehr *et al.* 2015). When applicable, the terms “cf.” (*confertim*, possibly for species) and “sp.1” (a single undetermined species) were employed to distinguish between different species of the same genus.

Three samples were re-analyzed to assess the precision of enumeration. Replicate samples were chosen at random and processed at different times to reduce counting and identification bias. Average precision was 95.1%.



At the end of the experiment, three palm-sized cobbles were collected from each mesocosm stream for analysis of chlorophyll-*a* and ash-free dry weight (AFDW), and three were collected for taxonomic identification and enumeration from each stream. The top surfaces of each rock were photographed to determine surface area (available in Appendix A3). Each cobble was scrapped and brushed into a container. Sample for taxonomic analysis was preserved with Lugol's solution. Sample for analysis of chlorophyll-*a* and ash-free dry weight (AFDW) were vacuum filtered onto 0.45 µm membrane filters that were folded and placed in black falcon tubes and stored at -20°C. Chl-*a* samples were shipped to ALS Environmental, Burnaby, BC for measurement of chlorophyll-*a* by fluorometry (EPA 445.0 [mod]) and AFDW by gravimetry (APHA 10200 I [mod]). AFDW was corrected for filter mass by subtracting AFDW of replicate blank filters from total AFDW (filters plus biomass). Taxonomy samples were sent to Biologica for taxonomic identification and enumeration.

### ***Benthic Invertebrates***

At the end of the experiment operation, streams were dewatered and the contents of the streams, minus the palm-sized cobble, which were simultaneously removed for Chl-*a* and taxonomic collection, were funneled into 250-µm net and decanted into 1-L benthic jars. Jars were ¾-filled with stream contents (sediment and macroinvertebrates) and preserved in 10% formalin.

At Biologica, samples were transferred from formalin into 70% ethanol and stained with Rose Bengal to aid in sorting. Each sample was provided a unique identification number and placed in the queue for analysis. Samples were sorted using dissecting microscopes at 10 to 40x magnification. All debris in each sample was checked microscopically, including leaves, twigs, moss, and other large debris, to ensure “clinger taxa” were recovered consistently from the samples. Samples were elutriated to separate gravel from fine organic material. All fine organic material was sorted whole. For the gravel portion, 20% of the gravel was checked to confirm the elutriation process was successful and no organisms were found. To minimize potential sorter bias, samples were distributed among technicians such that no one person sorted all the replicates of a given sample.

Ten percent of the samples were checked for sorting efficiency. A selected sample for checking was re-sorted and sorting efficiency was calculated as  $1 - [(\# \text{ of organisms in re-sort} / \text{total organisms})] \times 100$ . All checked samples had to meet or exceed 95% sorting efficiency. Any samples falling below 95% sorting efficiency were re-sorted in their entirety, and additional checks were undertaken as necessary. The re-sorts showed 96.6% to 100% sorting efficiency.

All organisms were identified using a combination of dissecting (10 to 40x) and compound (100 to 1,000x) microscopes and standard taxonomic keys in Bousfield (1958), Clarke (1981), Epler (2010), Epler (2001), Essig (1926), Kathman and Brinkhurst (1998), McAlpine (1989), Merritt and Cummins (1996), Needham et al. (2014), Oliver and Roussel (1983), Peckarsky et al. (1996), Pennak (2001), Proctor (2006), Rogers (2005), Stewart and Oswood (2006), Stewart and Stark (2002), Thorp and Covich (1991), Webb (2017), Witzel et al. (2009), and Wiggins (1996). Identification was to the lowest practicable level. As required, chironomids and oligochaetes were cleared and slide-mounted. All specimens were archived in air-tight glass vials with glycerin and 70% ethanol for long-term storage. A reference collection consisting of a minimum of one specimen representing each taxon and stage was created. These specimens were



labelled, placed in evaporation-resistant shell dram vials and given a unique location code. Approximately 1 mL of glycerin was added to each vial to prevent desiccation.

Biomass calculations were performed for all benthic taxa by measuring a minimum of 5 specimens of each taxon for each sample and applying length/weight regression formulae (Benke et al. 1999, Miserendino 2001). Biomass estimates were presented as average per-taxon dry-weight (mg) values.

#### **2.2.3.4 Opportunistic Sampling of Zooplankton Observed in Stage 3**

Following commissioning of the treatment process, Syncrude staff observed zooplankton and algal growth in the Stage 3 polishing pond. These organisms were not intentionally placed in the pond and would have arrived independent of human actions.

Taxa were identified by sampling water in the Treated OSPW water storage tank at the experiment site on September 23, 2021. Five gallons of the Treated OSPW water and the same amount from the river water storage tank were passed through 250-µm plankton net by opening a bypass valve on the discharge line from each tank. Net contents were dispensed into an opaque 500-mL plastic bottle. Zooplankton were anesthetized by adding club soda to a maximum concentration of 50% of the sample, and then preserved with enough 10% buffered formalin to double the volume of the sample (1:1 ratio). Samples were shipped to Biologica for taxonomic identification and enumeration.

## **2.3 DATA ANALYSIS**

### **2.3.1 Exposure Assessment**

#### ***Water Quality Summary Tables***

Mean concentrations of select water quality analytes were tabulated for each experimental dilution and compared against mean concentrations measured in Athabasca River water during the study (i.e., values measured in the river-water head tank). Values that exceeded Environmental Quality Guidelines for Alberta Surface Water (AEP 2018) were identified, as well as concentrations in Treated OSPW or mixtures that differed notably from the Athabasca River water samples (mean concentrations of greater than two standard deviations from the river-water mean were considered to be notably different). Screened results and guidelines for all dilutions are presented in Appendix A1; Section 3.1 of this main report summarizes those results.

Mean mesocosm-treatment concentrations of select major ion, nutrient, and dissolved and total metals were tabulated and organized according to the extent to which analyte concentration increased across treatment groups. Sparklines (simplified trendlines) were used to visualize trends in mean analyte concentrations across treatments.

Organic analytes were compared against MDLs, with maximum observed concentrations and percentage of samples above detection limit (%ND) summarized for detected analytes.

Although both total and dissolved metals were measured and assessed in this study, dissolved (i.e., filtered at 0.45 µm) metal concentrations are generally preferred over total (unfiltered) metals concentrations in



interpretation, given they better represent ions that may bind to or pass through membranes and thus be mostly bioavailable to periphyton and benthic invertebrates.

To assess nutrient availability and potential limitation of bioavailable N or P, molar N:P ratios were calculated using dissolved inorganic nitrogen (DIN) and orthophosphate - P, the forms of N and P that are considered most bioavailable for uptake by algae, using the formula (DIN/14)/(SRP/31).

Calculation of descriptive statistics and preparation of a correlation matrix and correlation plot were conducted in R (R Core 2022).

### ***Ultra-Trace PAH Concentrations Calculated From SPMDs***

Estimated water concentrations for PAHs were calculated from concentrations in SPMD field blanks and SPMDs deployed in river tanks and the Treated OSPW tank over the study, using a concentration calculator developed by the US Geological Survey (Alvarez 2010). SPMDs were deployed for 21 days with a SPMD volume of 1.7 mL, and a Trolein volume of 1 mL. Deuterium-labeled fluoranthene (d-10), phenanthrene (d-10), and dibenzo[a,h]anthracene (d-14) were used as performance reference compounds (PRCs). If a PRC final concentration was higher than that seen in the day zero blank, then the PRC was removed from the analysis to determine estimated water concentration. Estimated water concentration was used using the following calculation:

$$C_w = \frac{N}{\left( V_s K_{sw} \left[ 1 - \exp \left( \frac{-R_s t}{V_s K_{sw}} \right) \right] \right)}$$

Where  $C_w$  : ambient chemical concentration  
 $R_s$ : the sampling rate (L/d)  
 $t$ : the exposure time (d)  
 $V_s$  : SPMD volume  
 $K_{sw}$ : SPMD-water partition coefficient

### ***Metals in Biological Tissues***

Metal concentrations in tissues of fathead minnows, periphyton and bulk samples of benthic invertebrates (mg/kg dry weight) were compared across treatments (i.e., % Treated OSPW) and ordered in descending order of the magnitude of difference between 100% Treated OSPW and the River water control (0% Treated OSPW). Excel sparklines were used to visualize trends in mean analyte concentrations across treatments.

## **2.3.2 Toxicity Assessment**

Statistical analyses were performed using CETIS (Tidepool Scientific Software, version 1.9.4.11 or 2.1.0.7) to calculate threshold-effect concentrations such as LC50, IC25, etc. A laboratory control was used to establish test validity; the site control (i.e., Athabasca River water) was used as the negative control for endpoint calculation.



It should be noted that while test validity was met in the laboratory control for all tests, it was not met in the site control for fathead minnow survival during Week 3 of testing with Treated OSPW and *C. dubia* reproduction during Week 4 of testing with Stage 2 effluent. However, the site control was still used as the negative control for endpoint calculation for these two tests.

Spearman-Kärber or linear interpolation was used in the calculation of the lethal concentration (LC) values. For growth and/or reproduction inhibitory concentrations (IC) values, linear interpolation or non-linear regression was used based on best fit of the model.

## 2.3.3 Mesocosms

### 2.3.3.1 Periphyton

Relative abundance of algal cells by Phylum (cell count of a Phylum divided by total cell count) was displayed graphically to provide an overview of periphyton composition by treatment. For Phyla that were most common, similar graphics were used to show relative abundance of orders within Phyla and a narrative listed common genera.

Curves were produced from the biomass accrual measurements to present chl-*a* concentration as a function of time (days). Each stream was a treatment replicate. A general linear model for analysis of covariance (ANCOVA) was used to test for homogeneity of slopes of the regression lines between treatments wherein the dependent variable was  $\log_{10}(1 + \text{chl-}a \text{ concentration})$  transformed to produce a straight line that is required for ANCOVA. A value of 1 was added to each value to avoid negative numbers. The independent covariate was days of incubation, and the independent variable was treated as follows:

$$\log_{10}(1 + [\text{chl}a]) = \text{Constant} + \text{Treatment} + \text{Days} + (\text{Treatment} * \text{Days}) \quad \text{Equation 1}$$

If the interaction term (*Treatment \* Days*) was significant ( $p < 0.05$ ), slopes of the regression lines were considered different because it indicated that algal biomass, measured as chl-*a* concentration, differed over time between the treatments (hence a difference in slope of the regression lines).

Following Biggs and Kilroy (2016) the net accrual rate was calculated as:

$$B = a(\exp(kT)) \quad \text{Equation 2}$$

where *B* was algal biomass (mg chl-*a*) at day *T*, *a* was the initial biomass concentration and *k* was the net rate of accrual during the exponential growth phase. *k* was calculated for each curve by performing a  $\log_e(B + 1)$  transformation which changed the exponential part of the accrual curve into a straight line. Points on the curve were used in a regression of *B* against *T*. The resulting coefficient for *T* was the value for *k*. Biggs and Kilroy (2016) showed that low values for *k* are  $< \sim 0.10$  and high values are  $> \sim 0.35$ . Because *k* is the natural log exponent for rate of change, it has no units except day<sup>-1</sup>.

Cell growth expressed as divisions per day ( $\mu$ ) was then calculated as:

$$\mu = k/0.693 \quad \text{Equation 3}$$

following procedures by Bothwell (1988). The value of  $\mu$  for each Treated OSPW addition was normalized to that of 0% Treated OSPW (called  $\mu_c$ ) where 0% Treated OSPW was defined as having a maximum value of  $\mu$  among all treatments. The resulting ratio  $\mu:\mu_c$ , called relative specific growth rate, had values from



near 0 to more than 1. Values >1 showed enriched growth rates relative to that at 0% Treated OSPW and values near 0 showed very low growth rate relative to that at 0% Treated OSPW.

Periphyton data analyses were performed in R Project Software (R Core Team 2022), using *tidyverse* (Wickham and Henry 2019), with results plotted using *ggplot2* (Wickham 2016).

### 2.3.3.2 Benthic Invertebrates

Family level of taxonomic resolution was used for statistical analyses, based on findings that family-level data are equally sensitive to genus-level identifications for impact assessments (Bowman and Bailey 1998, Clarke et al. 2014). Federal Environmental Effects Monitoring (EEM) also uses family-level data for determination of effects of effluent discharges on benthic invertebrate communities (Environment Canada 2012b), making this level of taxonomic resolution relevant for discharge-assessment scenarios.

Two null hypotheses were tested. The first stated there was no difference in invertebrate assemblages between the group of subsamples that were collected from the Athabasca River and not used in the mesocosm (i.e., representing the river's benthic community previous to any live handling, sorting or distribution into the mesocosm) and the invertebrate assemblage present in the 100% river water samples collected from the mesocosms at the end of the study. This test showed effects of the mesocosm methodology, such as handling and incubation in the streams and final sampling, on assemblage patterns. The second hypothesis was that exposure to Treated OSPW did not affect benthic invertebrate assemblages in the mesocosm streams. This test was most relevant to the assessment of effects of Treated OSPW on the invertebrate community. The test of effects of mesocosm procedures on benthos over the study period compared 11 Athabasca River subsamples with eight mesocosm stream samples (i.e., two tables of four streams not receiving treated OSPW). The test of Treated OSPW additions compared assemblages among the seven Treated OSPW doses (i.e., 100%, 32%, 10%, 3.2%, 1%, 0.32%, 0%).

Similarities between benthic invertebrate assemblages were calculated using the Bray-Curtis coefficient (Krebs 1999) in PRIMER v7 (Clarke and Gorley 2015) to produce a similarity matrix. A fourth-root transformation was applied to all observations before the matrix was calculated to moderately down-weight the importance of the common families and increase the weighting of the rarer families.

Similarities of the invertebrate assemblages between samples were examined using the group average linkage in the hierarchical, agglomerative clustering algorithm performed in PRIMER, from which a dendrogram was plotted. Sample groupings were also examined using a non-metric multidimensional scaling (MDS) analysis from which an ordination was plotted. MDS is a procedure for fitting a set of points in a space such that the distances between points correspond as closely as possible to dissimilarities between objects, which in this case are samples. Output is displayed on two-dimensional or three-dimensional images having no scaling units wherein space between objects on the image provides perspective of dissimilarities. These images are called ordinations. The images showed similarities and dissimilarities among samples and treatments that were assigned as a factor in PRIMER. The representation of sample relationships on ordinations plotted in two dimensions was defined by "stress level", which is a number that indicates how representative was the two-dimensional image at presenting the multidimensional data. Any ordination with a stress of less than 0.2 was considered representative while a stress of >0.2 indicated that interpretation should be done using an alternative approach, potentially using a three-dimensional plot to examine the sample relationships (Clarke and Gorley 2015).



Analysis of similarities (ANOSIM) run in PRIMER was used to derive an R statistic that indicated the degree of similarity of the benthic invertebrate assemblages within and between treatments. R was based on a non-parametric permutation procedure that was applied to the similarity matrix that was used to run the cluster and MDS analyses. This procedure was a multivariate analogue of analysis of variance in parametric statistics. R can range from 0 in which there is no difference in assemblages between treatments to 1 in which all observations within treatments are more similar to each other than they are to any samples from different treatments.

The SIMPER routine in PRIMER was used to determine which families contributed most to the overall change in community structure identified in the ANOSIM test. Untransformed data were used to focus mostly on common taxa and less on incidental and rare taxa. This procedure compared the cumulative percentage each family made to the average dissimilarity between two treatments and the average similarity within treatments. Families were identified that cumulatively contributed to more than 70% of between-group dissimilarity. These were called “indicator families”.

Diversity was reported as family richness, which is a count of invertebrate families occurring in a sample and by calculation of what is called a k-dominance plot (Clarke and Gorley 2015). Richness weights all taxa evenly, regardless of them being rare or common. For the k-dominance plot, the mean abundance of each family among replicate streams was ranked in decreasing order and the cumulative relative abundance (i.e., percent of the total abundance for a Treated OSPW treatment) on the y-axis was plotted against increasing rank on the x-axis. All calculations were run in PRIMER.

### 2.3.3.3 Biotic-Abiotic Linkages

Links between chemical patterns and invertebrate assemblages were exemplified using the *BioEnv* algorithm in PRIMER (Clarke et al. 2014). *BioEnv* selected a set of chemical variables that maximized the rank correlation between biotic and abiotic similarity matrices by checking all combinations of variables. It found the best match between multivariate, among-sample patterns of an invertebrate assemblage and chemical variables associated with those invertebrate samples. The Spearman correlation coefficient ( $\rho$ ) was applied as recommended by Clarke et al. (2014). Patterns among chemicals and invertebrate families were expected between treatments if ANOSIM showed a significant treatment effect on assemblages. Conversely, patterns were not expected if ANOSIM was not significant.

The average abundance of every invertebrate family among the four stream replicates was calculated for each treatment. This step produced a single invertebrate sample matching each chemical sample. Similarly, the average concentration of each chemical analyte was calculated from the five replicate dates of measurement in each stream. This step produced one value of each chemical analyte and matching value of each invertebrate family for each Treated OSPW dose. The benthos data were fourth-root transformed as explained for the clustering, MDS, and ANOSIM.

A subset of chemical analytes was selected to avoid inter-correlation between variables and lack of detection. Analytes that were never detected or were found incidentally at the detection limit were omitted because they would not contribute to pattern detection. Analytes that had correlation coefficients of  $>0.99$  or  $<-0.99$  with any other analytes were separated out and called “Group1” analytes. One representative analyte from this Group1 was selected for inclusion in *BioEnv*. Any one of the others of Group1 could equally be used and were as important as the selected analyte for interpretation of biotic-abiotic links but



only one variable of Group1 could be used in *BioEnv* to avoid redundancy. Analytes not in Group1 were assigned to a “Group2”. The same filtering of variables was done in Group2, this time using 0.95 as the correlation cut off, leaving a final set of chemical variables to match with invertebrate samples in *BioEnv*.

Scatterplots were examined for all selected chemical variables and  $\log(x+1)$  transformed to reduce skewness and improve normal distributions as needed for comparison of matrices. These transformed chemical data were then normalized (from each entry of a single variable, subtract the mean across all samples and divide by the standard deviation of that variable) to correct for different scales of measurement. Biotic and abiotic matrix matching was then run in *BioEnv* with output showing matrix correlations for combinations of up to five chemical variables that best matched patterns of invertebrate assemblages among the Treated OSPW doses. *BioEnv* was considered an exploratory tool to reveal what may be the best combination of chemical variables contributing to variation in benthic invertebrate assemblage patterns shown by ANOSIM. Any observed relationships were not considered to be causal.



## 3.0 RESULTS

### 3.1 EXPOSURE ASSESSMENT

#### 3.1.1 Water Quality

##### 3.1.1.1 Ions, Nutrients and Metals

Table 6 presents average values ( $\pm$  standard deviation) for selected water quality analytes in 100% Treated OSPW and Athabasca River water during the September 2021 study period. Table 7, Table 8, Table 9 present average concentrations in each serial-dilution treatment in the mesocosm experiment (and also used for several sublethal toxicity tests), for ions and nutrients, dissolved metals and total metals, respectively, organized in order of the greatest difference between concentrations in 100% Treated OSPW and river water; mean $\pm$ SD values for analytes in each treatment appear in Appendix A1. Generally, water quality analytes were stable in Treated OSPW across the five weekly measurements, as demonstrated by standard deviation values relative to average values, but variability was lower in Treated OSPW than in river water, which is unsurprising given the relatively long retention time of the coke-treatment process.

Treated OSPW had higher concentrations of several analytes than did Athabasca River water. A major difference was salinity: based on concentrations of total dissolved solids (TDS), Treated OSPW was about an order of magnitude more saline than river water: the average TDS in River Water was 180 mg/L versus 1,917 mg/L in Treated OSPW. The salinity in Treated OSPW is associated with major ions or indicators of salinity, including bicarbonate, chloride, fluoride, sulphate, sodium, and TDS). However, the hardness of Treated OSPW was lower than river water (i.e., average 83 mg/L as  $\text{CaCO}_3$  in Treated OSPW versus 140 mg/L as  $\text{CaCO}_3$  in river water). Several trace elements including arsenic, boron, lithium, molybdenum, and vanadium were also elevated in Treated OSPW relative to river water.

Alkalinity, pH, and conductivity had similar concentrations in mixtures of 10% or less Treated OSPW, but concentrations or values increased in doses of 32% and 100% Treated OSPW (Table 7). Most dissolved carbon present was inorganic, but organic carbon content increased disproportionately at doses exceeding 10% Treated OSPW. With pH near 8 at doses  $\leq 10\%$  Treated OSPW, the dominant species of inorganic carbon would be  $\text{HCO}_3^-$  (Stumm and Morgan 1981). The rise in pH at 32% and 100% Treated OSPW would have shifted equilibria to convert some bicarbonate to carbonate.

Turbidity can be a surrogate for suspended solids concentrations in water, although some differences to concentrations of particles can occur because one method measures light scattering caused by particles (turbidity) while the other measures actual particle concentrations. Regardless, they are close enough for interpreting particle content in the mesocosm streams. Mean turbidity was 13 to 17 NTU among treatments up to 32% Treated OSPW, largely consistent with turbidity of the Athabasca River as shown in the 0% Treated OSPW. Turbidity declined at 100% Treated OSPW to approximately 10 NTU due to absence of turbid river water and clarification during treatment, mainly in Stage 2 (W. Zubot, Syncrude Canada Ltd., Edmonton, Alberta, pers. comm.). It is expected that turbidity in river water would be primarily inorganic (i.e., suspended silt and clay) whereas turbidity in Stage 3 would be largely biological in origin, given the high clarity of the Stage 2 effluent and visible algal growth in the Stage 3 basin.



**Table 6** Average water quality (select variables) of 100% Treated OSPW relative to Athabasca River water, September 2021.

Analyte	Units	Guideline <sup>1</sup>	100% Treated OSPW			Athabasca River water		
			n	Mean	± SD	n	Mean	± SD
Physical Measurements and Major ions								
Conductivity	mg/L	-	5	3,080	45	5	296	11
Total dissolved solids	mg/L	-	5	1,920	83.7	5	178	8.4
Alkalinity as CaCO <sub>3</sub>	mg/L	-	5	374	5.5	5	122	13.0
Dissolved hardness	mg/L	-	5	85.6	5.6	5	140.2	5.6
Potassium	mg/L	-	5	11.8	0.84	5	1.2	0.12
Calcium	mg/L	-	5	16	1.22	5	37.8	1.5
Magnesium	mg/L	-	5	10.6	0.58	5	11.2	0.84
Sodium	mg/L	-	5	724	41.6	5	9.86	0.71
Chloride	mg/L	120	5	<b>406</b>	18.17	5	4.2	1.07
Fluoride	mg/L	-	5	2.22	0.1	5	0.10	0.03
Sulphate	mg/L	128-429 <sup>a</sup>	5	<b>578</b>	21.68	5	40.8	2.77
Nutrients and Selected Organics								
Ammonia	mg/L	0.052 <sup>b</sup>	5	0.034	0.02	5	0.015	0
Nitrate	mg/L	0.2/0.6 <sup>c</sup>	5	0.024	0.02	5	0.0194	0.007
Dissolved Inorganic N	mg/L	-	5	0.084	0.04	5	0.044	0.0065
Total nitrogen	mg/L	-	5	1.7	0.19	5	0.24	0.07
Total Phosphorus	mg/L	-	5	0.069	0.011	5	0.021	0.014
Total Orthophosphate	mg/L	-	5	0.0060	0.0007	5	0.0024	0.0006
Total Dissolved Phosphorus	mg/L	-	5	0.0097	0.001	5	0.0051	0.004
Dissolved Organic Carbon	mg/L	-	5	20.2	3.3	5	5	1.7
Total Organic Carbon	mg/L	-	5	19.8	2.17	5	4.46	1.1
Total Inorganic Carbon	mg/L	-	5	88.2	1.9	5	28.4	1.5
Biological Oxygen Demand	mg/L	-	5	4.52	1.51	5	10.6	19.8
Chemical Oxygen Demand	mg/L	-	5	105.2	7.1	5	18	3.2
Naphthenic acids (FTIR)	mg/L	-	5	<2	-	5	<2	-
Dissolved metal								
Aluminum	µg/L	50/100 <sup>c</sup>	5	<b>93.7</b>	16.4	5	10.9	3.87
Antimony	µg/L	-	5	0.849	0.1	5	0.054	0.00
Arsenic	µg/L	5	5	<b>10.2</b>	0.6	5	0.31	0.04
Barium	µg/L	-	5	45.1	6.7	5	44.6	2.89

<sup>1</sup> Unless otherwise stated, guidelines are AEP (2018).

<sup>2</sup> Value for 2021-09-14 for Athabasca River Water excluded from summary statistics due to dissolved V concentration being much greater than total V concentration

<sup>a</sup> Hardness-dependent guideline; <sup>b</sup> Temp & pH-dependent guideline; <sup>c</sup> Chloride-dependent guideline; <sup>d</sup> pH-dependent guideline;

<sup>e</sup> Federal water quality guideline; <sup>f</sup> BC (2021) BC guideline for protection of aquatic life used instead of AB interim guideline;

**Bold** denotes one or more replicates above guideline



**Table 6 (Cont'd.)**

Analyte	Units	Guideline <sup>1</sup>	100% Treated OSPW			Athabasca River water		
			n	Mean <sup>2</sup>	± SD	n	Mean <sup>2</sup>	± SD
Dissolved metal (Cont'd.)								
Beryllium	µg/L	-	5	0.026	0.00	5	0.01	0.00
Boron	µg/L	-	5	2,398	357.1	5	52.2	45.3
Cadmium	µg/L	-	5	0.013	0.01	5	0.0099	0.00
Chromium	µg/L	-	5	0.328	0.3	5	0.11	0.02
Cobalt	µg/L	-	5	0.243	0.1	5	0.0834	0.01
Copper	µg/L	-	5	0.376	0.1	5	0.681	0.20
Iron	mg/L	-	5	0.112	0.1	5	0.108	0.1
Lead	µg/L	-	5	0.0311	0.02	5	0.0217	0.02
Lithium	µg/L	-	5	105	9.9	5	5.21	0.46
Manganese	mg/L	-	5	0.00876	0.01	5	0.00888	0.01
Mercury	µg/L	-	5	0.00088	0.0002	5	0.00085	0.0002
Molybdenum	µg/L	-	5	669.2	76.1	5	1.53	1.42
Nickel	µg/L	-	5	3.84	0.5	5	0.841	0.10
Selenium	µg/L	-	5	2.80	0.5	5	0.20	0.04
Silicon	µg/L	-	5	1,654	225	5	1,290	349
Strontium	µg/L	-	5	431	22	5	225	25
Thallium	µg/L	-	5	0.0080	0.0	5	0.0038	0.0
Uranium	µg/L	-	5	6.79	0.5	5	0.41	0.02
Vanadium	µg/L	120 <sup>d</sup>	5	<b>1,800</b>	255	4 <sup>2</sup>	0.225 <sup>2</sup>	0.025 <sup>2</sup>
Zinc	µg/L	-	5	3.45	1.6	5	3.28	1.81
Zirconium	µg/L	-	5	0.706	0.1	5	0.1	0.00
Total metal								
Aluminum	µg/L	-	5	163	26.73	5	339	403.92
Antimony	µg/L	-	5	0.844	0.06	5	0.067	0.02
Arsenic	µg/L	5	5	<b>10.1</b>	0.56	5	0.5	0.18
Barium	µg/L		5	50.4	6.83	5	53.6	7.99
Beryllium	µg/L	-	5	0.019	0.02	5	0.026	0.02
Boron	µg/L	1,500	5	<b>1,885</b>	890	5	39.2	32.4
Cadmium	µg/L	0.18	5	0.009	0.01	5	0.016	0.01
Chromium	µg/L	1	5	0.274	0.15	5	0.602	0.55
Cobalt	µg/L	0.94-2.2 <sup>a</sup>	5	0.335	0.11	5	0.342	0.17

<sup>3</sup> Unless otherwise stated, guidelines are AEP (2018).

<sup>4</sup> Value for 2021-09-14 for Athabasca River Water excluded from summary statistics due to dissolved V concentration being much greater than total V concentration

<sup>a</sup> Hardness-dependent guideline; <sup>b</sup> Temp & pH-dependent guideline; <sup>b</sup> Chloride-dependent guideline; <sup>c</sup> pH-dependent guideline; <sup>e</sup> Federal water quality guideline; <sup>e</sup> BC (2021) BC guideline for protection of aquatic life used instead of AB interim guideline;

**Bold** denotes one or more replicates above guideline



**Table 6 (Cont'd.)**

Analyte	Units	Guideline <sup>1</sup>	100% Treated OSPW			Athabasca River water		
			n	Mean <sup>2</sup>	± SD	n	Mean <sup>2</sup>	± SD
Total metal (Cont'd.)								
Copper	µg/L	2.66	5	0.523	0.21	5	1.287	0.58
Iron	µg/L	-	5	426.4	214.4	5	609.4	440.9
Lead	µg/L	2.5-5.2 <sup>a</sup>	5	0.160	0.08	5	0.358	0.24
Lithium	µg/L	-	5	107.6	14.50	5	5.43	0.64
Manganese	mg/L	-	5	20.9	6.2	5	32.8	13.8
Mercury	µg/L	0.005	5	0.00174	0.0002	5	0.00222	0.0011
Molybdenum	µg/L	7,600 <sup>e</sup>	5	644.6	56.16	5	1.0	0.34
Nickel	µg/L	44-72 <sup>a</sup>	5	4.07	0.35	5	1.45	0.64
Selenium	µg/L	2	5	<b>2.734</b>	0.52	5	0.198	0.04
Silicon	µg/L	-	5	1,832	227	5	1,808	984
Strontium	µg/L	-	5	455.6	27.9	5	245.2	25.77
Thallium	µg/L	-	5	0.00742	0.00	5	0.00934	0.01
Uranium	µg/L	15	5	6.71	0.25	5	0.45	0.06
Vanadium	µg/L	120 <sup>e</sup>	5	<b>1,924</b>	311	5	1.292	1.07
Zinc	µg/L	30	5	8.276	5.94	5	7.328	4.41
Zirconium	µg/L	-	5	0.754	0.04	5	0.332	0.34

<sup>1</sup> Unless otherwise stated, guidelines are AEP (2018).

<sup>2</sup> Value for 2021-09-14 for Athabasca River Water excluded from summary statistics due to dissolved V concentration being much greater than total V concentration

<sup>a</sup> Hardness-dependent guideline; <sup>b</sup> Temp & pH-dependent guideline; <sup>b</sup> Chloride-dependent guideline; <sup>c</sup> pH-dependent guideline;

<sup>e</sup> Federal water quality guideline; <sup>e</sup> BC (2021) BC guideline for protection of aquatic life used instead of AB interim guideline;

**Bold** denotes one or more replicates above guideline



**Table 7** Concentrations of ions and nutrients in mixtures of 0 to 100% Treated OSPW in Athabasca River water, arranged in order of greatest-to-smallest ratio of concentrations in Treated OSPW to river water.

Ion or Nutrient	Units	Guideline (AB or other)	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
<b>Major Ions</b>											
Chloride	mg/L	120	4	5	9	17	45	134	<b>404</b>		95.7
Sodium	mg/L	-	10	12	17	31	76	220	724		73
Fluoride	mg/L	-	0.09	0.11	0.15	0.16	0.31	0.78	1.92		20.6
Sulphate	mg/L	128-429 <sup>a</sup>	41	42	46	57	92	208	<b>562</b>		13.7
Total dissolved solids	mg/L	-	182	174	196	222	332	686	1,900		10.4
Conductivity	µS/cm	-	297	304	332	390	588	1,200	3,080		10.4
Potassium	mg/L	-	1	1	1	2	2	5	12		10.0
Alkalinity as CaCO <sub>3</sub>	mg/L	20	116	116	120	128	150	206	374		3.2
pH	pH units	6.5 to 9.0	7.99	7.91	7.86	8.00	8.26	8.80	<b>9.14</b>		1.1
Magnesium	mg/L	-	10.9	11.2	11.0	11.0	10.8	11.0	10.6		1.0
Dissolved hardness	mg/L	-	140	141	139	137	133	124	85		0.6
Calcium	mg/L	-	38	38	37	37	35	31	16		0.4
<b>Nutrients and General Organics</b>											
Total N	mg/L	-	0.26	0.24	0.25	0.31	0.38	0.70	1.70		6.6
TOC	mg/L	-	4.5	4.5	4.6	4.9	6.3	9.7	19.8		4.4
BOD	mg/L	-	2.0	2.1	1.8	1.8	1.9	2.2	4.5		4.4
COD	mg/L	-	24.3	16.0	21.2	20.2	26.4	43.2	102.6		4.4
DOC	mg/L	-	5.17	4.90	5.24	5.58	6.98	10.86	19.20		3.7
TDP	mg/L	-	0.003	0.002	0.002	0.002	0.002	0.004	0.010		3.2
Total P	mg/L	-	0.025	0.018	0.016	0.019	0.021	0.034	0.069		2.7
SRP	mg/L	-	0.002	0.002	0.002	0.002	0.001	0.002	0.006		2.5
Ammonia	mg/L	-	0.015	0.015	0.015	0.015	0.015	0.0432	0.034		2.3
DIN	mg/L	-	0.045	0.040	0.041	0.043	0.045	0.080	0.084		1.8
Nitrate	mg/L	3	0.020	0.015	0.016	0.0184	0.020	0.025	0.024		1.2
Naphthenic acids	mg/L	-	<2	<2	<2	<2	<2	<2	<2		N/A



**Table 8** Concentrations of dissolved metals in mixtures of 0 to 100% Treated OSPW in Athabasca River water, arranged in order of greatest-to-smallest ratio of concentrations in Treated OSPW to river water.

Metal	Units	Guideline (AB or other)	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	µg/L	120	0.3	3.6	16.9	49.7	154.0	<b>565.4</b>	<b>1,800</b>		<b>6,818</b>
Molybdenum	µg/L	7,600	0.9	2.2	7.4	20.4	61.8	203.2	669.2		751.3
Boron	µg/L	1,500	47	60	55	108	261	809	<b>2,398</b>		50.9
Arsenic	µg/L	5	0.31	0.35	0.42	0.62	1.25	3.36	<b>10.22</b>		33.1
Lithium	µg/L	-	5	6	6	8	15	37	105		20.4
Uranium	µg/L	15	0.40	0.43	0.48	0.61	1.01	2.37	6.79		16.8
Selenium	µg/L	2	0.19	0.20	0.23	0.28	0.47	1.04	<b>2.80</b>		14.7
Antimony	µg/L	20	0.06	0.06	0.07	0.08	0.13	0.31	0.85		14.4
Aluminum	µg/L	50-100	9.44	8.49	8.49	17.72	15.88	35.00	<b>93.74</b>		9.9
Zirconium	µg/L	-	0.1	0.1	0.1	0.1	0.1	0.3	0.7		7.1
Nickel	µg/L	106	0.81	0.83	0.84	0.93	1.10	2.00	3.84		4.8
Cobalt	µg/L	-	0.07	0.07	0.08	0.08	0.09	0.13	0.24		3.3
Chromium	µg/L	-	0.11	0.12	0.11	0.12	0.11	0.21	0.33		3.0
Beryllium	µg/L	-	0.01	0.01	0.01	0.01	0.01	0.02	0.03		2.6
Thallium	µg/L	-	0.004	0.004	0.004	0.005	0.004	0.006	0.008		2.0
Strontium	µg/L	-	222	226	225	232	243	293	431		1.9
Lead	µg/L	3.8	0.033	0.015	0.014	0.033	0.018	0.023	0.031		1.0
Silicon	µg/L	-	1,003	1,077	987	1,099	1,292	1,408	1,654		1.6
Zinc	µg/L	30	1.98	1.14	1.64	2.77	4.25	3.09	3.45		1.7
Cadmium	µg/L	0.18	0.011	0.010	0.007	0.005	0.005	0.009	0.013		1.2
Iron	µg/L	0.30	0	0	0	0	0	0	0		1.1
Manganese	µg/L	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0		1.1
Mercury	µg/L	0.0050	0.0010	0.0009	0.0009	0.0010	0.0010	0.0009	0.0009		0.9
Barium	µg/L	-	43	44	43	44	44	45	45		1.0
Copper	µg/L	2.66	0.739	0.736	0.764	0.768	0.787	0.607	0.376		<b>0.5</b>



**Table 9** Concentrations of total metals in mixtures of 0 to 100% Treated OSPW in Athabasca River water, arranged in order of greatest-to-smallest ratio of concentrations in Treated OSPW to river water.

Metal	Units	Guideline (AB or other)	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	µg/L	120	1.5	8.8	20.4	58.2	172.8	<b>565.0</b>	<b>1,924</b>		1,300
Molybdenum	µg/L	7,600	1.0	4.2	8.0	22.1	66.6	227.4	644.6		668.0
Boron	µg/L	1,500	51	117	56	100	232	652	<b>1885</b>		36.9
Arsenic	µg/L	5	0.53	0.96	0.62	0.86	1.58	3.83	<b>10.06</b>		19.1
Lithium	µg/L	-	6	11	7	9	15	36	108		18.6
Uranium	µg/L	15	0.48	0.87	0.53	0.67	1.11	2.55	6.71		14.0
Selenium	µg/L	2	0.22	0.35	0.24	0.27	0.46	1.01	<b>2.73</b>		12.5
Antimony	µg/L	20	0.08	0.16	0.08	0.10	0.15	0.32	0.84		11.2
Nickel	µg/L	106	1.70	2.77	1.40	1.92	1.97	2.34	4.07		2.4
Zirconium	µg/L	-	0.5	0.8	0.4	0.5	0.5	0.5	0.8		1.7
Strontium	µg/L	-	269	476	267	272	283	341	456		1.7
Cobalt	µg/L	0.94-2.2	0.37	0.62	0.31	0.37	0.44	0.30	0.34		0.9
Silicon	µg/L	-	2,122	3,696	1,910	2,058	2,278	1,892	1,832		0.9
Iron	µg/L	0.30	739	1181	557	700	851	480	426		0.6
Barium	µg/L	-	57	99	54	56	56	54	50		0.9
Thallium	µg/L	-	0.012	0.016	0.009	0.010	0.012	0.007	0.007		0.6
Mercury	µg/L	0.0050	0.0019	0.0020	0.0019	0.0021	0.0022	0.0020	0.0017		0.9
Manganese	µg/L	6.6	34.5	56.8	27.1	33.4	38.7	24.3	20.9		0.6
Aluminum	µg/L		485.4	731.8	360.2	440.8	551.2	260.2	<b>163.0</b>		0.3
Zinc	µg/L	30	5.11	4.98	3.64	7.16	5.93	6.57	8.28		1.6
Beryllium	µg/L	-	0.03	0.05	0.02	0.03	0.03	0.03	0.02		0.7
Chromium	µg/L	1	0.79	1.25	0.56	0.68	0.84	0.50	0.27		0.3
Lead	µg/L	3.8	0.398	0.633	0.299	0.375	0.440	0.247	0.160		0.4
Copper	µg/L	2.66	1.44	2.45	1.29	1.35	1.38	0.93	0.52		0.4
Cadmium	µg/L	0.18	0.020	0.028	0.013	0.015	0.017	0.009	0.009		0.5



Major anions showed clear trends across Treated OSPW mixtures. Relative to the river-water background (i.e., 0% Treated OSPW), increases in fluoride, chloride, and sulphate concentrations were notable at 1% and 3.2%, and generally increased in proportion to content of Treated OSPW. Chloride was a useful tracer for Treated OSPW, given the low background chloride of river water, and could be used to show the actual dosing of Treated OSPW. Doing so showed the nominal doses of Treated OSPW (100%, 32%, 10%, 3.2%, 1%, 0.32%, and 0%) were actually 100%, 32.4%, 10.2%, 3.1%, 1.0%, 0.24%, and 0% respectively, all very close to the intended targets. Ions in 100% Treated OSPW that exceed Alberta water quality guidelines for the protection of aquatic life included chloride, sulphate and pH. The latter exceeded the upper-bound guideline value of 9.0. There were no guideline exceedances for ions at dilutions <100% Treated OSPW.

Nutrient concentrations were higher in Treated OSPW than in river water, but by less than one order of magnitude, and trends in nutrients across treatment mixtures were minor: TN concentrations were similar between river water and Treated OSPW doses up to 32%, but approximately double in 100% Treated OSPW relative to river water. Similar patterns were found for TP and soluble phosphorus (TDP and orthophosphate). Smaller change was found for dissolved inorganic nitrogen (DIN), due to relatively constant nitrate concentrations over the Treated OSPW dilutions. Total ammonia concentrations (i.e., the sum of unionized and ionized forms of ammonia) were less than 0.015 mg/L in river water and in treatments up to 10% Treated OSPW, then increased to 0.04 mg/L at 32% and 100% Treated OSPW. At ambient pH of 9 and water temperature of 20°C that was present in the mesocosm streams and the Athabasca River during the experiment, total ammonia concentrations were less than the CCME water quality guideline (which includes the toxic unionized ammonia) for protection of aquatic life of 0.055 mg/L (CCME 2010).

The molar ratio of bioavailable N:bioavailable P in water can indicate the relative supply of N and P for algae (Guildford and Hecky 2000). Bioavailable N can be approximated as the sum of nitrate and ammonia (nitrite can be included but is transient in the oxidation of ammonia to nitrite and therefore does not need to be considered). Bio-available P can be approximated by detectable concentrations of orthophosphate (also described as soluble reactive phosphorus) or by total dissolved phosphorus (TDP) when orthophosphate is undetectable. When TDP is undetectable, total phosphorus (TP) can be used but only with recognition that refractory phosphorus that is not available for biological uptake is part of TP, and recognizing that suspended solids in Athabasca River typically contain mineralized P that contributes to TP values.

Rhee (1978) showed that for a given species of algae, there is a sharp transition between P-limited and N-limited growth. The particular N:P ratio at which the transition between N and P-limitation occurs is species dependent, varying from 7:1 to as high as 45:1 (Rhee and Gotham 1980, Healey 1985). Below a molar N:P of 20, the growth of most algal species will be limited by N whereas P-deficient growth is prevalent at molar N:P ratios greater than 50 (Guildford and Hecky 2000). Because an N:P ratio optimal for growth (i.e., above which P limitation occurs and below which N limitation occurs) can vary widely among algae, the range between 20 and 50 may be regarded as a transition range in an algal community where the growth of some species will be P-limited while the growth of others will be N-limited. Molar N:P in river water and up to 3.2% Treated OSPW showed potential co-limitation by N and P in the algal community where the growth of some species may be more limited by P than N and others more limited by N than P. At doses of 10% and 32% of Treated OSPW, higher N:P showed potentially increased P deficiency. At 100% Treated OSPW, high orthophosphate concentrations caused the N:P to drop to a level showing co-limitation by N and P, with N deficiency being prevalent. This interpretation shows that, although nutrient concentrations



in Treated OSPW were not high overall, the potential for nutrient enrichment leading to increased algal growth was present at treatments exceeding 10% Treated OSPW.

Chemical oxygen demand (COD) was about 10 times greater than the 5-day biological oxygen demand (BOD<sub>5</sub>) except at 100% Treated OSPW where it was more than 20 times greater. BOD<sub>5</sub> also doubled at 100% Treated OSPW compared with the lower doses. COD describes the oxygen demand required to chemically (i.e., abiotically) oxidize organic compounds. The COD test uses a strong chemical oxidant in an acid solution and heat to oxidize organic carbon to CO<sub>2</sub> and water (Boyles 1997) and indicates oxygen demand for the oxidation of all organic matter, whether it is labile (prone to biological decomposition) or not. The relatively high COD relative to BOD<sub>5</sub> suggested a low potential for biodegradability of the organic compounds in Treated OSPW by bacteria and other micro-organisms over a 5-day time period. BOD<sub>5</sub> concentrations across all treatments were less than 20% of the maximum BOD<sub>5</sub> permitted in effluent as stated in national effluent regulations for wastewater discharges (25 mg/L, Wastewater Systems Effluent Regulations 2022).

There was large variability in concentrations of dissolved and total elements (i.e., metals and metalloids) across doses. Several metals showed little or no variability across doses (e.g., barium, cadmium, chromium, copper, lead, manganese, and mercury), while a subset of metals, particularly vanadium, boron, molybdenum, and lithium, increased by orders of magnitude across the Treated OSPW gradient (Table 8, Table 9). Some metals showed different relationships between total and dissolved measurements, particularly aluminum. Total aluminum was five times higher in river water than Treated OSPW, but dissolved aluminum was nearly 10x higher in Treated OSPW than in river water. These differences likely reflect the different proportions of particulate versus dissolved metals in each test water (for example, the concentration of dissolved aluminum was 53% of the total aluminum in Treated OSPW, while this ratio of dissolved/total was 1% in river water), and likely relate to the effectiveness of the coke-treatment system to remove particulates from OSPW, as discussed previously. The relatively high pH of the Treated OSPW likely also plays a role in modifying speciation of aluminum relative to that observed in the river water.

Metals that exceeded Alberta or other relevant/lowest water quality guidelines for the protection of aquatic life in 100% Treated OSPW included boron, arsenic, selenium, dissolved aluminum, and vanadium. Vanadium exceeded the Federal water quality guideline of 120 µg/L (ECCC 2016); there is no Alberta or CCME guideline for vanadium. Although molybdenum in 100% Treated OSPW exceeded the Alberta guideline of 73 µg/L, an interim guideline based on 1999 CCME guideline, it was well below the recently published BC and Saskatchewan guidelines of 7,600 µg/L and 31,000 µg/L, respectively (BC ENV 2021, Government of Saskatchewan 2022). The BC chronic molybdenum guideline was used as a screening value in this report, given it was most recently developed.

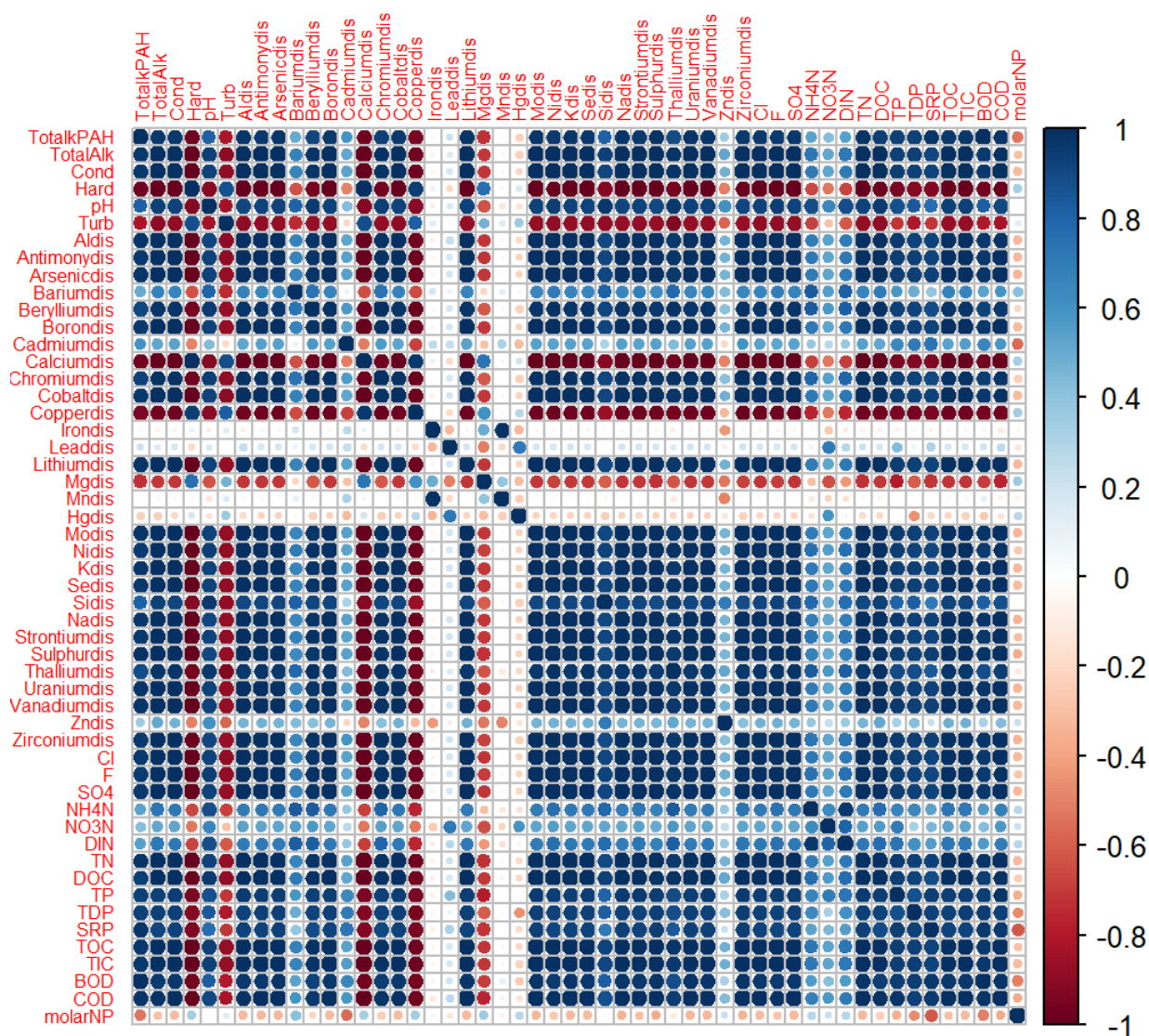
All analytes that exceeded a water quality guideline only did so in the 100% Treated OSPW dose, not in any lesser doses of Treated OSPW in river water, except vanadium, which exceeded the Federal guideline in 32% and 10% Treated OSPW mixtures. Across the range of Treated OSPW-river water mixtures, water quality was generally similar from 0% to 10% Treated OSPW for many analytes, only showing obvious and consistent increases in mixtures above 10% Treated OSPW.



### 3.1.1.2 Correlation Among Analytes

Unsurprisingly, there was a high frequency of strong, positive correlations among chemical variables across the various doses, and a correspondingly low frequency of weak or negative correlations (Figure 7). Most analytes were highly, positively correlated with each other, reflective of their greater concentrations in Treated OSPW than in river water (these positive correlations appear in blue in Figure 7). Others were more independent (appearing as blank or faintly coloured in Figure 7), such as iron, lead, manganese, mercury, zinc, barium, cadmium and copper. The small number of analyte pairs that showed negative correlations across treatments generally were present in higher concentrations in river water than in Treated OSPW (e.g., calcium, magnesium, hardness, turbidity); these appear in red in Figure 7.

**Figure 7** Correlation matrix for chemical analytes in the mesocosm. All metals are the dissolved fraction.





Total alkalinity, conductivity and organic carbon were highly correlated with most metals, given their higher concentrations in Treated OSPW relative to river water. Soluble N and P were not well correlated with each other across doses ( $r=0.55$ ), which was expected given demand for uptake from algae likely varied by treatment.

### 3.1.1.3 Organic Compounds and Hydrocarbons

Among 128 organic analytes investigated in this study, including several species of volatile organics, naphthenic acids (FTIR method), petroleum hydrocarbons, phenols, and PAHs (see Table 1 for a summary, and Appendix A1 for a detailed list), only 12 analytes were observed above detection limit in any weekly measurement (Table 10). These detections were all in either the 100% Treated OSPW head tank or the 100% Treated OSPW mesocosm exposure.

Concentrations of PAHs determined using SPMDs were less than the method detection limit for most analytes measured directly in water (compare Table 11 with Table 10). Of all PAH concentrations in Treated OSPW that were determined from SPMD samples, the only ones that exceeded 10x field blank concentrations were:

- Four alkylated naphthalene species (1-methylnaphthalene, 2,3,6-trimethylnaphthalene, 2,3,5-trimethylnaphthalene, and 1,4,6,7-Tetramethylnaphthalene);
- Dibenz[a,h]anthracene;
- 2/3-methyldibenzothiophene; and
- Phenanthrene.



**Table 10**      **Organic analytes that were detectable (i.e., >MDL) in 100% Treated OSPW table and tank, relative to their measurements in Athabasca River water.**

Analytes	Units	Treated OSPW Tank			100% Treated OSPW			River Water (0% Treated OSPW)		
		Lowest MDL	Max Result	%ND	Lowest MDL	Max result	%ND	Lowest MDL	Max result	%ND
F3 (C16-C34) Hydrocarbons	mg/L	0.1	0.13	60	0.1	<0.1	100	0.1	<0.1	100
C1 Substituted Dibenzothiophene	µg/L	0.02	0.045	40	0.02	0.048	50	0.02	<0.02	100
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	0.011	60	0.0085	0.0087	86	0.0085	<0.0085	100
C2 Substituted Dibenzothiophene	µg/L	0.02	<0.1	100	0.02	0.092	17	0.02	<0.02	100
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	0.014	80	0.0085	0.012	83	0.0085	<0.0085	100
C3 Substituted Dibenzothiophene	µg/L	0.02	0.033	60	0.02	0.037	50	0.02	<0.02	100
C3 Substituted Fluoranthene / Pyrene	µg/L	0.02	0.036	80	0.02	0.021	83	0.02	<0.02	100
C3 Substituted Fluorene	µg/L	0.05	0.076	80	0.05	0.079	67	0.05	<0.05	100
C3 Substituted Naphthalene	µg/L	0.1	0.12	80	0.1	<0.1	100	0.1	<0.1	100
C3 Substituted Phenanthrene / Anthracene	µg/L	0.05	0.051	80	0.05	<0.05	100	0.05	<0.05	100
C4 Substituted Fluoranthene / Pyrene	µg/L	0.02	0.041	80	0.02	<0.02	100	0.02	<0.02	100
Phenol	mg/L	0.0001	0.0004	80	0.0001	0.0003	83	0.0001	<0.0001	100

1: analyte which had a 100% non-detect for all replicates of the 100% Treated OSPW tank or 100% Treated OSPW table was not included in table.



**Table 11**      **Ambient PAH concentrations in river water and Treated OSPW, as determined from SPMDs.**

PAH Species (Parent & Alkylated)	Carbon Rings	Mole Weight	Treated OSPW	River Water	River Tank	River Tank	River Tank	Treated
			Field Blank	Field Blank	1	2	3	OSPW
(ng/L) <sup>1</sup>								
Biphenyl	2	154	0.84	0.84	0.90	0.58	0.56	1.91
Naphthalene	2	128	6.20	6.80	2.35	3.39	2.41	8.45
1-Methylnaphthalene	2	142	0.24	1.43	0.92	1.42	1.29	11.76
2-Methylnaphthalene	2	142	0.47	2.68	0.94	1.45	1.18	10.72
2,6-Dimethylnaphthalene	2	156	0.47	0.52	0.47	0.71	0.61	9.18
1,2-Dimethylnaphthalene	2	156	0.12	0.12	0.16	0.28	0.18	7.15
2,3,6-Trimethylnaphthalene	2	170	0.30	0.30	0.46	0.81	0.64	13.77
2,3,5-Trimethylnaphthalene	2	170	0.22	0.24	0.35	0.66	0.47	11.67
1,4,6,7-Tetramethylnaphthalene	2	184	0.00	0.00	0.23	0.43	0.29	2.71
Acenaphthylene	3	152	0.04	0.04	0.12	0.18	0.18	0.62
Acenaphthene	3	153	0.21	0.21	0.51	0.69	0.54	9.61
Anthracene	3	178	0.05	0.06	0.10	0.17	0.10	0.21
2-Methylanthracene	3	192	0.00	0.00	0.04	0.00	0.00	0.00
Benz[a]anthracene	4	228	0.01	0.00	4.39	0.08	0.04	0.00
Dibenz[a,h]anthracene	5	278	0.00	0.00	0.20	0.00	0.00	23.02
Fluorene	3	166	0.38	0.21	0.35	0.52	0.43	5.68
2-methylfluorene	3	180	0.00	0.00	0.07	0.09	0.10	1.51
1,7-Dimethylfluorene	3	194	0.00	0.00	0.00	0.00	0.00	1.38
Phenanthrene	3	178	0.17	1.74	2.31	3.36	2.74	17.80
1-Methylphenanthrene	3	192	0.12	0.10	0.29	0.45	0.35	4.84
2-Methylphenanthrene	3	192	0.22	0.21	0.50	0.80	0.59	7.33
3-Methylphenanthrene	3	192	0.19	0.16	0.38	0.56	0.47	5.23
9/4-Methylphenanthrene	3	192	0.12	0.11	0.39	0.66	0.48	7.99
3,6-Dimethylphenanthrene	3	206	0.00	0.00	0.18	0.28	0.21	1.74
2,6-Dimethylphenanthrene	3	206	0.00	0.00	0.12	0.20	0.15	1.15



**Table 11 (Cont'd.)**

PAH Species (Parent & Alkylated)	Carbon Rings	Mole Weight	Treated OSPW	River Water	River Tank	River Tank	River Tank	Treated
			Field Blank	Field Blank	1	2	3	OSPW
(ng/L) <sup>1</sup>								
1,7-Dimethylphenanthrene	3	206	0.05	0.00	0.22	0.45	0.32	2.65
1,8-Dimethylphenanthrene	3	206	0.00	0.00	0.00	0.08	0.08	0.64
1,2,6-Trimethylphenanthrene	3	220	0.00	0.00	0.20	0.00	0.15	0.78
Anthracene	3	178	0.05	0.06	0.10	0.17	0.10	0.21
Benz[a]anthracene	4	228	0.01	0.00	4.39	0.08	0.04	0.00
Dibenzothiophene	3	184	0.17	0.16	0.29	0.41	0.38	8.36
2/3-Methyldibenzothiophenes	3	198	0.11	0.10	0.84	1.13	0.83	27.43
2,4-Dimethyldibenzothiophene	3	212	0.00	0.06	0.10	0.25	0.00	2.41
4,6-Dimethyldibenzothiophene	3	212	0.00	0.04	0.32	0.52	0.38	4.35
Retene	4	234	0.09	0.08	1.02	1.66	0.97	0.83
Fluoranthene	4	202	0.61	0.46	0.82	1.21	0.91	0.87
3-Methylfluoranthene	4	216	0.03	0.00	0.24	0.38	0.26	0.63
Benzo[b]fluoranthene	4	252	0.00	0.00	0.20	0.00	0.00	0.05
Benzo[j,k]fluoranthenes	5	252	0.00	0.00	0.22	0.00	0.00	0.00
Pyrene	4	202	0.35	0.23	0.77	1.18	0.91	2.15
Benzo[a]pyrene	5	252	0.00	0.00	0.25	0.00	0.00	4.47
Benzo[e]pyrene	5	252	0.00	0.00	0.25	0.15	0.08	0.35
Indeno[1,2,3-cd]pyrene	6	276	0.00	0.00	0.33	0.00	0.00	4.57
Perylene	4	252	0.00	0.00	0.42	0.53	0.31	0.09
Benzo[g,h,i]perylene	6	276	0.00	0.00	6.62	0.00	9.43	5.05
Chrysene	4	228	0.04	0.01	4.05	0.53	0.35	2.66
1-Methylchrysene	4	242	0.91	0.00	0.32	0.14	0.10	0.16
5/6-Methylchrysene	4	242	0.00	0.00	0.30	0.11	0.06	0.20

<sup>1</sup> Ambient chemical concentration calculated from Alvarez (2010)



### 3.1.2 Metals in Tissues

Concentrations of metals in bulk periphyton tissue collected at the end of mesocosm exposures and in fathead minnows sacrificed at the end of the on-site juvenile-adult test and laboratory early-life-stage test yielded similar results, with concentrations of most metals in tissues similar between Treated OSPW and river water exposures (Table 12, Table 13, Table 14, and Table 15). The notable exception was vanadium, which was over 50x higher in periphyton tissue and 25x or 75x higher in fish tissue (in fish from the juvenile-adult test and early-life-stage test, respectively) from 100% Treated OSPW exposures relative to river-water exposures. Molybdenum and boron showed similar elevation in Treated OSPW-exposed tissues but to a much lesser extent than vanadium. These three metals generally have low potential for biomagnification across trophic levels (CCME 2009, ECCC 2016, BC ENV 2021).

Benthic invertebrate tissues from mesocosms generally showed similar trends across dilutions, except the composite tissue sample from the 10% Treated OSPW treatment which was substantially higher than other treatments, including the 32% and 100% treatments. This inconsistent outcome raised questions regarding sample chain-of-custody, but confirmation with the consulting taxonomic and chemistry laboratories did not yield any indication of issues with sample labelling or misattribution of results. Regardless, overall patterns among metals in benthos were consistent with other tissue media, with vanadium concentrations being notably elevated relative to other metals in its ratio of concentrations between Treated OSPW and river-water exposures, and the majority of other metals being similar (i.e.,  $\pm 1x$  increase or decrease) between these treatments.

It is important to note that all exposures of Treated OSPW to periphyton, benthos and fish potentially lead to bioconcentration through uptake of metals by organisms from surrounding water. However, only the benthic invertebrate tissues included potential for bioaccumulation—i.e., where there could be an uptake of metals through diet as well as from the water column. Fathead minnows were fed with non-exposed feed, but like algae they would be exposed directly to waters could absorb some constituents directly. Among the various elements measured in tissues, mercury and selenium are most prone to bioaccumulation. In all tissue types sampled, concentrations of mercury in tissues were generally lower in organisms exposed to Treated OSPW than those exposed to river water, consistent with mercury concentrations in water being lower in Treated OSPW than in river water. Selenium, which was 14x higher in Treated OSPW (mean 2.80  $\mu\text{g/L}$ ) than in river water, was 6x higher in algae exposed to 100% OSPW than algae exposed to river water, less than 2x higher in benthos, and similar or lower in fathead minnows exposed to Treated OSPW relative to river water.




























**Table 12** Metal concentrations (mg/kg dry weight) in periphyton samples collected from mesocosm exposures of 0 to 100% Treated OSPW in Athabasca River water, arranged in order of greatest-to-smallest ratio of concentrations in 100% Treated OSPW to 100% river water.

Metal	Lowest MDL	Units	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	0.10	mg/kg dw	30.9	76.9	210	289	551	1,070	3,520		114.1
Molybdenum	0.040	mg/kg dw	0.7565	1.08	1.3	1.3	1.66	4.09	19.9		26.3
Selenium	0.10	mg/kg dw	1.075	1.64	1.82	1.61	1.81	2.53	6.45		6.0
Boron	1.0	mg/kg dw	18.5	28.2	36.4	35	38.5	47.1	104		5.6
Tin	0.10	mg/kg dw	0.45	0.65	0.88	0.72	0.82	1.31	2.08		4.6
Arsenic	0.030	mg/kg dw	8.015	11.3	13.4	11.3	13.3	18.7	31		3.9
Strontium	0.10	mg/kg dw	98.9	136	180	149	166	220	379		3.8
Zinc	1.0	mg/kg dw	81.1	128	143	117	133	168	261		3.2
Iron	5.0	mg/kg dw	20,100	30,300	41,300	32,300	39,500	48,200	61,300		3.0
Barium	0.050	mg/kg dw	182	271	350	277	320	397	524		2.9
Zirconium	0.20	mg/kg dw	11.2	16.8	18.5	17.2	17.4	23.7	30.2		2.7
Antimony	0.010	mg/kg dw	0.033	0.039	0.036	0.038	0.033	0.039	0.104		3.2
Bismuth	0.010	mg/kg dw	0.156	0.234	0.324	0.248	0.294	0.351	0.381		2.5
Tellurium	0.020	mg/kg dw	0.032	0.054	0.072	0.053	0.061	0.071	0.077		2.4
Uranium	0.0020	mg/kg dw	0.561	0.858	1.13	0.893	1.08	1.24	1.23		2.2
Nickel	0.20	mg/kg dw	21.4	30.3	40.4	33.4	36.8	48	47		2.2
Manganese	0.050	mg/kg dw	935	1,230	1,740	1,410	1,650	1,960	1,990		2.1
Lead	0.050	mg/kg dw	9.01	14.1	18.6	14.2	17	19.3	16.5		1.8
Cobalt	0.020	mg/kg dw	9.22	13.7	17.2	13.8	15.4	17.4	15.8		1.7
Cesium	0.0050	mg/kg dw	1.85	2.87	3.87	3.3	3.94	4.81	3.27		1.8
Thallium	0.0020	mg/kg dw	0.156	0.245	0.316	0.248	0.288	0.328	0.26		1.7
Phosphorus	10	mg/kg dw	1,022	1,480	1,540	1,240	1,300	1,630	1,610		1.6
Lithium	0.50	mg/kg dw	18.9	29.6	39.8	30.3	38.3	40.6	28.4		1.5
Rubidium	0.050	mg/kg dw	21.8	34.3	41.2	34.2	38.2	43.1	31.6		1.4
Beryllium	0.010	mg/kg dw	0.6645	1.04	1.39	1.07	1.31	1.4	0.926		1.4
Chromium	0.20	mg/kg dw	22.8	31.7	44.1	37.3	37.4	50.3	34.1		1.5
Mercury	0.0050	mg/kg dw	0.02995	0.0667	0.0682	0.051	0.0625	0.0659	0.0342		1.1
Aluminum	5.0	mg/kg dw	13,400	21,000	26,300	21,400	25,700	27,200	15,400		1.1
Cadmium	0.010	mg/kg dw	0.202	0.315	0.405	0.316	0.336	0.362	0.194		1.0
Copper	0.20	mg/kg dw	17.2	25.7	29.3	24	24.8	25.8	10.9		0.6



**Table 13** Metal concentrations (mg/kg dry weight) in bulk benthic invertebrates samples collected from mesocosm exposures of 0 to 100% Treated OSPW in Athabasca River water, arranged in order of greatest-to-smallest ratio of concentrations in 100% Treated OSPW to 100% river water.

Metal	Units	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	mg/kg dw	36.3	49.9	183.6	132.9	443.8	193.4	161.7		4.5
Silver	mg/kg dw	0.203	0.266	0.539	0.231	0.381	0.258	0.574		2.8
Strontium	mg/kg dw	215	225	229	259	156	322	534		2.5
Tin	mg/kg dw	2.636	4.355	6.517	3.596	8.126	6.897	5.523		2.1
Copper	mg/kg dw	223	258	367	203	356	157	429		1.9
Chromium	mg/kg dw	113	105	390	91	575	322	202		1.8
Nickel	mg/kg dw	168	185	608	147	981	608	299		1.8
Molybdenum	mg/kg dw	17.2	15.3	48.2	15.4	61.3	45.1	27.5		1.6
Boron	mg/kg dw	236	322	700	231	431	442	348		1.5
Selenium	mg/kg dw	11.4	16.9	16.1	11.9	11.9	20.3	17.0		1.5
Lead	mg/kg dw	9.3	12.9	19.5	7.7	24.4	12.9	12.9		1.4
Zinc	mg/kg dw	1,271	1,054	1,377	1,001	1,069	976	1,423		1.1
iron	mg/kg dw	17,828	24,019	41,453	14,854	44,944	21,464	16,689		0.9
Uranium	mg/kg dw	1.03	0.94	2.66	1.19	2.88	0.75	0.90		0.9
Arsenic	mg/kg dw	3.779	3.727	6.551	3.128	8.751	3.978	3.242		0.9
Mercury	mg/kg dw	1.168	1.167	0.861	0.595	0.531	0.985	0.930		0.8
Antimony	mg/kg dw	0.501	0.531	0.665	0.483	0.688	0.350	0.323		0.6
Aluminum	mg/kg dw	24,411	25,001	59,466	18,912	68,878	28,545	14,789		0.6
Lithium	mg/kg dw	12.73	12.88	24.09	8.40	26.88	11.97	7.24		0.6
Cobalt	mg/kg dw	23.7	27.4	50.5	16.8	50.6	21.2	12.9		0.5
Barium	mg/kg dw	1,525	1,739	2,421	1,252	1,113	1,022	809		0.5
Thallium	mg/kg dw	0.158	0.177	0.321	0.147	0.294	0.129	0.081		0.5
Titanium	mg/kg dw	1,583	1,666	3,901	1,259	3,125	1,685	776		0.5
Manganese	mg/kg dw	2,129	2,254	2,203	1,896	1,019	1,639	1,011		0.5
Cadmium	mg/kg dw	2.371	2.849	5.152	2.666	1.531	0.755	0.881		0.4



**Table 14** Metal concentrations (mg/kg dry weight) in tissue of fathead minnows exposed of 0 to 100% Treated OSPW in Athabasca River water during on-site juvenile-adult testing, arranged in order of greatest-to-smallest ratio of concentrations in 100% Treated OSPW to 100% river water.

Metal	Lowest MDL	Units	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	56% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	0.10	mg/kg dw	1.22	4.16	12.4	22.3	33.3	45.6	58.6	31.5		25.8
Boron	1.0	mg/kg dw	2.8	2.9	3.0	3.0	3.9	4.4	8.2	12.6		4.5
Strontium	0.10	mg/kg dw	57.5	59.6	62	64.1	73.5	88.2	175	191		3.3
Molybdenum	0.040	mg/kg dw	0.473	0.222	0.29	0.428	0.537	0.956	1.78	1.34		2.8
Antimony	0.010	mg/kg dw	0.016	0.014	0.015	0.014	0.019	0.015	0.013	0.031		1.9
Rubidium	0.050	mg/kg dw	30.7	31.5	29.8	31.2	31.6	33.4	36.2	40.3		1.3
Thallium	0.0020	mg/kg dw	0.0122	0.0104	0.0118	0.0136	0.0114	0.0094	0.0092	0.0159		1.3
Arsenic	0.030	mg/kg dw	2.14	2.24	2.28	2.32	2.2	2.29	1.85	2.43		1.1
Cesium	0.0050	mg/kg dw	0.104	0.0962	0.101	0.122	0.118	0.127	0.129	0.118		1.1
Selenium	0.10	mg/kg dw	2.32	2.33	2.33	2.44	2.44	2.46	2.7	2.53		1.1
Barium	0.050	mg/kg dw	12.4	11.7	13.2	15.1	13.5	12.2	13.6	12.4		1.0
Mercury	0.0050	mg/kg dw	0.427	0.394	0.385	0.358	0.326	0.292	0.31	0.328		0.8
Zinc	1.0	mg/kg dw	178	172	191	187	195	196	213	133		0.7
Uranium	0.0020	mg/kg dw	0.0264	0.0217	0.0254	0.0328	0.0304	0.0274	0.0188	0.0185		0.7
Nickel	0.20	mg/kg dw	0.53	0.45	0.51	0.66	0.52	0.54	0.33	0.32		0.6
Zirconium	0.20	mg/kg dw	0.42	0.31	0.38	0.56	0.44	0.43	<0.20	0.21		0.5
Manganese	0.050	mg/kg dw	20.0	15.3	20.9	30.2	22.4	17.3	11.6	8.2		0.4
Copper	0.20	mg/kg dw	7.54	8.99	8.70	7.38	6.91	5.06	5.02	2.54		0.3
Cobalt	0.020	mg/kg dw	0.276	0.198	0.217	0.288	0.225	0.161	0.097	0.086		0.3
Cadmium	0.010	mg/kg dw	0.049	0.044	0.049	0.044	0.044	0.018	0.017	0.012		0.2
Iron	5.0	mg/kg dw	544	380	492	681	398	269	119	54.5		0.1
Aluminum	5.0	mg/kg dw	449	209	280	394	248	182	54.8	19.7		0.0
Bismuth	0.010	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		ND
Lithium	0.50	mg/kg dw	<0.50	<0.50	<0.50	0.53	<0.50	<0.50	<0.50	<0.50		ND
Tellurium	0.020	mg/kg dw	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020		ND
Beryllium	0.010	mg/kg dw	0.013	<0.010	0.012	0.017	<0.010	<0.010	<0.010	<0.010		ND
Chromium	0.20	mg/kg dw	0.47	0.34	0.45	0.63	0.35	0.3	<0.20	<0.20		ND
Lead	0.050	mg/kg dw	0.209	0.15	0.195	0.268	0.174	0.115	<0.05	<0.05		ND
Tin	0.10	mg/kg dw	0.56	0.12	0.11	<0.100	<0.100	<0.100	<0.100	<0.100		ND



**Table 15** Metal concentrations (mg/kg dry weight) in tissue of fathead minnows exposed of 0 to 100% Treated OSPW in Athabasca River water during lab-based early-life-stage testing, arranged in order of greatest-to-smallest ratio of concentrations in 100% Treated OSPW to 100% river water.

Metal	Lowest MDL	Units	100% River (0% T-OSPW)	0.32% T-OSPW	1.0% T-OSPW	3.2% T-OSPW	10% T-OSPW	32% T-OSPW	56% T-OSPW	100% T-OSPW	Trend: 100% River to 100% T-OSPW	Ratio: 100% T-OSPW/ 100% River
Vanadium	0.10	mg/kg dw	0.8	2.62	3.34	22.8	11.4	46.6	56.8	136		170.0
Chromium	0.20	mg/kg dw	0.41	0.53	0.3	0.53	0.52	<0.20	<0.20	6.16		15.0
Nickel	0.20	mg/kg dw	0.43	0.52	0.37	0.59	0.6	0.26	<0.20	5.95		13.8
Uranium	0.0020	mg/kg dw	0.043	0.0428	0.0435	0.0459	0.0477	0.0321	0.0318	0.408		9.5
Boron	1.0	mg/kg dw	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	8.3		≥8.3
Strontium	0.10	mg/kg dw	65.3	65.3	49.3	61.2	58.8	92.5	130	391		6.0
Molybdenum	0.040	mg/kg dw	0.169	0.173	0.197	0.337	0.262	0.57	0.572	0.98		5.8
Tin	0.10	mg/kg dw	1.17	1.23	1.22	2.27	1.25	0.83	0.69	4.83		4.1
Barium	0.050	mg/kg dw	15.9	17.4	12.2	14.6	15	11.6	17.6	51.1		3.2
Zirconium	0.20	mg/kg dw	0.36	0.39	<0.2	<1.00	0.31	<0.2	<0.2	1.14		3.2
Mercury	0.0050	mg/kg dw	0.492	0.451	0.436	0.496	0.418	0.561	0.615	1.5		3.0
Zinc	1.0	mg/kg dw	139	130	117	134	140	139	161	361		2.6
Antimony	0.010	mg/kg dw	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	0.022		≥2.2
Lead	0.050	mg/kg dw	0.204	0.254	0.189	0.252	0.19	0.078	0.067	0.367		1.8
Arsenic	0.030	mg/kg dw	0.768	0.74	0.806	0.857	0.87	0.718	0.569	1.09		1.4
Selenium	0.10	mg/kg dw	3.27	3.27	3.15	3.74	3.74	3.65	3.82	4.11		1.3
Rubidium	0.050	mg/kg dw	4.51	4.56	4.41	7.17	5.79	7.77	10.6	5.37		1.2
Copper	0.20	mg/kg dw	4.69	4.98	4.44	4.59	4.94	5.38	4.52	5.08		1.1
Cadmium	0.010	mg/kg dw	0.029	0.027	0.027	0.026	0.026	0.019	0.025	0.03		1.0
Cobalt	0.020	mg/kg dw	0.191	0.224	0.173	0.25	0.21	0.098	0.075	0.19		1.0
Tellurium	0.020	mg/kg dw	0.039	0.035	0.035	0.036	0.038	0.032	0.03	0.026		0.7
Cesium	0.0050	mg/kg dw	0.0408	0.0476	0.032	0.0707	0.047	0.0382	0.038	0.0228		0.6
Manganese	0.050	mg/kg dw	28	29.8	20.2	29.5	24.7	16.3	11.5	14		0.5
Thallium	0.0020	mg/kg dw	0.011	0.0106	0.0101	0.0105	0.0101	0.0059	0.0059	0.0039		0.4
Iron	5.0	mg/kg dw	448	551	334	600	442	156	153	138		0.3
Aluminum	5.0	mg/kg dw	266	343	188	340	260	72.3	66.5	16.4		0.1
Bismuth	0.010	mg/kg dw	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		ND
Lithium	0.50	mg/kg dw	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		ND
Beryllium	0.010	mg/kg dw	0.011	0.014	<0.010	0.013	<0.010	<0.010	<0.010	<0.010		ND



## 3.2 TOXICITY ASSESSMENT

Summary results for all toxicity tests associated with this study appear in Table 16, Table 17, and Table 18 and are presented graphically and discussed in the following subsections. Full details and supporting data and information regarding these tests appear in the Nautilus report in Appendix A2, including QA/QC information and corresponding results of laboratory-water controls for each test conducted in the Nautilus Calgary laboratory that used Athabasca River water as the dilutant.

### 3.2.1 Acute Toxicity Tests

Exposure to a full range of Treated OSPW concentrations (i.e., 0% to 100%, added to Athabasca River water) showed no toxic effect to juvenile rainbow trout and *Daphnia magna* neonates in any of the five weekly tests (Table 16). The 50% lethal concentration (LC50) was >100% with no mortality for rainbow trout and *D. magna*; no immobilization effect was observed on *D. magna* neonates exposed to Treated OSPW (EC50 > 100%).

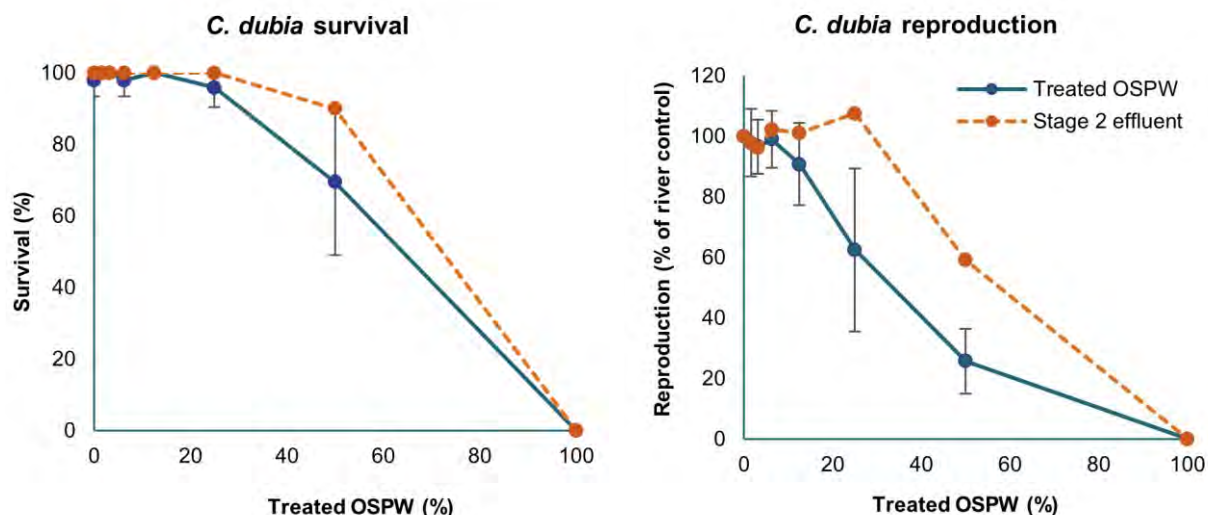
Results of supplemental acute toxicity tests using Stage 2 effluent at Week 4 were consistent with the toxicity results of Stage 3 Treated OSPW, with no toxic effect on the survival of rainbow trout and *D. magna*.

### 3.2.2 Sublethal Toxicity Tests

#### 3.2.2.1 *Ceriodaphnia dubia*

*Ceriodaphnia dubia* exposed to Treated OSPW in 7-day sublethal toxicity tests showed adverse effects on survival. Impacts on survival were seen over the five weeks of testing, with an average (geomean) LC50 of 56.7%, and LC50 results from individual weeks ranging from 46.6 to 66.7 respectively (Table 16, Figure 8). Effects on *C. dubia* reproduction also were apparent, with declines in performance above 12.5% and a mean IC25 of 20.4%.

**Figure 8** Survival and reproduction of *Ceriodaphnia dubia* exposed to Treated OSPW (average of Weeks 1 to 5), with Stage 2 exposure result (Week 4).





**Table 16** Summary results of laboratory exposures of test organisms to mixtures of Treated OSPW and Athabasca River water (i.e., 0% Treated OSPW = 100% Athabasca River water), using standard tests and test species (average with 95% confidence interval in brackets).

Test Species	Life Stage	Test Endpoint	Treated OSPW (%)					Geometric Mean (Weeks 1-5)
			Week 1	Week 2	Week 3	Week 4	Week 5	
Acute toxicity tests								
Rainbow trout ( <i>Oncorhynchus mykiss</i> )	Juvenile	96-h survival (LC50)	>100	>100	>100	>100	>100	>100
Waterflea ( <i>Daphnia magna</i> )	< 24h neonates	48-h survival (LC50)	>100	>100	>100	>100	>100	>100
		48-h immobility (EC50)	>100	>100	>100	>100	>100	>100
Sublethal toxicity tests								
Green alga ( <i>Pseudokirchneriella subcapitata</i> )	3-7 day old culture	72-h growth (IC25)	11.0 (8.6-13.8)	5.6 (3.5-16.0)	14.8 (10.6-19.8)	8.9 (6.2-14.1)	50.7 (41.5-60.0)	13.3*
Waterflea ( <i>Ceriodaphnia dubia</i> )	< 24h neonates	7-d survival (LC50)	61.1 (51.1-74.1)	46.7 (36.1-62.0)	46.6 (36.0-64.0)	66.7 (59.0-75.3)	66 (51.7-73.4)	56.7
		7-d reproduction (IC25)	20.1 (16.9-24.7)	20.7 (14.2-27.2)	30.8 (27.2-32.4)	27.8 (9.9-34.7)	9.9 (6.5-13.3)	20.4
Fathead minnow ( <i>Pimephales promelas</i> )	<24h post-hatch	7-d survival (LC50)	57.3** (47.4-69.2)	68.7** (55.1-85.7)	83.9** (72.5-97.1)	>100**	>100**	80.1**
		7-d biomass (IC25)	34.5** (26.7-41.0)	55.5** (27.4-64.0)	55.1** (46.7-65.3)	63.5** (54.1-65.4)	67.9** (59.0-75.2)	53.9**
Amphipod ( <i>Hyalella azteca</i> )	7-9 day old	14-d survival (LC50)	>100	>100	>100	>100	>100	>100
		14-d growth (IC25)	92.6 (70.0-NC***)	70.1 (53.2-87.2)	70.4 (55.6-84.1)	92.3 (80.9->100)	95.5 (64.8-NC***)	83.4

\* Mean IC25 = 13.3% relative to Athabasca-River-water control, but >100% relative to corresponding laboratory-water control (see text).

\*\* Due to observed microbial growth in all treatments in Week 1-2 tests, anti-microbial control of 20 µg/L copper added partly to Week 3 test and fully to Week 4-5 tests.

\*\*\*NC: Not calculable.



**Table 17 Results of long-term and early life stages exposures of fathead minnows in on-site and laboratory settings, to mixtures of Treated OSPW and Athabasca River water.**

Type of Toxicity Test	Test Endpoint	Life Stage	Treated OSPW (%)	
			On-Site Exposure	Laboratory Exposure
Juvenile-adult	Survival (LC50)	Juvenile (28-d)	82.7 (64.7->100)	90.4 (79.4->100)
	Length (IC25)	Juvenile (28-d)	>100	>100
	Wet Weight (IC25)	Juvenile (28-d)	57.2 (38.0-76.7)	59.8 (47.6-70.8)
	Condition Factor (IC25)	Juvenile (28-d)	-	-
	LSI (I25)	Juvenile (28-d)	-	-
Early life stage	Hatch (EC50)	Egg to 28 d	NA*	100
	Dry Weight (IC25)	Egg to 28 d	NA	100
	Length (IC25)	Egg to 28 d	NA	100
	Normal Development	Egg to 28 d	NA	100
	Post-hatch Survival (LC50)	Egg to 28 d	NA	61.4 (56.2-67.1)
	Overall Survival (LC50)	Egg to 28 d	NA	61.1 (56.1-66.7)

\*NA: Not applicable. The early life stages toxicity test with fathead minnow was not conducted at on-site exposure.

**Table 18 Results of laboratory exposures of native species to mixtures of Treated OSPW and Athabasca River water.**

Species	Life Stage	Test Endpoint	Treated OSPW (%)
Fingernail clams ( <i>Sphaerium</i> sp.)	1-21 day old	28-d Survival (LC50)	74.8 (56-100)
		28-d Dry weight (IC25)	>56
		28-d Shell length (IC25)	>56
Freshwater mussel ( <i>Lampsilis siliquoidia</i> )	<24 h old glochidia	48-h Percent viability (EC50)	72.7 (67.6-78.2)
		48-h Percent viability (EC20)	46.2 (40.5-52.9)
Walleye ( <i>Sander vitreus</i> )	24-48 h post-fertilization	23-h Hatch (EC50)	>100
		23-h Hatch (EC25)	>100
		23-h Overall survival (LC50)	73.8 (38.9->100)
		23-h Post-hatch survival (LC50)	>100
	2-32 days	30-d Dry weight (IC25)	>100
		30-d Length (IC25)	>100
		30-d Normal development (LC25)	>100
		30-d Overall survival (LC50)	20.9 (19.2-22.7)
		30-d Post-hatch survival (LC50)	21.6 (19.7-23.7)



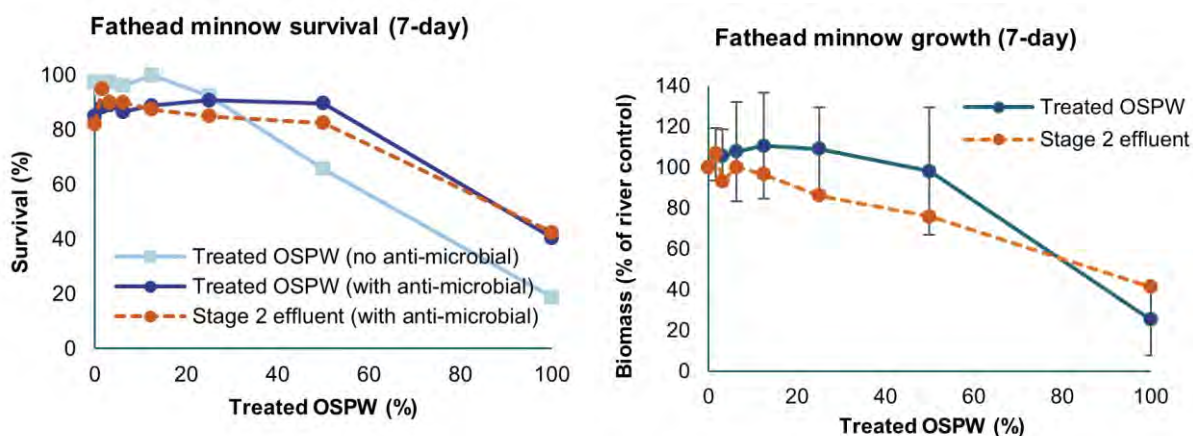
Stage 2 effluent, tested in Week 4, also showed an adverse effect on *C. dubia* survival and reproduction (LC50 = 66.0%, IC25 = 38.0%; see Appendix A2), which was generally consistent with the toxicity results determined for Treated OSPW in Week 4. Treated OSPW exhibited a higher pH of 8.8 to 8.9 relative to Stage 2 effluent (i.e., 8.3 to 8.4). To assess potential effects of pH on *C. dubia* response, a pH-adjusted sample of Treated OSPW (adjusted to pH 8.2) was tested in Week 5, but resulted in no improved performance, which suggests that elevated pH on its own was not the cause of impaired survival or reproduction observed with *C. dubia*.

### 3.2.2.2 Fathead Minnow (Weekly 7-day Test)

In Weeks 1 and 2, the survival of fathead minnow in 7-day tests showed adverse outcomes, with LC50 values of 57.3% and 68.7%, respectively (Table 16). Due to observed microbial growth in 50 and 100% Treated OSPW exposures in Week 1 and 2, an anti-microbial treatment of 20 µg/L copper was added to 50% and 100% doses in Week 3, which improved survival and effectively controlled microbial growth, leading to use of this anti-microbial treatment prophylactically in all doses in Weeks 4 and 5. Addition of 20 µg/L copper to test samples in Week 4 and 5 eliminated observed microbial growth as well as acute toxicity that had previously been observed in the 50% exposure in Week 1 to 3 testing (Figure 9).

Survival of fathead minnow exposed to Stage 2 effluent in Week 2 (96.4%) was consistent with the Treated OSPW result in that week. As was done for *C. dubia* (see Section 2.1.2), an additional pH-adjusted test was undertaken on Treated OSPW, with pH reduced daily to < 8.6 to investigate the potential impact of pH on fathead minnow survival. No difference in survival was observed between the pH adjusted and unadjusted treatments, indicating that the high pH was not a primary cause of observed adverse effects of 100% Treated OSPW on fathead minnows.

**Figure 9** Survival and growth (biomass) of fathead minnow exposed to Treated OSPW, showing results with and without anti-microbial treatment, as well as response to Stage 2 effluent.



Treated OSPW affected fathead minnow growth (biomass) at relatively high concentrations, with an average IC25 value of 53.9% (Table 16, Figure 9). Testing of Stage 2 effluent in Week 4 found a response similar to that for Treated OSPW.

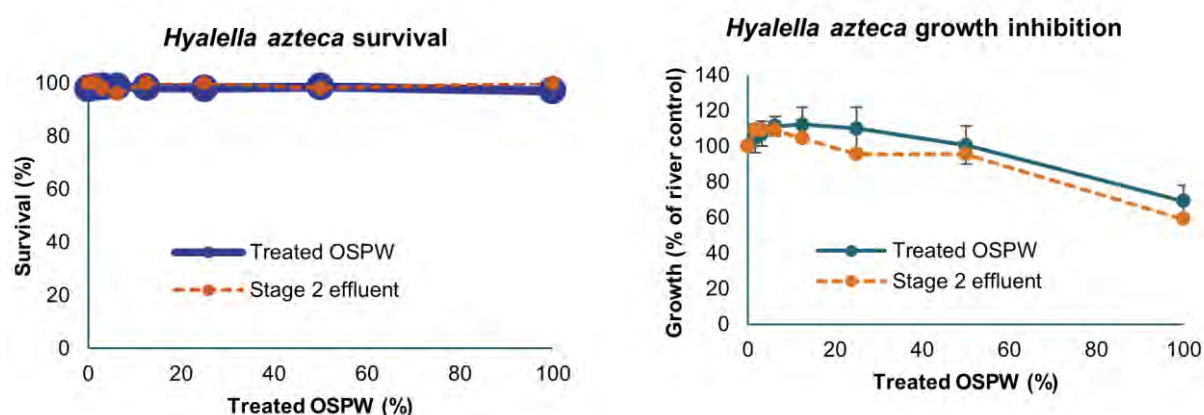


### 3.2.2.3 *Hyalella azteca*

Survival of the amphipod *H. azteca* was not affected by exposure to Treated OSPW in any week of testing (Table 16, Figure 10). No adverse effect was observed from Stage 2 effluent either (i.e., LC50 >100%).

Growth inhibition was observed at relatively high concentrations of Treated OSPW, with an average IC25 values of 71.6% and weekly values ranging from 70.1 to 95.5% across Weeks 1 to 5 (Table 16). Concurrent testing of Stage 2 effluent and Treated OSPW found Stage 2 effluent to have a similar effect on *H. azteca* growth, with an IC25 of 71.6% for Stage 2 effluent, versus an IC25 for Treated OSPW at Week 4 of 92.3% (Figure 10).

**Figure 10** Survival and growth of *Hyalella azteca* exposed to Treated OSPW (n=5), as well as response to Stage 2 effluent.



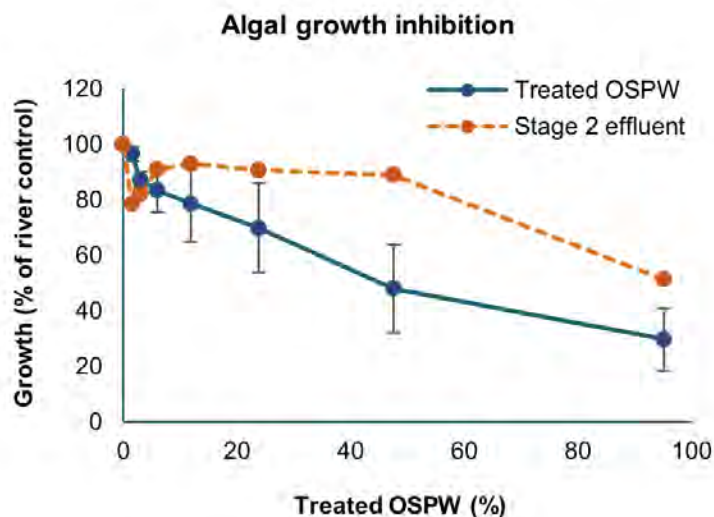
### 3.2.2.4 Green Algae (*Pseudokirchneriella subcapitata*)

Green algae showed a range of growth responses to Treated OSPW across testing weeks, with weekly IC25 values ranging from 5.6 to 50.7% (mean = 13.3%) (Table 16, Figure 11). However, despite the clear dose-response relationship shown in Figure 11, with a decline in growth to approximately 30% of that observed in the 100% river water control in 100% Treated OSPW, it is important to note that the growth rate in 100% Treated OSPW corresponds closely with the growth rate in laboratory-control water for these tests, the average of which was approximately 30% of the river-water control. Therefore, if this test of Treated OSPW was done relative to a standard laboratory-water control only, no effect on growth would have been measured. This suggests an influence of the type of dilution water used, and that there may be a stimulatory effect of river water relative to laboratory control water on the growth of green algae.

Exposure to Stage 2 effluent in Week 4 generated a smaller inhibition effect on growth of green algae to that observed in Treated OSPW in that week (less growth inhibition was observed in Treated OSPW in Week 4 than in the average over the five weeks of testing [see Appendix A2]).



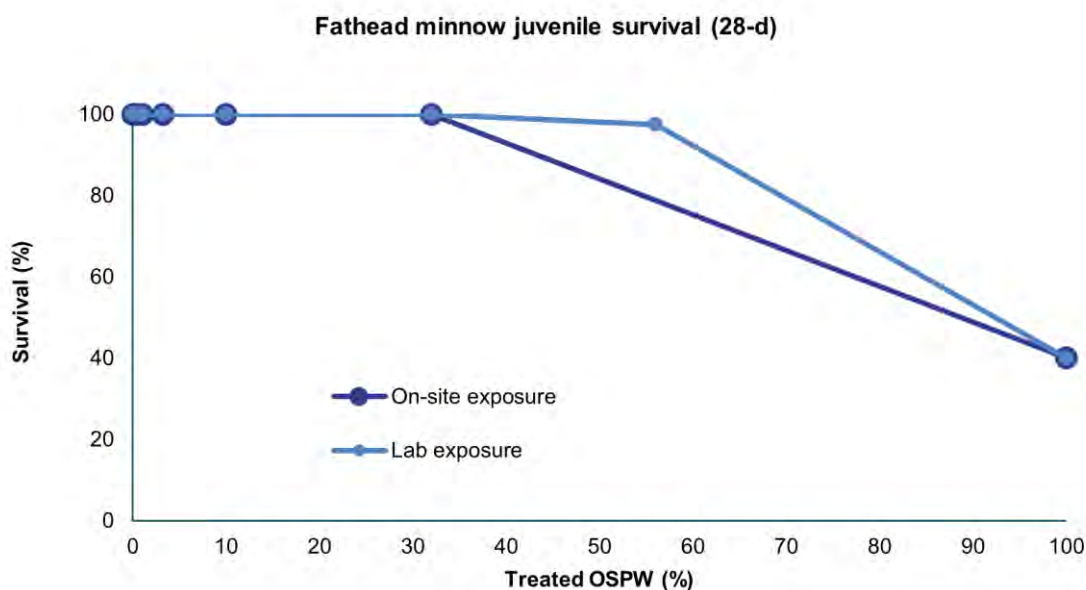
**Figure 11** Growth inhibition of green algae exposed to Treated OSPW (n=5), relative to response to Stage 2 effluent at Week 4.



### 3.2.3 Extended Tests Using Fathead Minnow

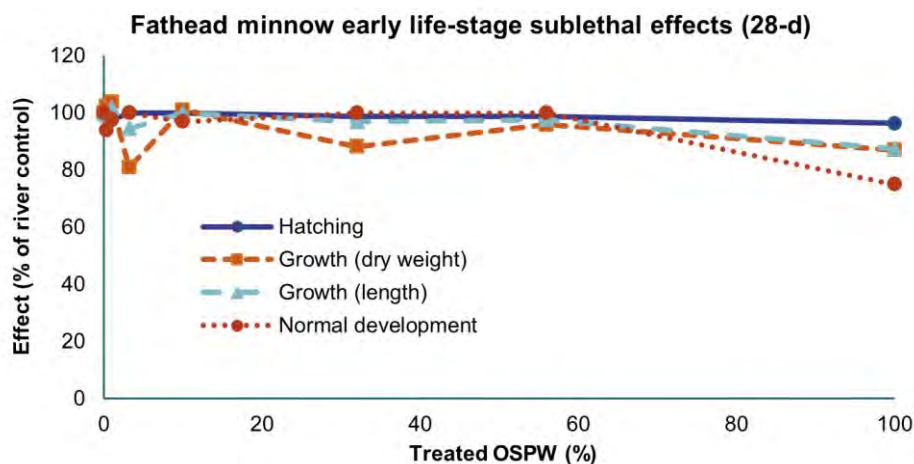
Results of extended sublethal toxicity tests with juvenile fathead minnow exposed to Treated OSPW in both on-site trailer and laboratory are provided in Table 17. Similar survival results were observed in both on-site and laboratory-based tests, with calculated LC50 values of 82.7% for the on-site test and 90.4% for the laboratory test; results were similar for growth inhibition for on-site and laboratory-based tests as well (i.e., IC25=57.2% on-site, 59.8% laboratory) (Figure 12). No effects on survival or growth were observed in Treated OSPW concentrations of  $\leq 32\%$  in either on-site or laboratory exposures (Figure 13 and Figure 14).

**Figure 12** Percent survival of juvenile fathead minnow exposed to Treated OSPW in on-site and laboratory tests.

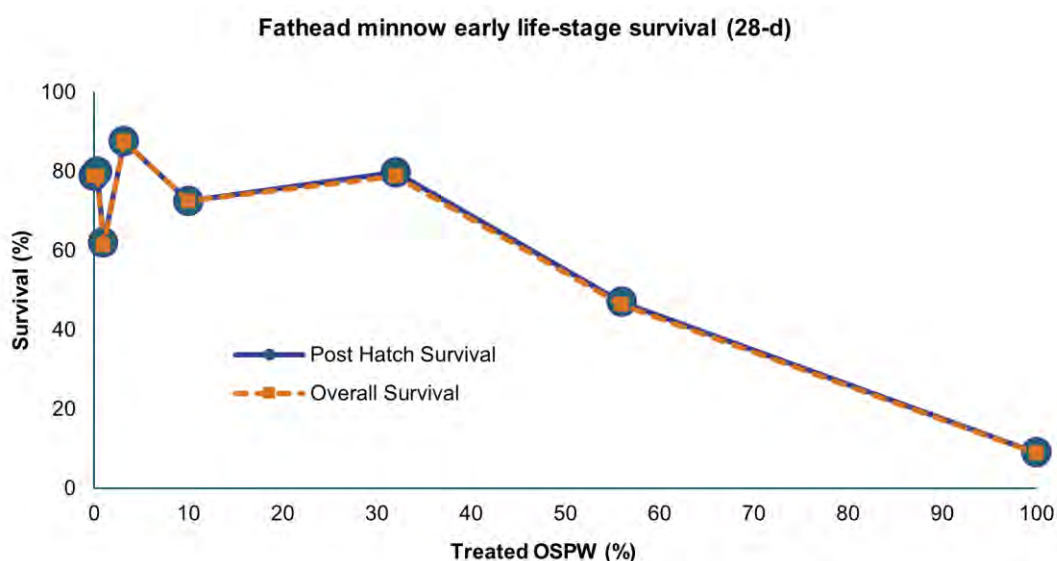




**Figure 13** Results of early life-stage toxicity testing on hatching, dry weight, length, and normal development of fathead minnow exposed to Treated OSPW.



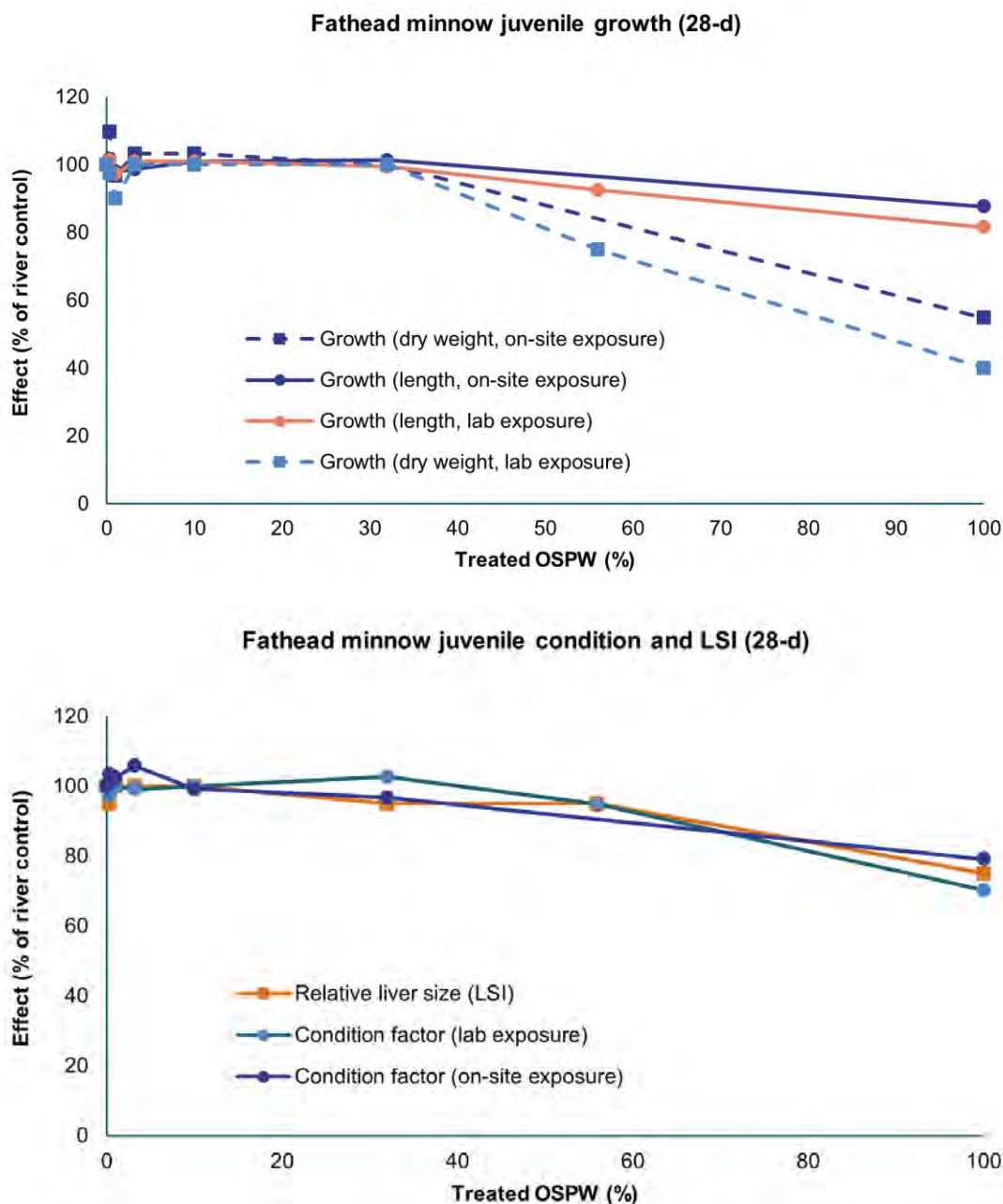
**Figure 14** Percent survival of early-life-stage toxicity fathead minnows exposed to Treated OSPW (post-hatch and overall survival).



No sublethal effects on growth of juvenile fathead minnows were observed in either on-site or laboratory exposures to Treated OSPW, when measured by fish length (i.e., IC<sub>25</sub> >100%) (Table 17). However, effects on growth when measured as fish weight were observed at concentrations above 32% in both on-site and laboratory exposures (i.e., IC<sub>25</sub> = 57.2% on-site, 59.8% lab) (Figure 15). Juvenile fathead minnows in on-site and laboratory exposures showed similar declines in condition factor at high effluent concentrations (Figure 15) which would be expected given condition factor is calculated as weight divided by the cube of length, indicating that fish in the 100% exposures were of similar length but skinny relative to fish from the ≤56% exposures. Relative liver size in laboratory exposures of juvenile fathead minnows showed a similar dose-response trend to condition, with fish from the 100% exposure having reduced liver sizes. Dissections of fish exposed to 100% Treated OSPW found livers in poor visible condition that affected their easy removal as whole, intact organs (Appendix A2).



**Figure 15** Results of sublethal tests of growth (length and weight), condition factor, and relative liver weight (LSI) of juvenile fathead minnow exposed to Treated OSPW.



### 3.2.4 Toxicity Testing Using Native Species

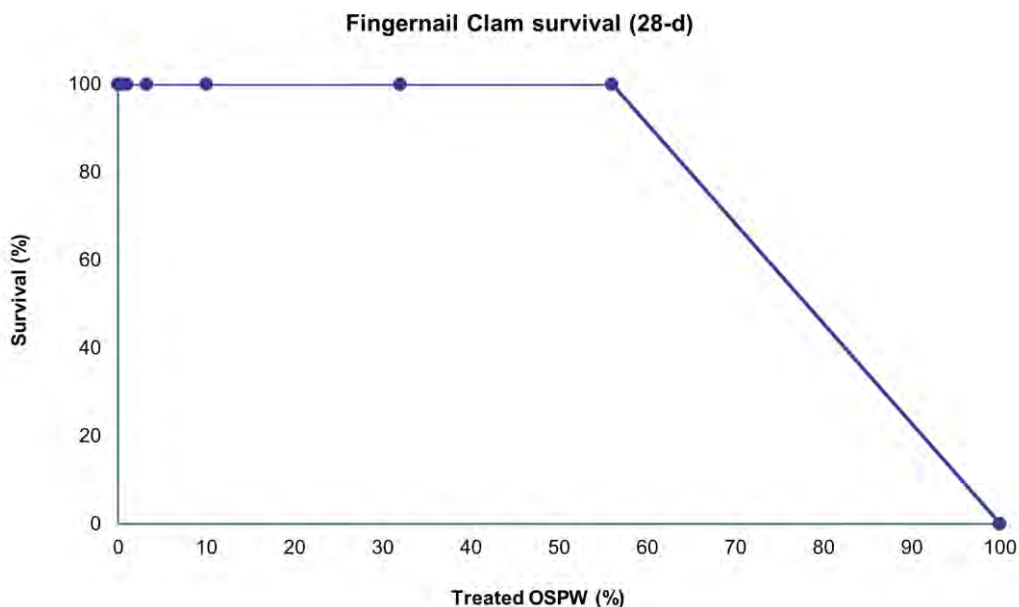
Results of toxicity tests with native species, including fingernail clam (*Sphaerium* sp.), freshwater mussel (*Lampsilis siliquoidea*), and walleye (*Sander vitreus*) are provided in Table 18. These tests were conducted in summer 2022 using Treated OSPW collected in late September 2021, due to test-organism availability issues (particularly availability of walleye eggs) and used laboratory-control water rather than river-control water as was done in September 2021 exposures.



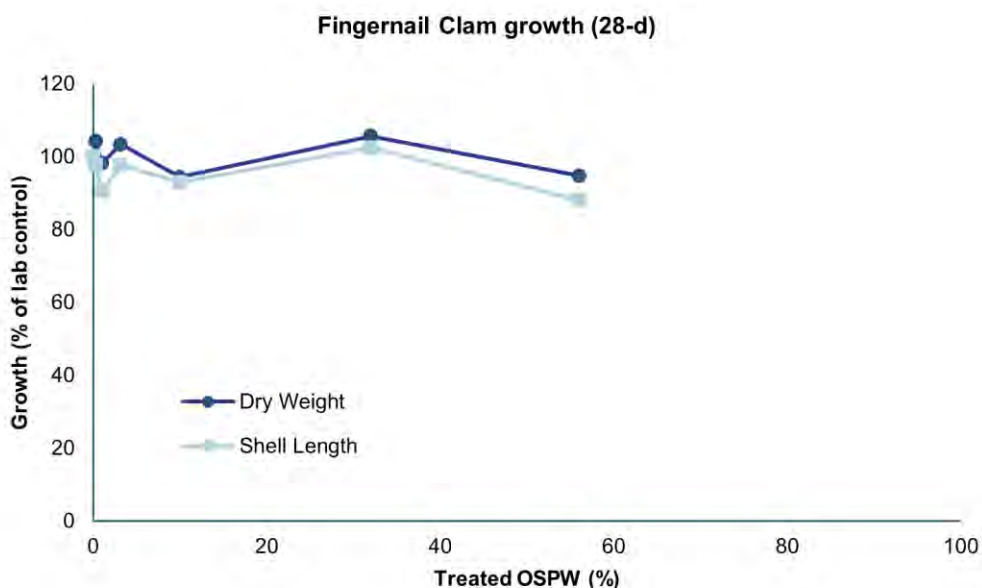
### 3.2.4.1 Fingernail Clam (*Sphaerium* sp.)

Survival of fingernail clam was evaluated after 28-day exposure to Treated OSPW. Survival of fingernail clam was adversely affected in 100% Treated OSPW concentrations but not in the 56% dilution, with the LC50 and LC25 values of 74.8 and 64.8%, respectively. The full-strength treatment (100% Treated OSPW) caused 100% mortality in fingernail clam (Figure 16). However, results of growth measured as dry weight and length of surviving clams, or burrowing ability of surviving clams were not affected (Figure 17). An IC25 value of >56% (i.e., no effect) was estimated for the growth of fingernail clam.

**Figure 16** Percent survival of fingernail clams exposed to Treated OSPW.



**Figure 17** Results of toxicity test on the dry weight and shell length of fingernail clam exposed to Treated OSPW.

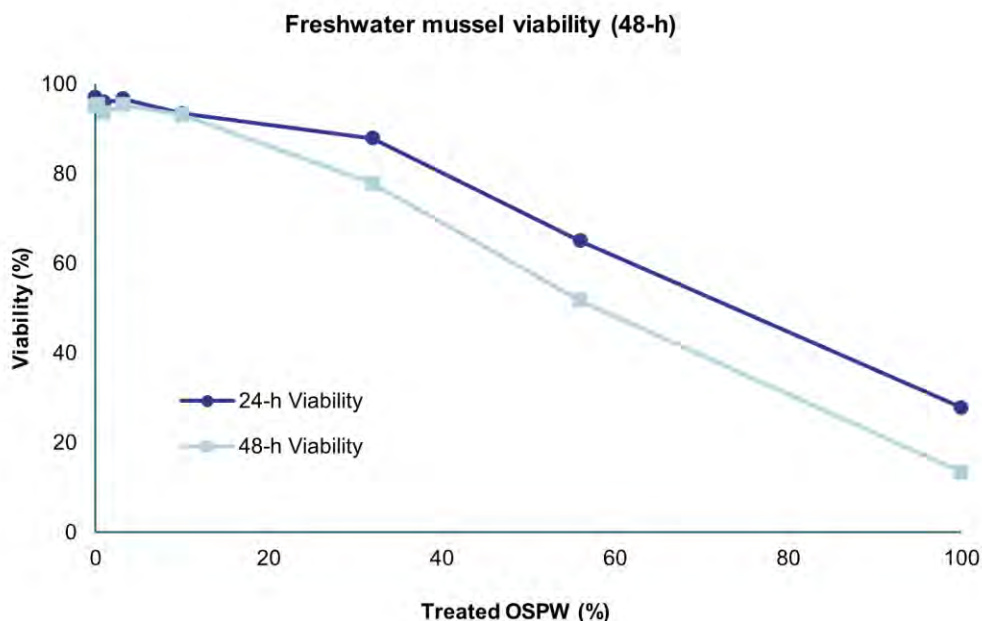




### 3.2.4.2 Freshwater Mussel (*Lampsilis siliquoidea*)

A 48-h toxicity test was conducted using the viability of mussel glochidia (a commensal or parasitic larval stage) as the endpoint. Viability refers to the ability of glochidia to close their valves in response to stimulus. An adverse effect of Treated OSPW was observed on glochidia viability at 24h and 48h, with EC25 values of 46.2% at 24h and 37.0% at 48h (Figure 18).

**Figure 18** Results of toxicity test on glochidia viability of freshwater mussel exposed to Treated OSPW.



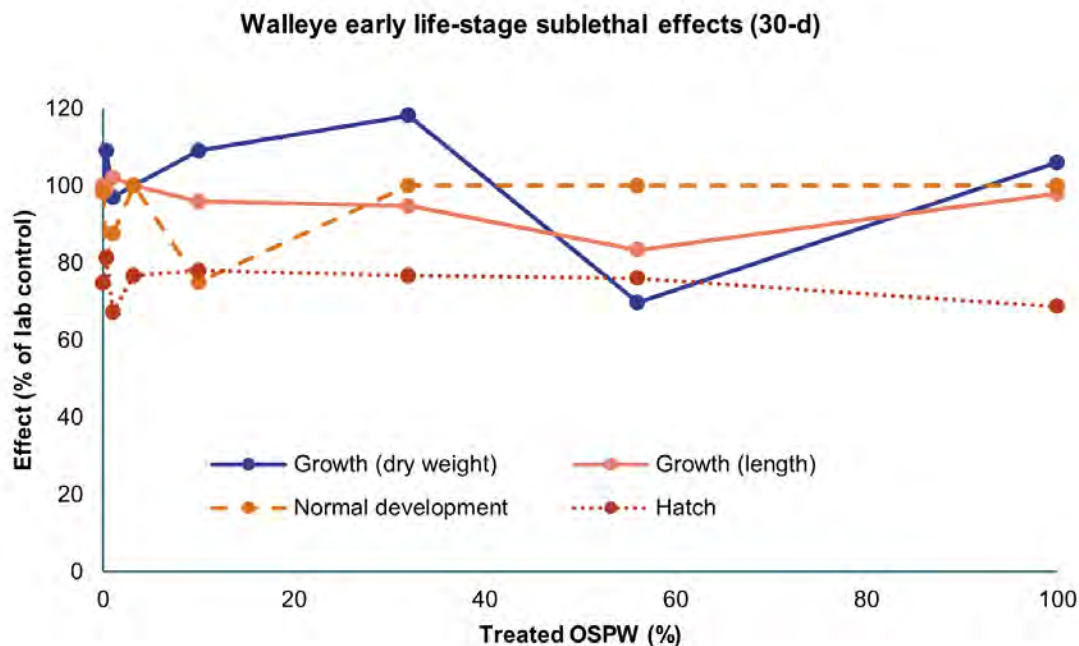
### 3.2.4.3 Walleye (*Sander vitreus*)

Toxicity tests using early life stages of walleye experienced poor survival in all treatments (i.e., 0 to 100% treated OSPW) across the test period, with laboratory controls exhibiting only 16% post-hatch survival and 13% overall survival by end of test. Therefore, effects of Treated OSPW on walleye survival reported in Table 18 (i.e., LC25 =23.2% for overall survival and 24.6% for post-hatch survival) cannot be considered reliable.

No effect of Treated OSPW was observed on walleye hatch success, dry weight, length, or normal development, with variable responses across the dilution series and EC25 values >100% (Figure 19). Although organisms all hatched between Day 12 and 23, the overall survival and post-hatch survival showed a decline in the last week of exposure up to Day 30 in both laboratory control and Treated OSPW treatments.



**Figure 19** Results of toxicity test on dry weight, length, normal development, and hatch success of walleye exposed to Treated OSPW.



### 3.3 MESOCOSM ASSESSMENT

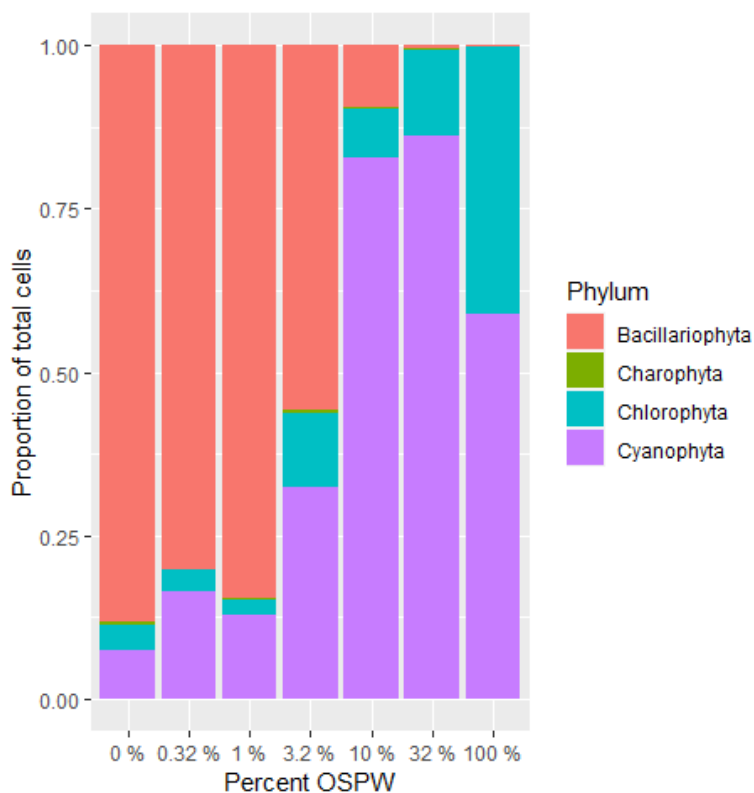
#### 3.3.1 Periphyton

Periphyton taxa collected from the Styrofoam balls were from four phyla: Cyanophyta (blue-green algae), Chlorophyta (green algae), Bacillariophyta (diatoms), and Charophyta (also considered green algae) (Figure 20). Blue-green algae cell counts were proportionately greatest at Treated OSPW doses >3.2%, reaching greatest relative abundance at 32% Treated OSPW. Below Treated OSPW doses of 32%, many of the blue-green algae were replaced with diatoms (Bacillariophyta), with assemblages in the 0% dose being about 90% diatoms. Green algae (Chlorophyta) were present across all treatments, with greatest relative abundance at 100% Treated OSPW. Green algae of the Charophyta were rare.

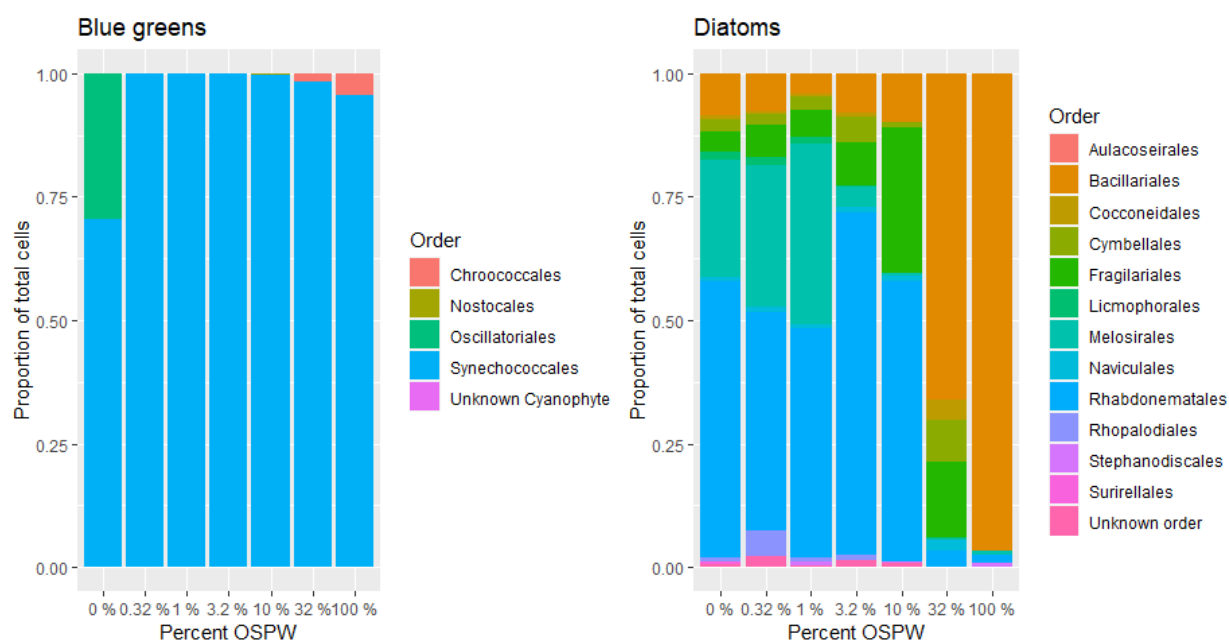
The Cyanophyta were almost entirely from the Order Synechococcales that included five genera: *Aphanocapsa* sp., *Chamaesiphon* sp., *Merismopedia* sp., *Pseudanabaena* sp., and *Synechocystis* sp. (Figure 21). Greater importance of the diatoms at the lower doses of Treated OSPW was mainly due to higher relative abundance of Rhabdonematales (genera were *Diatoma*, *Asterionella*, and *Meridion*), Melosirales (genus *Melosira*), Naviculales (genera were *Navicula*, *Amphipleura*, *Caloneis*, *Girosigma*, and *Pinnularia*), and lower relative abundance of the Bacillariales (genus *Nitzschia*), which were common at high doses of Treated OSPW (Figure 21).



**Figure 20** Periphyton relative cell counts by algal phylum and treatment on Styrofoam balls.



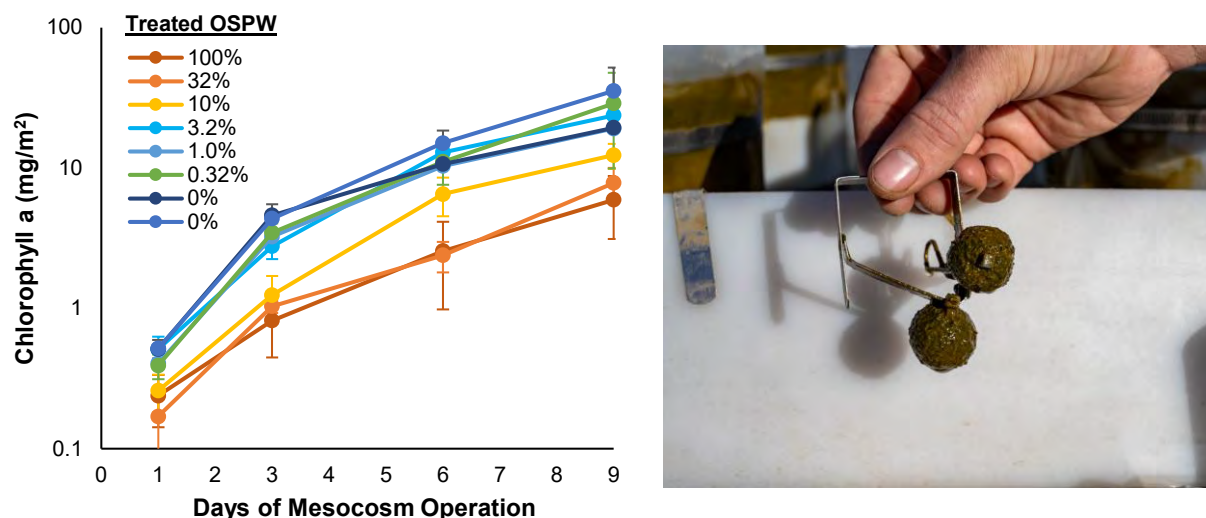
**Figure 21** Blue-green algae (Cyanophyta) (left panel) and diatom (right panel) relative cell counts by order and treatment on Styrofoam balls.





Algal accrual on Styrofoam balls was logarithmic, with biomass reaching 6 to 35 mg/m<sup>2</sup> chl-a among treatments after nine days (Figure 22). Afterward, sloughing followed by rapid regrowth was found. Lowest biomass was associated with the larger doses of Treated OSPW; greatest biomass was from the 0% Treated OSPW.

**Figure 22** Accrual of periphyton chlorophyll-a on Styrofoam balls that were fitted into the mesocosm streams on September 4, 2021.



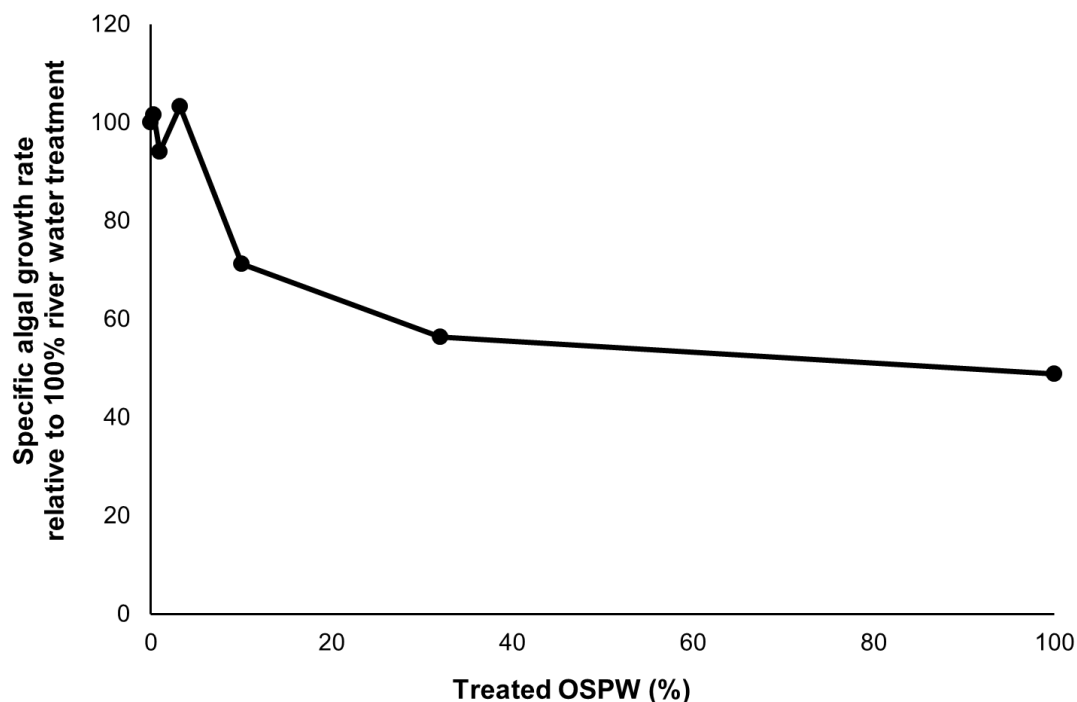
Algal accrual data for the first 9 days are shown, which is the time when biomass accrual was not confounded by sloughing.

The image shows biomass on the Styrofoam balls attached to a stainless-steel fitting that clipped onto the side of a stream to keep the balls submerged but well above invertebrates in the substrata.

Analysis of covariance (ANCOVA) showed a significant interaction between “day” and “treatment”, which indicated a difference in slopes of the accrual lines ( $p < 0.001$ ). This effect is shown in Figure 23, with declining relative specific growth rates at treatments above 3.2% Treated OSPW. Values of  $\mu:\mu_c$  expressed as a percentage were slightly greater than 100% of the 100%-river-water stream at 0.32% Treated OSPW and 3.2% Treated OSPW but declined sequentially with greater addition of Treated OSPW, ending at 0.49 at 100% Treated OSPW or about half of the growth rate of the 0% treatment.



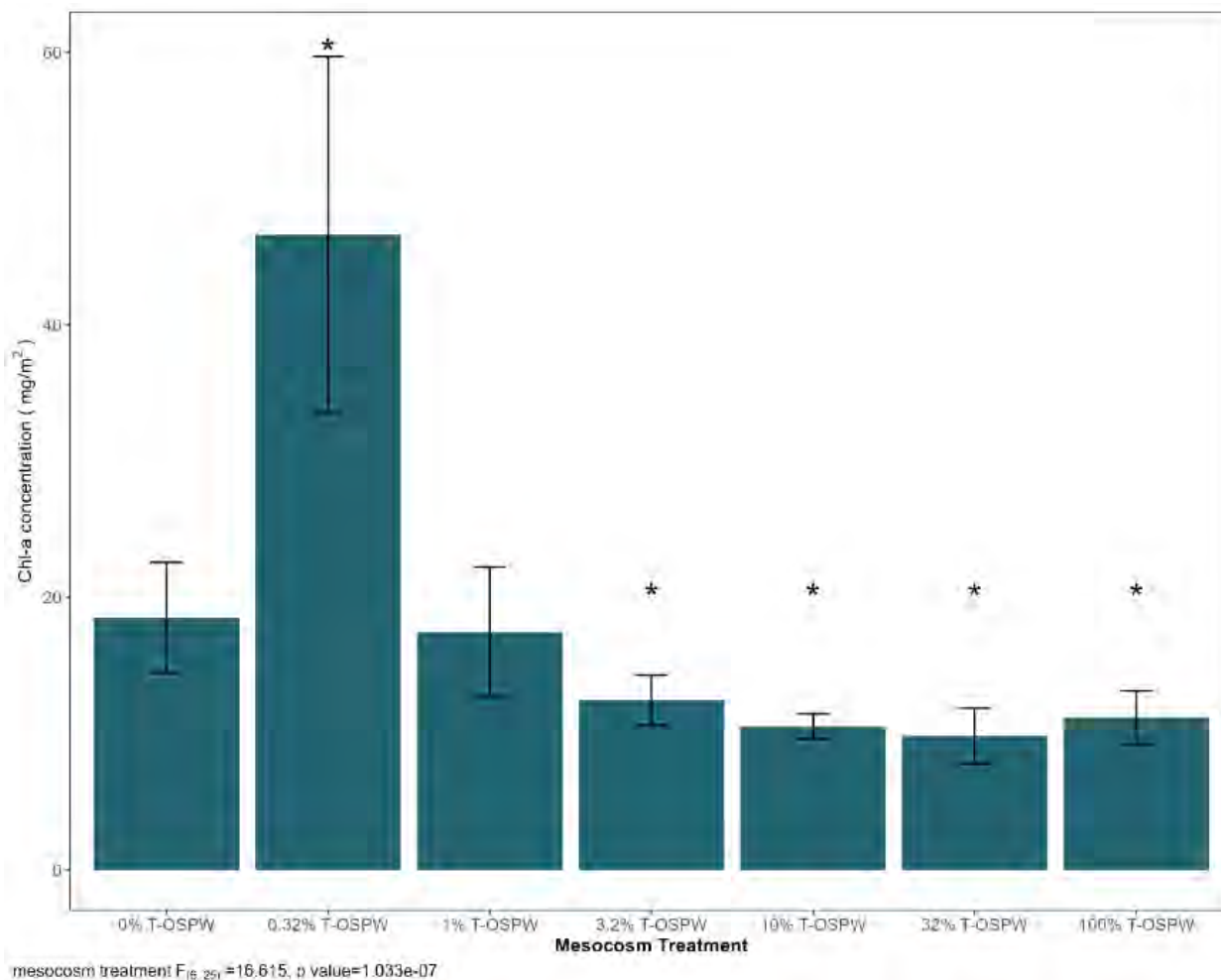
**Figure 23**      **Relative specific growth rate of the algal community growing on artificial substrata in the mesocosm streams, relative to Treated OSPW dilution.**



This pattern in relative specific growth rate across treatments—i.e., some stimulation at low doses of Treated OSPW and some inhibition at high doses—also was observed for the standing algal biomass collected from mesocosm-stream cobbles at the end of the study. There was significantly greater algal biomass exposed to 0.32% Treated OSPW dose relative to river water and significantly less algal biomass at doses of 3.2% and above (Figure 24).



**Figure 24** Chlorophyll-a biomass on mesocosm-stream cobbles at the end of the study.



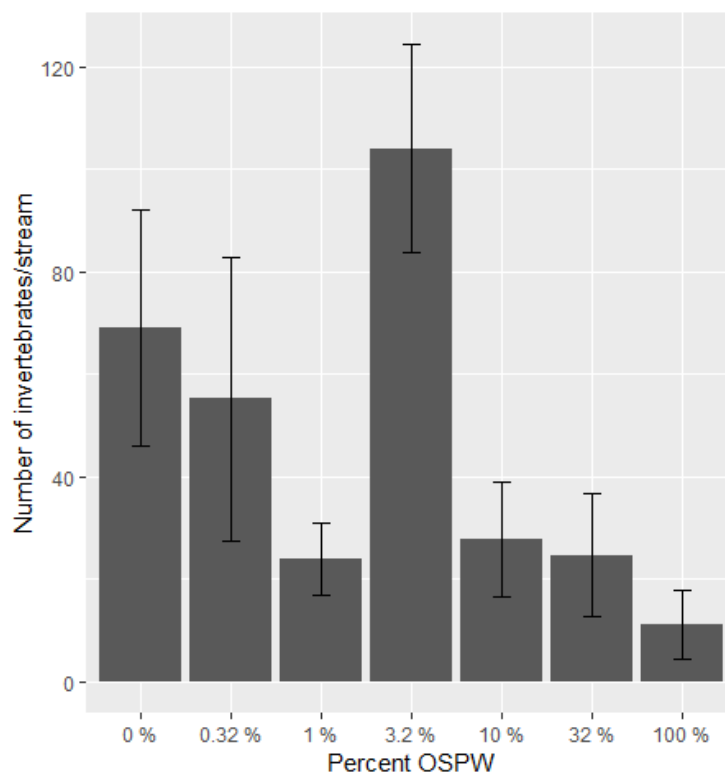
### 3.3.2 Benthic Invertebrates

#### Overview

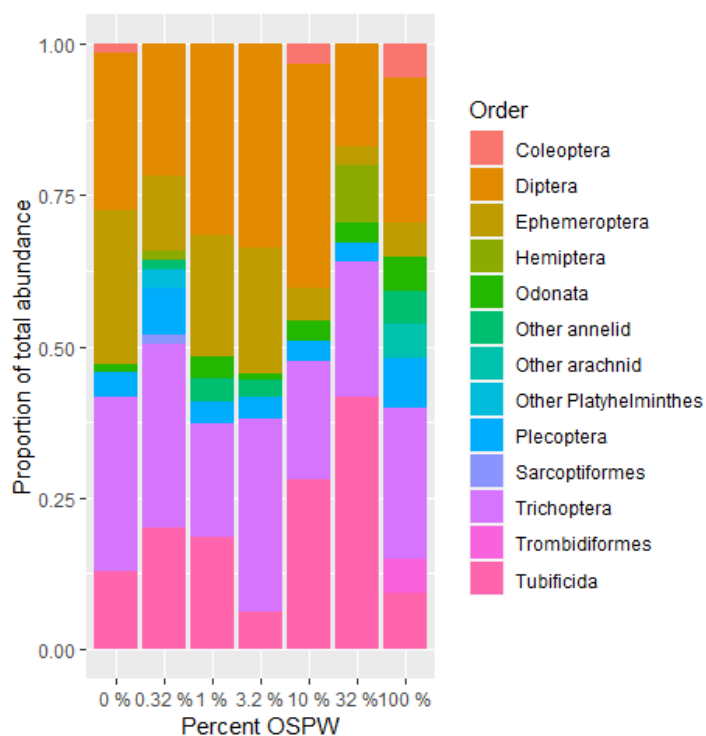
Mean abundance of benthic invertebrates ranged from 11 individuals per stream at 100% Treated OSPW to 104 individuals per stream at 3.2% Treated OSPW (Figure 25). Invertebrate densities generally increased from low values at highest Treated OSPW dosing to progressively higher values with decreasing OSPW dose. High abundance at 3.2% Treated OSPW was anomalous. Common invertebrate orders were found across all OSPW treatments with Diptera, Ephemeroptera, Trichoptera, and Tubificidae being in greatest relative abundance (Figure 26).



**Figure 25** Mean  $\pm$  standard deviation of total invertebrate counts per stream by treatment.



**Figure 26** Relative abundance of invertebrate orders by treatment.

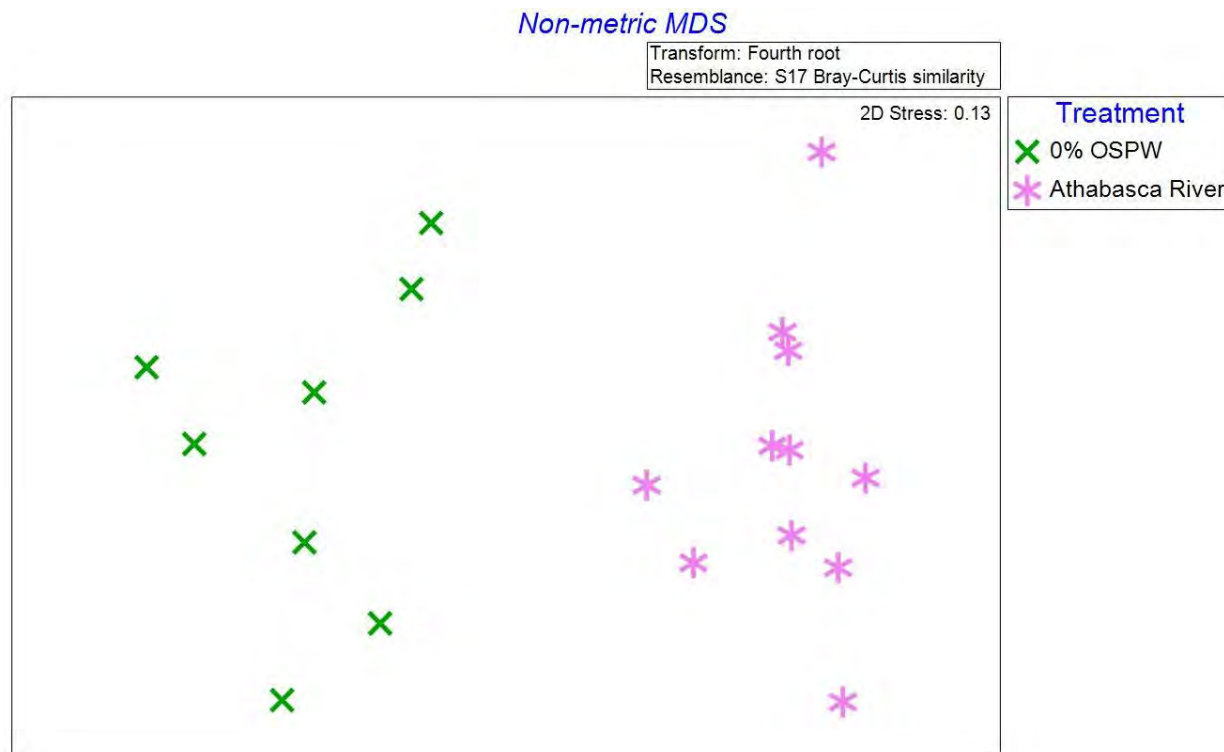




### Effect of Mesocosm Procedures on Final Benthos Assemblages

Communities of Athabasca River benthos and mesocosm benthos not exposed to OSPW were widely spaced on the NMDS ordination (Figure 27). ANOSIM confirmed the community differences were significant ( $R=0.91$ ,  $p=0.001$ ). The benthic invertebrate NMDS had a stress level of 0.13, which showed it was representative of the multidimensional data.

**Figure 27** NMDS of benthic invertebrate counts among subsamples (symbols) between the Athabasca River and mesocosm streams not receiving a Treated OSPW dose.



**Notes:**

The subsamples were collected from the Athabasca River at the same place and time.

The mesocosm subsamples were exposed to handling and incubation in the mesocosm experiment after collection from the river whereas the Athabasca River samples were immediately preserved after collection.

SIMPER showed that larvae of two insect families cumulatively contributed to more than 70% of these differences in assemblage patterns. They were Heptageniidae (a group of mayflies) and Hydropsychidae (a group of net-spinning caddisflies) (Table 19). In both cases, abundances were lower in the mesocosm than in the river. They contributed to lower abundances of total invertebrates and lower family richness in the mesocosm than in the river samples.



**Table 19**      **Diversity and abundance metrics showing differences between benthos assemblages from the Athabasca River and mesocosm streams not receiving a Treated OSPW dose.**

Metric	Mean $\pm$ standard deviation	
	Benthos in the 0% Treated OSPW mesocosm stream at end of exposure (n=8)	Benthos collected from the Athabasca River at study initiation (n=11)
Family richness (number of families)	8 $\pm$ 1.5	13.4 $\pm$ 1.8
Total abundance (number of individuals/stream)	69 $\pm$ 23	292 $\pm$ 95
Heptageniidae abundance (number of individuals/stream)	18 $\pm$ 14	143 $\pm$ 57
Hydropsychidae abundance (number of individuals/stream)	20 $\pm$ 5	80 $\pm$ 34

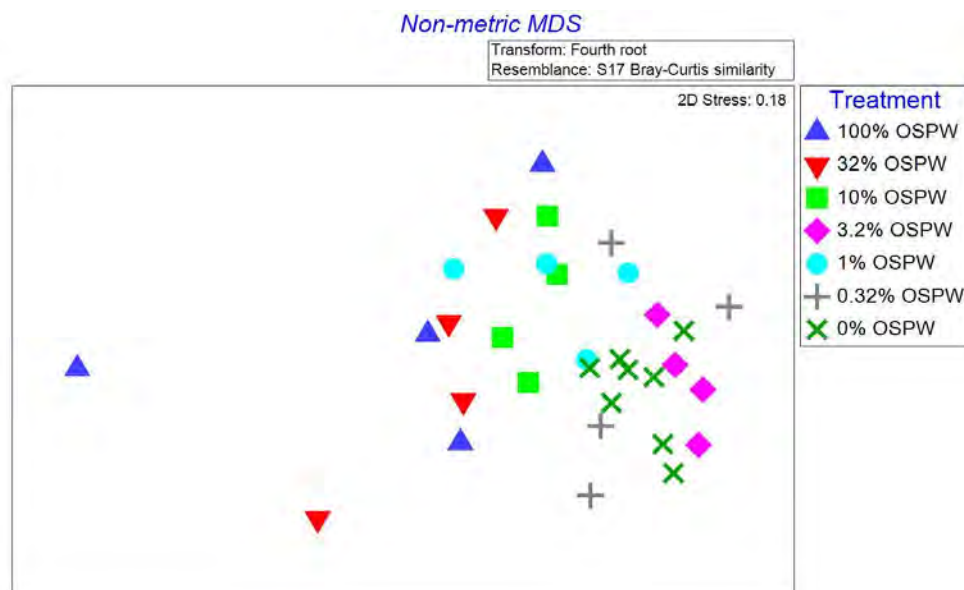
### ***Effects of Exposure to Treated OSPW on Final Benthos Assemblages***

The benthic invertebrate NMDS among Treated OSPW doses had a stress level of 0.18, which showed it was representative of the multidimensional data (Figure 28). Stream benthos receiving 0%, 3.2%, and 0.32% grouped together, showing greater similarities among samples compared to those from the other treatments. The benthos assemblage exposed to 1% Treated OSPW was shifted upwards and to the left and overlapped assemblages receiving 10% Treated OSPW. Further to the left were assemblages receiving the 32% and 100% Treated OSPW doses.

The cluster dendrogram showed a similar pattern with demarcation at the 58% level of similarity of three stream groups plus two outliers (Figure 29). The group to the left included streams receiving 0% to 3.2% Treated OSPW and one stream at 10%. The group to the far right received doses of 100% and 32% with one stream at 10%. The middle group received mixtures of doses but no stream at 0%. This pattern shows a gradient of response with variability of assemblages at one or more doses overlapping variability of assemblages at other doses. Most of this overlap occurred in the middle stream group on the cluster dendrogram.



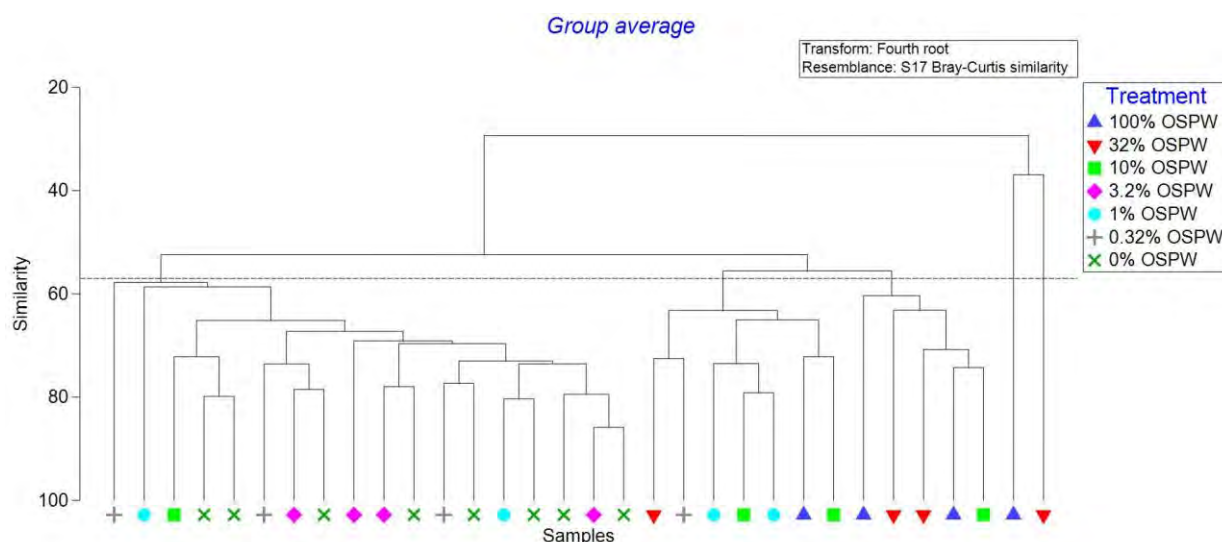
**Figure 28 NMDS ordination of benthic invertebrate counts at the family level among mesocosm streams.**



Note: Stream symbols are organized by OSPW treatment (percent of Treated OSPW).

ANOSIM confirmed treatment effects were present and significant (Global  $R=0.42$ ,  $p=0.001$ ). The relatively low  $R$  value of 0.42 shows differences and similarities between treatment pairs, as expected from an assemblage gradient apparent in the MNDS and cluster analysis. Pairwise contrasts showed this pattern (Table 20). Most significant differences were between communities exposed to high and low doses of Treated OSPW. Comparisons of communities in other doses showed greater similarity, evidenced by overlapping variability of assemblages from streams receiving those different OSPW treatments (Figure 29).

**Figure 29 Cluster dendrogram of fourth root transformed benthic invertebrate counts at the family level among mesocosm streams.**



Note: The line drawn at the 58% level of similarity shows three stream groups and two outliers, one from each of 100% Treated OSPW and 32% Treated OSPW. The demarcation is where the horizontal dotted line crosses vertical lines of the dendrogram.



SIMPER showed that larvae of five insect families cumulatively contributed more than 70% of the differences in assemblage patterns shown in Figure 28, Figure 29, and Table 20. They were the mayfly family Heptageniidae, the caddisfly Hydropsychidae, the oligochaete worm Naididae, dance flies (Empididae), and bloodworms/midges (Chironomidae). The Heptageniidae and Hydropsychidae were the same taxa that showed effects of the mesocosm experiment itself on assemblages (Table 19).

Comparison of abundances along with family richness and total abundance of all invertebrates across OSPW treatments showed that greatest abundance or richness occurred with some Treated OSPW addition, and lowest abundance or richness occurred at 100% Treated OSPW (Table 21). Few animals were present at 100% Treated OSPW. Largest abundance of total invertebrates, Heptageniidae, Hydropsychidae, Chironomidae, and highest family richness occurred at 3.2% Treated OSPW (Figure 25, Figure 26). Largest abundance of Naididae and Empididae occurred at 32% Treated OSPW.

**Table 20** Contrasts among all pairs of OSPW treatments found in the benthic invertebrate ANOSIM.

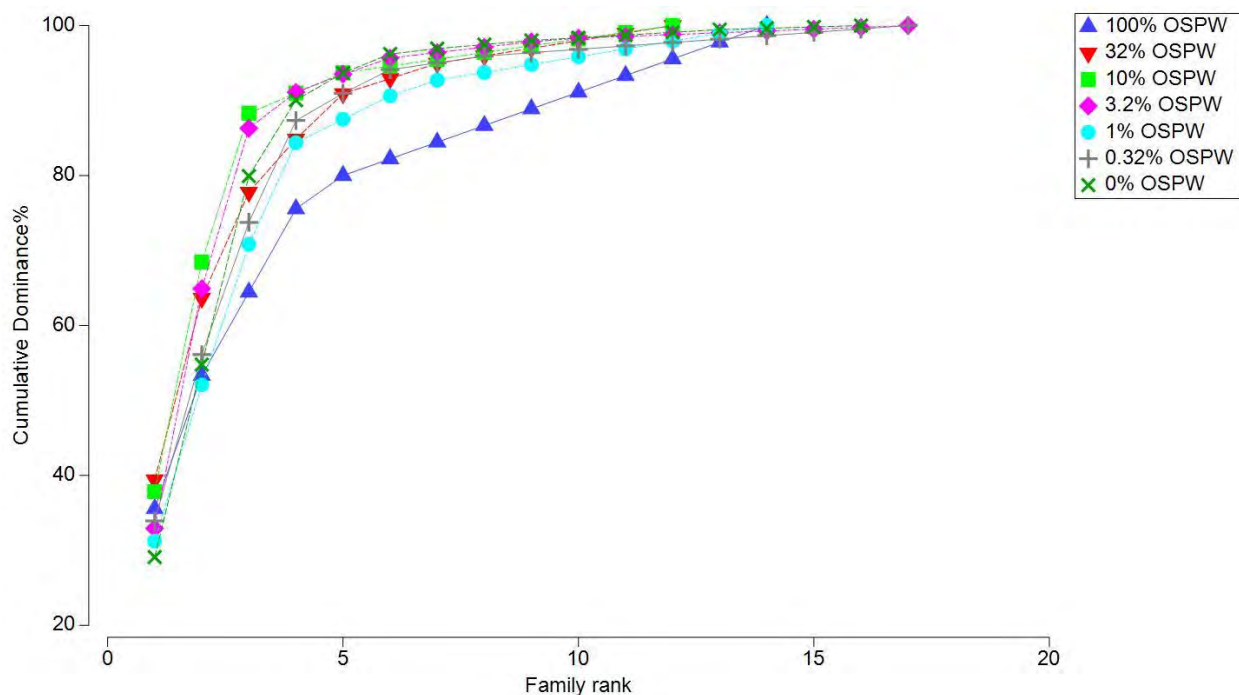
Pairwise Comparison of Mesocosm Treatments (% Treated OSPW)			R Statistic	Significance Level (%)	Possible Permutations	Actual Permutations	Number ≥ Observed
100%	vs	32%	-0.094	77.1	35	35	27
100%	vs	10%	0.021	42.9	35	35	15
<b>100%</b>	<b>vs</b>	<b>3.2%</b>	0.521	2.9	35	35	1
100%	vs	1%	0.052	31.4	35	35	11
<b>100%</b>	<b>vs</b>	<b>0.32%</b>	0.354	2.9	35	35	1
<b>100%</b>	<b>vs</b>	<b>0%</b>	0.783	0.2	495	495	1
32%	vs	10%	0.073	37.1	35	35	13
<b>32%</b>	<b>vs</b>	<b>3.2%</b>	0.604	2.9	35	35	1
32%	vs	1%	0.198	20	35	35	7
32%	vs	0.32%	0.292	8.6	35	35	3
<b>32%</b>	<b>vs</b>	<b>0%</b>	0.844	0.2	495	495	1
<b>10%</b>	<b>vs</b>	<b>3.2%</b>	0.854	2.9	35	35	1
10%	vs	1%	-0.104	68.6	35	35	24
10%	vs	0.32%	0.365	8.6	35	35	3
<b>10%</b>	<b>vs</b>	<b>0%</b>	0.732	0.2	495	495	1
3.2%	vs	1%	0.458	5.7	35	35	2
3.2%	vs	0.32%	-0.042	51.4	35	35	18
3.2%	vs	0%	0.022	41.6	495	495	206
1%	vs	0.32%	0.219	14.3	35	35	5
<b>1%</b>	<b>vs</b>	<b>0%</b>	0.607	0.6	495	495	3
<b>0.32%</b>	<b>vs</b>	<b>0%</b>	0.507	0.2	495	495	1

Global R was 0.42. Blue shading and **bold** shows significant differences ( $p < 0.05$ ) between contrasted treatments.



The cumulative family dominance plot showed assemblages in all treatments had high family dominance by having steeply rising curves with few families (i.e., cumulative dominance exceeded 80% at  $\leq 5$  families) (Figure 30). This diversity was much the same for all treatments except 100% Treated OSPW. For that treatment, the curve was flatter along the x-axis, showing greater richness for a given level of cumulative dominance than found in the other treatments. Given the very low abundances of common families (Heptageniidae, Hydropsychidae, Chironomidae, Naididae, and Empididae) at 100% Treated OSPW, this curve shows the richness could only be from rare taxa occurring uniquely and incidentally at 100% Treated OSPW. A run of SIMPER using a fourth-root transform to reveal rare and incidental taxa contributing to assemblage patterns showed these families were Pteronarcyidae (giant stoneflies), unidentified Trichoptera (i.e., caddisflies that were unrecognizable due to body damage that prevented family identification), Dytiscidae (water beetles), and Perlidae (stoneflies).

**Figure 30** Cumulative dominance plot for invertebrate families by treatment.





**Table 21**      **Diversity and abundance metrics showing differences of benthos assemblages between OSPW treatments in the mesocosm.**

Metric	Benthic invertebrate metric value $\pm$ standard deviation						
	0% Treated OSPW	0.32% Treated OSPW	1% Treated OSPW	3.2% Treated OSPW	10% Treated OSPW	32% Treated OSPW	100% Treated OSPW
Family richness (number of families)	8 $\pm$ 1.5	7.8 $\pm$ 2.1	7.3 $\pm$ 3	8.3 $\pm$ 1.3	6 $\pm$ 2.2	5.8 $\pm$ 2.2	5.5 $\pm$ 1.9
total abundance (number of individuals/stream)	69 $\pm$ 23	55 $\pm$ 28	24 $\pm$ 7	104 $\pm$ 20	28 $\pm$ 11	25 $\pm$ 12	11 $\pm$ 7
Heptageniidae (number of individuals/stream)	18 $\pm$ 14	7.5 $\pm$ 3.1	3.3 $\pm$ 2.8	22.3 $\pm$ 8.8	0.8 $\pm$ 0.5	0 $\pm$ 0	0.3 $\pm$ 0.5
Hydropsychidae (number of individuals/stream)	20 $\pm$ 5	19 $\pm$ 13	5 $\pm$ 2	33 $\pm$ 9	6 $\pm$ 1	6 $\pm$ 3	4 $\pm$ 2
Naididae (number of individuals/stream)	7 $\pm$ 9	10 $\pm$ 13	5 $\pm$ 5	5 $\pm$ 4	9 $\pm$ 3	10 $\pm$ 8	1 $\pm$ 1
Empididae (number of individuals/stream)	2 $\pm$ 1	2 $\pm$ 2	1 $\pm$ 1	2 $\pm$ 2	1 $\pm$ 1	2 $\pm$ 2	1 $\pm$ 2
Chironomidae (number of individuals/stream)	17 $\pm$ 8	12 $\pm$ 10	8 $\pm$ 1	34 $\pm$ 18	11 $\pm$ 9	4 $\pm$ 3	2 $\pm$ 2

Notes:

More than 70% of the dissimilarities of assemblages between treatments were due to variation in abundances of Heptageniidae, Hydropsychidae, Naididae, Empididae, and Chironomidae.

Blue shading shows the treatment where greatest value of a metric was found.

Orange shading shows the treatment where lowest value of a metric was found.



### 3.3.3 Biotic-Abiotic Linkages

The complete set of 249 chemical variables were reduced to 8 for *BioEnv* using steps described in Section 2.3.3.3. Hydrocarbons that were not detected or were at the detection limit were omitted. Group1 analytes were those being  $\geq 99\%$  correlated with each other, and included the majority of detectable metals and ions (i.e., alkalinity, conductivity, hardness, pH, turbidity, aluminum, antimony, arsenic, beryllium, boron, cadmium, calcium, chromium, cobalt, lithium, molybdenum, nickel, potassium, selenium, sodium, strontium, sulphur, uranium, vanadium, zirconium, chloride, fluoride, and sulphate), DOC, TOC, BOD<sub>5</sub> and COD, which increased in treatments with higher doses of Treated OSPW (see Section 3.1.1.2), and therefore changed most with Treated OSPW dose. Analytes that were consistently non-detectable in all treatments, such as naphthenic acids, were excluded from this analysis.

Conductivity was selected as an indicator of Group1 because it characterized contribution to saline conditions by others in the group. All other analytes in Group1 were omitted from *BioEnv* because of their strong co-linearity with conductivity. Any one of them could have been selected and would lead to the same outcome in *BioEnv* because of the very high inter-correlations. A selection of Group2 analytes obtained after filtering at a 95% correlation cut-off (See Section 2.3.3.3) included copper, lead, manganese, mercury, thallium, zinc, COD, and molar N:P, all of which showed weak correlation with increasing concentrations of Treated OSPW. The final set of analytes used for matching with the benthos matrix included conductivity (as an indicator for Group1 chemicals), copper, lead, manganese, mercury, zinc, orthophosphate, and dissolved inorganic nitrogen (DIN).

The *BioEnv* analysis showed conductivity alone (as an indicator of Group1 chemicals) was 57% correlated with the benthos family assemblages (Table 22). Addition of another four analytes to conductivity (Group1 chemicals), namely DIN, orthophosphate, and dissolved copper and manganese, improved the correlation between matrices to 65%. However, these incremental improvements in model fit were small relative to the conductivity-only model, indicating that the dominant correlation between mesocosm-stream benthos assemblages and water quality was associated with conductivity and the associated metals of Group1.

**Table 22** Best combination of up to five chemical variables correlated with benthos assemblages in the mesocosm from *BioEnv* analysis.

Number of chemical variables	Spearman correlation between chemical and benthos matrices	Chemicals best matching benthos assemblages
1	0.57	Conductivity as an indicator of Group1 chemicals
2	0.59	Conductivity as an indicator of Group1 chemicals, dissolved copper
3	0.62	Conductivity as an indicator of Group1 chemicals, dissolved manganese, DIN
4	0.64	Conductivity as an indicator of Group1 chemicals, dissolved manganese, DIN, ortho-P
5	0.65	Conductivity as an indicator of Group1 chemicals, dissolved manganese, DIN, ortho-P, dissolved copper



### 3.3.4 Zooplankton Present in the Stage 3 Polishing Pond

During the test period, biological activity was noted in the Stage 3 polishing pond, most obviously by the green-brown colour of the water indicating primary production by phytoplankton, but also upon closer inspection by the visual presence of zooplankton in the pond water. Opportunistic sampling of Treated OSPW from the head tank at the mesocosm facility showed that several invertebrate species had colonized the Stage 3 pond, including rotifers, waterfleas (Cladocera), copepods and chironomid larvae (Table 23). Note that screens on head-tank outflows prevented these organisms from adding to the measured benthic community in the mesocosm streams.

**Table 23** Zooplankton present in the Stage 3 holding pond and Athabasca River water, as collected from the Treated OSPW and river-water head tanks, September 23, 2021.

Major Taxon	Genus/Species	Count of Organisms (#)
<b>Treated OSPW Head Tank</b>		
Rotifera	<i>Notholca</i> sp.	1,288
Crustacea: Cladocera	<i>Moina</i> sp.	1,005
Crustacea: Copepoda	Cyclopoida indet.	414
Crustacea: Copepoda	<i>Acanthocyclops</i> sp.	225
Crustacea: Copepoda	<i>Tropocyclops</i> sp.	105
Rotifera	<i>Platylabus patulus</i>	63
Insecta: Diptera	Chironomidae indet.	13
Crustacea: Cladocera	<i>Chydorus</i> sp.	6
Crustacea: Copepoda	<i>Eucyclops agilis</i>	5
Crustacea: Cladocera	<i>Bosmina longirostris</i>	2
Crustacea: Cladocera	<i>Daphnia mendotae</i> complex	1
<b>River Water Head Tank</b>		
Rotifera	<i>Conochilus</i> sp.	160
Rotifera	<i>Notholca</i> sp.	112
Crustacea: Copepoda	<i>Acanthocyclops</i> sp.	66
Crustacea: Copepoda	<i>Tropocyclops</i> sp.	10
Crustacea: Cladocera	<i>Bosmina longirostris</i>	5
Insecta: Diptera	Chironomidae indet.	3
Crustacea: Copepoda	<i>Eucyclops agilis</i>	2

When compared with organisms collected similarly from the river-water holding tanks, Treated OSPW supported generally similar taxa (i.e., all taxa present in river water also were present in Treated OSPW except the rotifer *Conochilus* sp.), with more Cladocera (waterflea) species collected from Treated OSPW. The two most abundant taxa in the Treated OSPW sample, the rotifer *Notholca* and the cladoceran *Moina*, are known to be tolerant of saline conditions.



## 4.0 SYNTHESIS AND DISCUSSION

### *Weight of Evidence Assessment*

Multiple lines of evidence (chemical, toxicological, and biological) assembled through this study are presented in a simple weight-of-evidence assessment in Table 24. In this table, dark circles show concentrations of Treated OSPW in Athabasca River water where a potential adverse response was observed, as measured by exceedance of a water quality guideline, an observed toxicological endpoint response (typically IC25 or LC50), or a difference in biological community endpoints; open circles show no such effect at that dilution.

Overall, results confirm the effectiveness of the PC-treatment process to eliminate acute toxicity and reduce sublethal effects of OSPW on aquatic organisms and communities. Although several study endpoints showed effects of Treated OSPW at full-strength (100%) concentration, fewer endpoints showed effects of Treated OSPW when mixed with Athabasca River water. Of the 249 water quality analytes measured, only seven exceeded relevant aquatic-life guidelines in 100% Treated OSPW (i.e., pH, chloride, sulphate, dissolved aluminum, total selenium, total arsenic and dissolved vanadium). Only one (dissolved vanadium) exceeded its guideline in several dilutions (i.e., also in 32% and 56% Treated OSPW). Although half of the 12 survival or viability toxicity endpoints showed effects in 100% Treated OSPW, these results were confounded by microbial effects on fathead minnow. That is, toxicity was substantially reduced after anti-microbial treatments were applied. Furthermore, control failure occurred in the walleye early-life-stage test. *Ceriodaphnia dubia*, freshwater mussel glochidia (larval stage) and fingernail clams showed effects on survival or viability at mean LC50/EC50 values of 56.7%, 72.7% and 74.8% respectively. Sublethal effects were noted to fathead minnow growth in long-term and short-term exposures at concentrations above 50% Treated OSPW, but generally not to other fathead minnow sublethal endpoints. The most apparent sublethal effects were to growth of green algae, which was reduced at a mean IC25 of 13.3%, and *Ceriodaphnia dubia* reproduction (mean IC25 = 20.1%). Walleye tests did not show sublethal effects of 100% Treated OSPW.

The observed inhibition of algal growth in the toxicity tests was corroborated in the mesocosms, where periphyton growth rates and total biomass accrual were negatively affected at concentrations of 3.2% and higher. Shifts in algal community structure, and benthic invertebrate abundance and community composition, were apparent at Treated OSPW concentrations of 10% and higher.

The progressive nature of toxicological and biological changes observed in study endpoints with increasing doses of Treated OSPW and the very strong correlation of nearly all Treated OSPW-associated water quality analytes with these doses, clearly shows an effect of Treated OSPW on study endpoints, with the most sensitive endpoints (i.e., algal growth and community structure) showing effects at Treated OSPW mixtures of 3.2% and higher, other toxicological and biological endpoints showing effects at doses of 10% to 50%, and several endpoints only showing effects in 100% Treated OSPW.

At doses of 3.2% Treated OSPW or less in Athabasca River water, some toxicological and biological endpoints showed small stimulatory effects on growth, biomass or abundance. Across the tested dilution series, the 3.2% dilution provided a threshold between negligible or stimulatory effects and adverse effects of Treated OSPW, with doses above 3.2% having risk of showing adverse aquatic effects.



**Table 24** Summary of ecotoxicity study endpoints, relative to exposure to Treated OSPW in a mixture with Athabasca River water.

Study endpoint	Treated OSPW concentration in Athabasca River water							
	0%	0.32%	1.0%	3.2%	10%	32%	56%	100%
<b>Water quality (concentrations exceeding a water quality guideline)</b>								
pH	○	○	○	○	○	○	○	●
Chloride	○	○	○	○	○	○	○	●
Sulphate	○	○	○	○	○	○	○	●
Dissolved aluminum	○	○	○	○	○	○	○	●
Total arsenic	○	○	○	○	○	○	○	●
Total selenium	○	○	○	○	○	○	○	●
Dissolved vanadium	○	○	○	○	○	●	●	●
All other water quality endpoints	○	○	○	○	○	○	○	○
<b>Toxicity (test endpoint value relative to a tested Treated OSPW concentration)</b>								
<i>Survival endpoints (LC50)</i>								
Rainbow trout (acute test)	○	○	○	○	○	○	○	○
<i>Daphnia magna</i> (acute test)	○	○	○	○	○	○	○	○
Fathead minnow early life-stage (28d)	○	○	○	○	○	○	○	●*
Fathead minnow juv. (28d)	○	○	○	○	○	○	○	●*
Fathead minnow juv. (7d)	○	○	○	○	○	○	○	●*
<i>Ceriodaphnia dubia</i>	○	○	○	○	○	○	○**	●
<i>Hyalella azteca</i>	○	○	○	○	○	○	○	○
Clam EC50 (28d)	○	○	○	○	○	○	○	●
Mussel EC50 (48h)	○	○	○	○	○	○	○	●
Walleye overall	○	○	○	○	○	○	○	●***
Walleye post-hatch	○	○	○	○	○	○	○	○
<i>Sublethal endpoints (IC/EC25)</i>								
Fathead minnow early life-stage	○	○	○	○	○	○	○	●
Fathead minnow juv.	○	○	○	○	○	○	○	●
Fathead minnow 7-day	○	○	○	○	○	○	●	●
Green alga growth****	○	○	○	○	○**	●	●	●
<i>C. dubia</i> reproduction	○	○	○	○	○	●	●	●
<i>H. azteca</i> growth	○	○	○	○	○	○	○	●
Clam growth (weight)	○	○	○	○	○	○	○	-
Clam growth (length)	○	○	○	○	○	○	○	-
Walleye hatch success	○	○	○	○	○	○	○	○
Walleye growth (weight)	○	○	○	○	○	○	○	○
Walleye growth (length)	○	○	○	○	○	○	○	○
Walleye development	○	○	○	○	○	○	○	○
<b>Mesocosm exposures (apparent effects on algal growth or community composition)</b>								
Periphyton growth rate	○	○	○	●	●	●	-	●
Periphyton biomass	○	○	○	●	●	●	-	●
Invertebrate abundance	○	○	○	○	●	●	-	●
Invertebrate richness	○	○	○	○	○	○	-	●
Invertebrate community similarity	○	○	○	○	●	●	-	●

● = Effect observed at that concentration; ○ = No effect observed at that concentration; - = No data

\* Fathead minnow survival and reproduction endpoints affected by microbial growth in exposures in first half of study.

\*\* Calculated toxicological endpoint value (IC25 or LC50) just above this exposure concentration.

\*\*\* Walleye survival failure in control exposures.

\*\*\*\* Growth inhibition observed relative to river-water control but not relative to laboratory-water control.



Results of the mesocosm experiment indicated several complex or subtle effects of Treated OSPW exposure that would not have been apparent in single-species toxicity tests. Addition of the Treated OSPW caused changes in potential nutrient deficiency, based on measurement of molar N:P. Ratios showed potential co-limitation by N and P in unamended river water and with additions of treated OSPW up to 3.2% treated OSPW. At 32% treated OSPW, the ratio of 66.4 showed a shift to greater phosphorus deficiency due to relatively high ammonia concentrations. Highest DIN and second-highest ortho-P concentrations occurred at this 32% level, implying nutrient enrichment at this dose relative to all others, despite relatively low accrual rates on Styrofoam balls and rocks in mesocosm streams at this dilution. At 100% treated OSPW, the molar N:P reverted to co-limitation but at the very low end. Growth of periphyton exposed to that dose was potentially more N-limited than P-limited. Enrichment effects were apparent in the periphyton assemblages, but these were small: relative specific growth rates in 0.32 and 3.2% Treated OSPW were 102 and 103% of the 0% Treated OSPW dose, respectively. In all other cases the addition of treated OSPW caused a decline in relative specific growth rates, thus showing inhibition of algal growth from the addition of treated OSPW.

The mesocosm periphyton community shifted from mainly diatoms to mainly blue-green algae (Cyanophyta, or cyanobacteria) with increasing dose of Treated OSPW, with the largest change above 3.2% Treated OSPW; only one order of diatoms (Aulacoseirales) was present at higher doses of Treated OSPW. Diatoms are ubiquitous to waters with low nutrient concentrations and are highly reactive to small amounts of nutrient addition (Bothwell 1989), until larger additions favour blue-green algae (Wetzel 2001). Many blue-green algae and some green algae that increased in prevalence with increasing dose of Treated OSPW may have a competitive advantage for acquiring nutrients, mainly phosphorus at high nutrient concentrations (Wetzel 2001). Many blue-green algae can fix their own nitrogen, which makes them even more competitive at relatively high phosphorus concentrations and low nitrogen concentrations, and may be large-celled taxa that are not well ingested by invertebrates. Several taxa of blue-green algae can produce a toxin called microcystin that can affect a wide range of organisms (Christofferson 2019), including taxa (i.e., Nostocales, Chroococcales, Oscillatoriales; Pilon et al. 2019) that were present in low abundance in mesocosm treatments with greater than 3.2% Treated OSPW.

Highest benthos densities and richness were found at 3.2% treated OSPW. This treatment supported highest algal growth rates and may be related to the small enrichment that was detected at that OSPW dose. However, benthos may have been sensitive to lessened food supply due to declining periphyton growth rates and standing biomass at doses of Treated OSPW above 3.2%. It is unknown if autotrophic areal biomass and production was actually low enough to cause increasing food limitation for benthos in the mesocosm above 3.2% treated OSPW, but it cannot be ruled out. Benthos can be sensitive to small changes in autochthonous production as noted in many food web studies (e.g., Ardon et al. 2020). Benthos taxa most affected at high doses of treated OSPW were also those that provide food supply to fish populations in northern rivers (Little et al. 1998), notably Heptageniid mayflies, Hydropsychid caddisflies, and Chironomids. Larvae of these taxa include scrapers and collector-gatherers or collector-filterers that feed on periphyton and detritus associated with periphyton (Merritt and Cummins 1996). As a result, benthos may have been sensitive to declining availability of food associated with lower periphyton production in mesocosm streams at doses of Treated OSPW greater than 3.2%.



## Potential Causes of Observed Effects

Although the most toxic constituents of untreated OSPW are generally considered to be organic acids and hydrocarbons, those hydrocarbons were nearly universally absent from Treated OSPW in all tests undertaken throughout the study. Naphthenic acids were undetectable in all treatments. Therefore, it is clear that these traditional sources of toxicity in OSPW were not causative agents of observed effects of Treated OSPW, reinforcing the effectiveness of the coke-treatment process to remove these chemicals from OSPW.

Investigative toxicity tests undertaken during the study—using pH adjustment to reduce the high pH of Stage 3 Treated OSPW, and testing of Stage 2 effluent, which had both lower pH and higher carbonate and ammonia—indicated that the high pH of Treated OSPW was not likely the cause of observed progressive effects on toxicological and biological endpoints. The Stage 3 pond did not substantively alter observed effluent toxicity (although algal growth inhibition was reduced in Stage 2 effluent).

Some dissolved metals or ions exceeded water quality guidelines for the protection of aquatic life in 100% Treated OSPW (i.e., vanadium, boron, arsenic, selenium, chloride, sulphate). Concentrations of all of these analytes except vanadium were below protective guidelines in all Treated OSPW doses less than 100% Treated OSPW. This finding shows that exposures to these individual analytes may not have caused the progressive effects observed in decreasing doses below 100%. Even in 100% Treated OSPW, concentrations of all of these analytes other than vanadium were below published effect-thresholds (which are higher than guidelines) for the species tested, which further supports this proposition.

Dissolved vanadium concentrations exceeded the Federal guideline of 120 µg/L in doses of 32% to 100%, with concentrations of 565 to 1,800 µg/L (= 0.57 and 1.8 mg/L) in these doses, respectively. These concentrations do exceed recently published effect-thresholds for vanadium in water with hardness and alkalinity comparable to Athabasca River water (Table 25; data from Schiffer 2016), particularly for *C. dubia* and fathead minnow. These survival results for fathead minnow correspond well with the reduced survival observed in the present study, in which mortality was observed in the full-strength samples (1.8 mg/L V), but not in the sample that had been diluted to 32%. Adverse responses on growth of fathead minnows were negligible in concentrations less than 0.58 mg/L V in the exposure conducted by Schiffer (2016), also consistent with the present dataset in which sublethal effects were not evident in treatments that did not exhibit mortality.

Although Schiffer (2016) reported a 72-h IC25 for green algae of 3.24 mg/L V, which exceeds the 1.8 mg/L that was present in the samples, other studies have found greater sensitivity of algae to vanadium. Nalewajko et al. (1995) reported a Lowest Observable Effect Concentration in 7- to 10-d exposures for *Diatoma elongatum* and *Ankistrodesmus falcatus* of 0.1 mg/L V, which is less than concentrations of vanadium in Treated OSPW dilutions of 10% or higher in this study. The authors noted that in phosphorus-sufficient cultures, vanadium was inhibitory when the vanadium concentration exceeded the phosphate concentration, whereas in P-deficient cultures, depression of photosynthesis by vanadium increased with increasing phosphorus deficiency. Nalewajko et al. (1995) hypothesized that algal cells cannot distinguish between orthovanadate ( $\text{VO}_4^{3-}$ , the primary V species present at pH 6 to 9) and orthophosphate ( $\text{PO}_4^{3-}$ ) which could lead to competition at uptake sites, leading to competition of vanadium with phosphate for uptake by algal cells. This may decrease photosynthesis due to competitive exclusion of this nutrient. Nalewajko et al. (1995) found blue-green algae to be less sensitive to vanadium than diatoms, while green algae were more intermediate in their sensitivity.



**Table 25** Effects concentrations observed for aquatic organisms exposed to dissolved vanadium at hardness and alkalinity levels comparable to Athabasca River water by Schiffer (2016).

Test Species	Test Endpoint		Effect concentration, mg/L V (95% confidence limit)
Waterflea ( <i>Daphnia pulex</i> )	Survival	48-h LC50	2.2 (1.9 - 2.5)
Waterflea ( <i>Ceriodaphnia dubia</i> )	Survival	48-h LC50	1.0 (-)
		7-d LC50	0.5 (0.4 - 0.6)
	Reproduction	7-d EC50	0.5 (0.2 - 0.6)
Green alga ( <i>Pseudokirchneriella subcapitata</i> )	Growth	72-h IC20	3.7 (2.9 – 4.3)
Fathead minnow ( <i>Pimephales promelas</i> )	Survival	7-d LC50	1.0 (0.8 – 1.1)
		28-d LC50	0.5 (0.4 – 0.6)

In addition to competition with orthophosphate, authors including Giles et al. (1979) and Gillio Meina et al. (2020a,b) report mechanisms of toxicity of dissolved vanadium to aquatic biota related to impacts on ion regulation, particularly associated with sodium and calcium uptake.

Although the concentrations of individual ions in Treated OSPW were below concentrations likely to make them causative agents of observed effects on their own, it is likely that the overall ionic strength of Treated OSPW mixtures was sufficiently high to create osmotic stresses in study organisms and communities. Components of TDS in the undiluted effluent approached the known salinity threshold for toxicity to *C. dubia*. For example, the average concentration of TDS was 1,920 mg/L in the effluent, and included 578 mg/L sulphate and 406 mg/L of chloride, with a hardness of 85.6 mg/L; toxicity of both of these constituents are dependent on hardness. The IC25 for reproduction of *C. dubia* was reported as 855 mg/L sulphate (Elphick et al. 2011a) and 454 mg/L chloride (Elphick et al. 2011b) at a similar hardness of 80 mg/L. While the measured values were somewhat lower than the IC25s reported for both constituents, their combined presence would likely have been sufficient to contribute to toxicity in 100% Treated OSPW. However, it is unlikely that toxicity caused by TDS would have been evident in the diluted samples. At the geometric mean IC25 for *C. dubia* of 20.4% sample, the TDS would have been 522 mg/L, containing 150 mg/L sulphate and 86 mg/L of chloride at a hardness of 129 mg/L; these values are well below the thresholds for toxicity to this species, indicating that it is unlikely that salinity on its own was the primary cause of toxicity in the samples. Additive effects of high salinity with other elements in Treated OSPW on aquatic biota are plausible, particularly effects of high salinity with dissolved vanadium, which is known to adversely affect ion regulation (Gillio Meina et al. 2020a,b). Additive or, in rare cases, synergistic effects of other of metals mixtures with salinity also have been observed (e.g., see Gebara et al. 2020, Tang et al. 2013, Gao et al. 2020).

Nutrients added with Treated OSPW likely also affected some study endpoints in both the mesocosm and in toxicity testing, but to a minor degree. Several sublethal tests showed evidence of hormesis at low doses, and enrichment effects were seen in the mesocosm periphyton specific growth rates but they were small



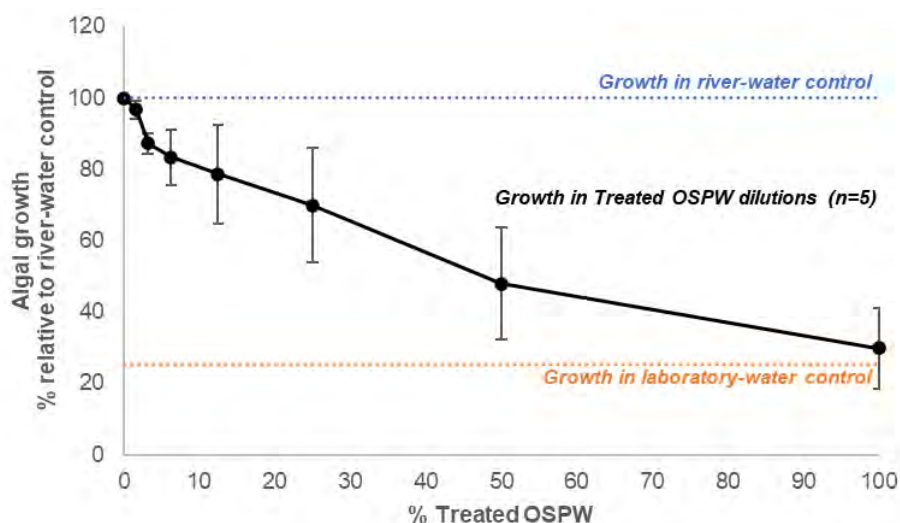
(i.e., relative specific growth rates at 3.2% and 0.32% Treated OSPW showed only an incremental 2-3% increase over the 0% Treated OSPW control). In all other cases the addition of treated OSPW caused a decline in relative specific growth rates that showed inhibition of algal growth from the addition of treated OSPW. It is possible that observed algal growth inhibition seen in mesocosm streams and toxicity testing was caused by the same or different agents than what caused other adverse effects observed on other study endpoints. Inclusion of N and P concentrations among variables best explaining benthos community structure at different Treated OSPW doses showed that small additions of the treated OSPW provided a trophic benefit to benthos. However, above the 3.2% treated OSPW, any benefit was offset by loss of benthos.

Nutrient supply was not the likely cause of increasing blue-green algae prevalence in mesocosm streams with higher Treated OSPW. The marked decline of relative specific growth rates of periphyton above 3.2% Treated OSPW was opposite to what to expect if nutrient supply was the main factor driving conditions favouring the blue-green algae, given the nutrient enrichment at those higher levels of treated OSPW. At more than 3.2% treated OSPW, the aqueous mixture reduced the growth rates to the point that at 100% treated OSPW, growth rates were less than half of those in unamended river water. This finding means that constituents other than nutrients in the Treated OSPW caused a decline in growth rate of diatoms, favouring blue-green algae but at lower growth rates than in 0% Treated OSPW.

Although increasing concentration of treated OSPW was associated with decreased growth of algae in both the laboratory tests and mesocosms, these comparisons were made relative to the growth observed in the Athabasca River water control, and not (in the case of the algal test) to laboratory water control, which was tested alongside these river-water and Treated OSPW exposures. Although a clear depression of growth was observed relative to river water, all Treated OSPW exposures exhibited higher growth than the laboratory control in the algal growth tests (Figure 31), indicating that the effect that was observed reflects a modified growth rate between treatments, which could either have been caused by differences in availability of nutrients between treatments, or by a toxicological effect. It is notable that the treated effluent had pH exceeding 9, and this might be expected to reduce algal growth in the toxicity test because of decreased availability of carbon dioxide in solution, which is used for algal growth. At pH 9, approximately half of the carbonate buffer system is present in the form of  $\text{CO}_3^{2-}$  and the other half as  $\text{HCO}_3^-$ , which a very small percentage present as  $\text{H}_2\text{CO}_3$  (which dissociates to provide  $\text{CO}_2$ ). Alternatively, the high pH could have altered the solubility and bioavailability of required nutrients such as iron. These processes were not relevant in the mesocosm given flow-through test waters would have continually refreshed carbonate or iron in all exposures.



**Figure 31** Growth of green algae in increasing Treated OSPW dilutions in river water, relative to growth in 100% river water and laboratory-water control.



Treatments greater than 3.2% treated OSPW showed declining abundances and richness of the community along with shifts in dissimilarity of assemblages. Potential adverse effects of salinity or dissolved metals were additive to effects associated with food-web interactions driven by change to periphyton assemblages and growth rates caused by the treated OSPW. The relative importance of each process cannot be defined in the present design, but both could contribute to the observed changes in benthos assemblages across the spectrum of treated OSPW additions.

Taken collectively, evidence suggests a potential combined effect of high salinity and high dissolved vanadium concentrations in Treated OSPW on aquatic biota. These effects may inter-relate because of vanadium's potential mode of action via impacts on osmotic regulation. Competitive relationships between vanadium and phosphorus availability may also have contributed to effects observed on green algae in toxicity testing and periphyton growth and biomass in mesocosm treatments.

### Methodological Observations

There was broad agreement among all study endpoints, within and across study components. Among the large number of toxicity tests, long-term (28-30d) tests showed similar results to short-term (7-day) tests. Extended fathead minnow tests undertaken on-site and in the laboratory also gave comparable results. Therefore, future single species studies could use short-term tests without sacrificing data quality or reducing the meaningfulness of results.

Toxicity tests using native species were similar to or less sensitive to Treated OSPW than tests using standard laboratory species. A downside of the native species tests is they were prone to culture/control failures (i.e., walleye) and challenging to plan and execute due to the sporadic availability of test organisms at the right life-stage. There were few places where these organisms are cultured and available for testing. Using similar endpoints, fathead minnow was more sensitive to Treated OSPW than walleye, and *Ceriodaphnia dubia* was more sensitive than freshwater bivalves. These comparisons show that conventional test species using standard toxicological methods may be good proxy test species for native species such as walleye and freshwater bivalves during any laboratory testing. Regardless of this finding, if a Treated OSPW discharge to the Athabasca River is approved, an effects-monitoring program that



targets local aquatic species and communities would be essential. The present results show that this potential future monitoring could be supported with toxicity testing using a range of standard test species with direct relevance to protection of aquatic life in the Athabasca River.

The mesocosm was an effective tool to examine structural and functional benthic community response to dilutions of Treated OSPW. The facility supported a controlled community-level experiment that allowed for definitive testing of hypotheses, a considerable advance over field-based monitoring where hypothesis testing may be challenging. It also incorporated a community of endemic benthic taxa rather than single test species, thus introducing elements of realism at the community level that are not possible with standard toxicity tests. When used in combination with toxicity testing as was done in this project, the result provided comprehensive and integrated insight into both physiological response to contaminants at the species level (single species toxicity tests) and at the whole community level with combined trophic levels (mesocosm experiment). The mesocosm was a hybrid of different testing approaches that incorporated ecological realism (i.e., using Athabasca River organisms), and fresh river water and freshly treated OSPW held for not more than a few hours before it passed through each stream. The use of precision pumps and controlled stirrers allowed for clear demarcation of treated OSPW dilutions, chemically identical replicates within each treatment level, and consistent physical conditions among treatments and replicates within treatments. This level of control was similar to that experienced in a lab setting common to standard toxicity testing with added benefit of using endemic biota common to less controlled monitoring studies.

Observed differences in benthic communities sampled directly from the river and from the mesocosm after study completion indicated effects of handling, transport and animal incubation on invertebrate assemblages. Reduced abundance of common taxa, mainly larvae of the Heptageniid mayflies and Hydropsychid caddisflies, was the main effect of this handling. The mean density of invertebrates at 0% OSPW was 69 individuals per stream at the time of final harvest or about 24% of the starting density. This density was less than that reported in the earlier mesocosm experiments using similar equipment, and less than that found in direct tests of mesocosm effects on benthos by Schmidt et al. (2018). These differences likely relate to site logistics, including longer holding times before distribution to the mesocosm streams (i.e., hours versus less than an hour inferred from methods descriptions by Alexander et al. 2008 and Culp et al. 2003). Within that holding time, mortalities may have occurred in association with physical movement, lack of flow, temperature variation in jars within coolers despite temperature control using baths of river water, and other unknown factors. Once in the streams, further mortalities may have occurred as animals distributed themselves among the installed substrata that were somewhat different from those in the river.

Overall, the combined and harmonized chemical, toxicological and biological elements of this study were effective at identifying aquatic-effects thresholds for different dilutions of Treated OSPW in Athabasca River water. Endemic periphytic algae and standard green algae test species were found to be most sensitive among tested organisms and communities followed in order of decreasing sensitivity by endemic benthic invertebrates, standard zooplankton test organisms, standard single fish species test organisms, and endemic fish species. This gradient of response could only be detected using the integrated applications of standard toxicity testing and the mesocosm scale experiment. All testing pointed to high concentrations of vanadium within a saline matrix as being important in contributing to the observed change in community structure and mortalities exposed to treated OSPW. No effect of the Treated OSPW using the integrated triad approach of toxicity testing and mesocosm-scale experiment on any organism or community metric was found at dilutions less than 3.2% Treated OSPW in Athabasca River water.



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## APPENDICES

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## **Appendix A1**

### **Exposure Assessment (Environmental Chemistry): Detailed Results and Supporting Data**

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## **Appendix A1.1**

### **Summary of Water Quality and Tissue Analytes and Analytical Methods**

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**Table A1.1 List of analytical chemistry targets in surface waters and tissues.**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
Calculated Variables	Anion Sum	meq/L	-	Auto Calc	BV
	Cation Sum	meq/L	-	Auto Calc	BV
	Hardness (CaCO <sub>3</sub> )	mg/L	0.5	Auto Calc	BV
	Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	0.5	Auto Calc	BV
	Total Hardness (CaCO <sub>3</sub> )	mg/L	0.5	Auto Calc	BV
	Ion Balance (% Difference)	%	-	Auto Calc	BV
	Dissolved Nitrate (N)	mg/L	0.01	Auto Calc	BV
	Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.044	Auto Calc	BV
	Dissolved Nitrite (NO <sub>2</sub> )	mg/L	0.033	Auto Calc	BV
	Calculated Total Dissolved Solids	mg/L	10	Auto Calc	BV
	Un-Ionized Ammonia	mg/L	0.0035	Auto Calc	BV
Field Variables	Field pH	-	-	Field Test	BV
	Field Temperature (Fd)	°C	-	-	BV
Conventional Variables	Biochemical Oxygen Demand	mg/L	2.0	SM 23 5210B m	BV
	Chemical Oxygen Demand	mg/L	10	SM 23 5220D m	BV
	Conductivity	µS/cm	2	SM 23 2510 B m	BV
	Dissolved Organic Carbon (C)	mg/L	0.5	MMCW 119 1996 m	BV
	pH	-	-	SM 23 4500 H+ B m	BV
	Total Organic Carbon (C)	mg/L	0.5	MMCW 119 1996 m	BV
	Total Dissolved Solids	mg/L	10	SM 23 2540 C m	BV
	Total Suspended Solids	mg/L	1	SM 23 2540 D m	BV
Anions	Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	1	SM 23 2320 B m	BV
	Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	1	SM 23 2320 B m	BV
	Bicarbonate (HCO <sub>3</sub> )	mg/L	1	SM 23 2320 B m	BV
	Carbonate (CO <sub>3</sub> )	mg/L	1	SM 23 2320 B m	BV
	Dissolved Fluoride (F)	mg/L	0.05	SM 23 4500-F C m	BV
	Hydroxide (OH)	mg/L	1	SM 23 2320 B m	BV
	Orthophosphate (P)	mg/L	0.001	SM 23 4500-P A, F m	BV
	Dissolved Chloride (Cl)	mg/L	5	SM23-4500-Cl/SO4-E m	BV
	Dissolved Sulphate (SO <sub>4</sub> )	mg/L	5	SM23-4500-Cl/SO4-E m	BV
Nutrients	Total Ammonia (N)	mg/L	0.015	SM 23 4500 NH <sub>3</sub> A G m	BV
	Total Inorganic Carbon (C)	mg/L	1	Modified AE 2411	BV
	Dissolved Phosphorus (P)	mg/L	0.001	SM 23 4500-P A,B,F m	BV
	Total Phosphorus (P)	mg/L	0.001	SM 23 4500-P A,B,F m	BV
	Dissolved Nitrite (N)	mg/L	0.01	Auto Calc	BV
	Dissolved Nitrate plus Nitrite (N)	mg/L	0.01	Auto Calc	BV
	Total Nitrogen (N)	mg/L	0.1	SM 23 4500-N C m	BV
Misc. Organics	Naphthenic Acids	mg/L	2	EPA 3510C R3 / FTIR	BV
Physical Properties	True Colour	PtCo units	2	SM 23 2120 C m	BV
	Turbidity	NTU	0.1	SM 23 2130 B m	BV
Extractable Petroleum Hydrocarbons	F1 (C6-C10)-BTEX	mg/L	0.1	Auto Calc	BV
	F1 (C6-C10)	mg/L	0.1	Auto Calc	BV
	F2 (C10-C16 Hydrocarbons)	mg/L	0.1	CCME PHC-CWS m	BV
	F3 (C16-C34 Hydrocarbons)	mg/L	0.1	CCME PHC-CWS m	BV
	F4 (C34-C50 Hydrocarbons)	mg/L	0.2	CCME PHC-CWS m	BV
Polycyclic Aromatic Hydrocarbons	B[a]P TPE Total Potency Equivalents	µg/L	0.01	Auto Calc	BV
	Acenaphthene	µg/L	0.1	EPA 8270e m	BV
	Acenaphthylene	µg/L	0.1	EPA 8270e m	BV
	Acridine	µg/L	0.04	EPA 8270e m	BV
	Anthracene	µg/L	0.01	EPA 8270e m	BV
	Benzo(a)anthracene	µg/L	0.0085	EPA 8270e m	BV
	Benzo(b&j)fluoranthene	µg/L	0.0085	EPA 8270e m	BV



**Table A1.1 (Cont'd.)**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
	Benzo(k)fluoranthene	µg/L	0.0085	EPA 8270e m	BV
	Benzo(g,h,i)perylene	µg/L	0.0085	EPA 8270e m	BV
	Benzo(c)phenanthrene	µg/L	0.05	EPA 8270e m	BV
	Benzo(a)pyrene	µg/L	0.0075	EPA 8270e m	BV
	Benzo(e)pyrene	µg/L	0.05	EPA 8270e m	BV
	Chrysene	µg/L	0.0085	EPA 8270e m	BV
	Dibenz(a,h)anthracene	µg/L	0.0075	EPA 8270e m	BV
	Fluoranthene	µg/L	0.01	EPA 8270e m	BV
	Fluorene	µg/L	0.05	EPA 8270e m	BV
	Indeno(1,2,3-cd)pyrene	µg/L	0.0085	EPA 8270e m	BV
	Indeno(1,2,3-cd)fluoranthene	µg/L	0.0085	EPA 8270e m	BV
	2-Methylnaphthalene	µg/L	0.1	EPA 8270e m	BV
	Naphthalene	µg/L	0.1	EPA 8270e m	BV
	Phenanthrene	µg/L	0.05	EPA 8270e m	BV
	Perylene	µg/L	0.05	EPA 8270e m	BV
	Pyrene	µg/L	0.02	EPA 8270e m	BV
	Quinoline	µg/L	0.2	EPA 8270e m	BV
	Retene	µg/L	0.05	EPA 8270e m	BV
	C1-Naphthalene	µg/L	0.1	EPA 8270e m	BV
	C3-Naphthalene	µg/L	0.1	EPA 8270e m	BV
	C4-Naphthalene	µg/L	0.1	EPA 8270e m	BV
	C2-Naphthalene	µg/L	0.1	EPA 8270e m	BV
	Biphenyl	µg/L	0.02	EPA 8270e m	BV
	C1-biphenyl	µg/L	0.02	EPA 8270e m	BV
	C2-biphenyl	µg/L	0.02	EPA 8270e m	BV
	C1-fluorene	µg/L	0.05	EPA 8270e m	BV
	C2-fluorene	µg/L	0.05	EPA 8270e m	BV
	C3-fluorene	µg/L	0.05	EPA 8270e m	BV
	Dibenzothiophene	µg/L	0.02	EPA 8270e m	BV
	C1-dibenzothiophene	µg/L	0.02	EPA 8270e m	BV
	C2-dibenzothiophene	µg/L	0.02	EPA 8270e m	BV
	C3-dibenzothiophene	µg/L	0.02	EPA 8270e m	BV
	C4-dibenzothiophene	µg/L	0.02	EPA 8270e m	BV
	C1 phenanthrene/anthracene	µg/L	0.05	EPA 8270e m	BV
	C2 phenanthrene/anthracene	µg/L	0.05	EPA 8270e m	BV
	C3 phenanthrene/anthracene	µg/L	0.05	EPA 8270e m	BV
	C4 phenanthrene/anthracene	µg/L	0.05	EPA 8270e m	BV
	C1 fluoranthene/pyrene	µg/L	0.02	EPA 8270e m	BV
	C2 fluoranthene/pyrene	µg/L	0.02	EPA 8270e m	BV
	C3 fluoranthene/pyrene	µg/L	0.02	EPA 8270e m	BV
	C4 fluoranthene/pyrene	µg/L	0.02	EPA 8270e m	BV
	C1 benzo(a)anthracene/chrysene	µg/L	0.0085	EPA 8270e m	BV
	C2 benzo(a)anthracene/chrysene	µg/L	0.0085	EPA 8270e m	BV
	C3 benzo(a)anthracene/chrysene	µg/L	0.0085	EPA 8270e m	BV
	C4 benzo(a)anthracene/chrysene	µg/L	0.0085	EPA 8270e m	BV
	C1benzobjkfluoranthene/benzoapyrene	µg/L	0.0075	EPA 8270e m	BV
	C2benzobjkfluoranthene/benzoapyrene	µg/L	0.0075	EPA 8270e m	BV
	C1-Acenaphthene	µg/L	0.1	EPA 8270e m	BV
	1-Methylnaphthalene	µg/L	0.1	EPA 8270e m	BV
Phenols	2,3,4-trichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	Cresols	mg/L	0.00014	Auto Calc	BV
	Phenol	mg/L	0.0001	EPA 8270e m	BV



**Table A1.1 (Cont'd.)**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
	3 & 4-chlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,3,5,6-tetrachlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,3,4,6-tetrachlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,4,5-trichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,4,6-trichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,3,5-trichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,4-dichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2,4-dimethylphenol	mg/L	0.0001	EPA 8270e m	BV
	2,4-dinitrophenol	mg/L	0.001	EPA 8270e m	BV
	2,6-dichlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2-chlorophenol	mg/L	0.0001	EPA 8270e m	BV
	2-methylphenol	mg/L	0.0001	EPA 8270e m	BV
	2-nitrophenol	mg/L	0.001	EPA 8270e m	BV
	3 & 4-methylphenol	mg/L	0.0001	EPA 8270e m	BV
	4,6-dinitro-2-methylphenol	mg/L	0.001	EPA 8270e m	BV
	4-chloro-3-methylphenol	mg/L	0.0001	EPA 8270e m	BV
	4-nitrophenol	mg/L	0.001	EPA 8270e m	BV
	Pentachlorophenol	mg/L	0.0001	EPA 8270e m	BV
Major Ions	Dissolved Calcium (Ca)	mg/L	0.3	EPA 6010d R5 m	BV
	Dissolved Iron (Fe)	mg/L	0.06	EPA 6010d R5 m	BV
	Dissolved Magnesium (Mg)	mg/L	0.2	EPA 6010d R5 m	BV
	Dissolved Manganese (Mn)	mg/L	0.004	EPA 6010d R5 m	BV
	Dissolved Potassium (K)	mg/L	0.3	EPA 6010d R5 m	BV
	Dissolved Sodium (Na)	mg/L	2.5	EPA 6010d R5 m	BV
Dissolved Metals	Dissolved Aluminum (Al)	µg/L	0.5	SM 23 3030B m	BV
	Dissolved Antimony (Sb)	µg/L	0.02	SM 23 3030B m	BV
	Dissolved Arsenic (As)	µg/L	0.02	SM 23 3030B m	BV
	Dissolved Barium (Ba)	µg/L	0.02	SM 23 3030B m	BV
	Dissolved Beryllium (Be)	µg/L	0.01	SM 23 3030B m	BV
	Dissolved Bismuth (Bi)	µg/L	0.005	SM 23 3030B m	BV
	Dissolved Boron (B)	µg/L	10	SM 23 3030B m	BV
	Dissolved Cadmium (Cd)	µg/L	0.005	SM 23 3030B m	BV
	Dissolved Chromium (Cr)	µg/L	0.1	SM 23 3030B m	BV
	Dissolved Cobalt (Co)	µg/L	0.005	SM 23 3030B m	BV
	Dissolved Copper (Cu)	µg/L	0.05	SM 23 3030B m	BV
	Dissolved Iron (Fe)	µg/L	1	SM 23 3030B m	BV
	Dissolved Lead (Pb)	µg/L	0.005	SM 23 3030B m	BV
	Dissolved Lithium (Li)	µg/L	0.5	SM 23 3030B m	BV
	Dissolved Manganese (Mn)	µg/L	0.05	SM 23 3030B m	BV
	Dissolved Molybdenum (Mo)	µg/L	0.05	SM 23 3030B m	BV
	Dissolved Nickel (Ni)	µg/L	0.02	SM 23 3030B m	BV
	Dissolved Selenium (Se)	µg/L	0.04	SM 23 3030B m	BV
	Dissolved Silicon (Si)	µg/L	50	SM 23 3030B m	BV
	Dissolved Silver (Ag)	µg/L	0.005	SM 23 3030B m	BV
	Dissolved Strontium (Sr)	µg/L	0.05	SM 23 3030B m	BV
	Dissolved Thallium (Tl)	µg/L	0.002	SM 23 3030B m	BV
	Dissolved Tin (Sn)	µg/L	0.2	SM 23 3030B m	BV
	Dissolved Titanium (Ti)	µg/L	0.5	SM 23 3030B m	BV
	Dissolved Uranium (U)	µg/L	0.002	SM 23 3030B m	BV
	Dissolved Vanadium (V)	µg/L	1	SM 23 3030B m	BV
	Dissolved Zinc (Zn)	µg/L	0.1	SM 23 3030B m	BV
	Dissolved Zirconium (Zr)	µg/L	0.1	SM 23 3030B m	BV



**Table A1.1 (Cont'd.)**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
	Dissolved Calcium (Ca)	mg/L	0.05	SM 23 3030B m	BV
	Dissolved Magnesium (Mg)	mg/L	0.05	SM 23 3030B m	BV
	Dissolved Potassium (K)	mg/L	0.05	SM 23 3030B m	BV
	Dissolved Sodium (Na)	mg/L	0.25	SM 23 3030B m	BV
	Dissolved Sulphur (S)	mg/L	3	SM 23 3030B m	BV
Total Metals	Total Aluminum (Al)	µg/L	0.5	EPA 6020 m	BV
	Total Antimony (Sb)	µg/L	0.02	EPA 6020 m	BV
	Total Arsenic (As)	µg/L	0.02	EPA 6020 m	BV
	Total Barium (Ba)	µg/L	0.02	EPA 6020 m	BV
	Total Beryllium (Be)	µg/L	0.01	EPA 6020 m	BV
	Total Bismuth (Bi)	µg/L	0.005	EPA 6020 m	BV
	Total Boron (B)	µg/L	50	EPA 6020 m	BV
	Total Cadmium (Cd)	µg/L	0.005	EPA 6020 m	BV
	Total Chromium (Cr)	µg/L	0.1	EPA 6020 m	BV
	Total Cobalt (Co)	µg/L	0.005	EPA 6020 m	BV
	Total Copper (Cu)	µg/L	0.05	EPA 6020 m	BV
	Total Iron (Fe)	µg/L	1	EPA 6020 m	BV
	Total Lead (Pb)	µg/L	0.005	EPA 6020 m	BV
	Total Lithium (Li)	µg/L	0.5	EPA 6020 m	BV
	Total Manganese (Mn)	µg/L	0.05	EPA 6020 m	BV
	Total Molybdenum (Mo)	µg/L	0.05	EPA 6020 m	BV
	Total Nickel (Ni)	µg/L	0.02	EPA 6020 m	BV
	Total Phosphorus (P)	µg/L	5	EPA 6020 m	BV
	Total Selenium (Se)	µg/L	0.04	EPA 6020 m	BV
	Total Silicon (Si)	µg/L	50	EPA 6020 m	BV
	Total Silver (Ag)	µg/L	0.005	EPA 6020 m	BV
	Total Strontium (Sr)	µg/L	0.05	EPA 6020 m	BV
	Total Thallium (Tl)	µg/L	0.002	EPA 6020 m	BV
	Total Tin (Sn)	µg/L	0.2	EPA 6020 m	BV
	Total Titanium (Ti)	µg/L	0.5	EPA 6020 m	BV
	Total Uranium (U)	µg/L	0.002	EPA 6020 m	BV
	Total Vanadium (V)	µg/L	1	EPA 6020 m	BV
	Total Zinc (Zn)	µg/L	0.1	EPA 6020 m	BV
	Total Zirconium (Zr)	µg/L	0.1	EPA 6020 m	BV
	Total Calcium (Ca)	mg/L	0.05	Auto Calc	BV
	Total Magnesium (Mg)	mg/L	0.05	Auto Calc	BV
	Total Potassium (K)	mg/L	0.05	Auto Calc	BV
	Total Sodium (Na)	mg/L	0.25	Auto Calc	BV
	Total Sulphur (S)	mg/L	3	Auto Calc	BV
Volatiles	Total Trihalomethanes	µg/L	1.3	Auto Calc	BV
	Benzene	µg/L	0.4	CCME CWS/EPA 8260d m	BV
	Bromodichloromethane	µg/L	0.5	EPA 5021a/8260d m	BV
	Toluene	µg/L	0.4	CCME CWS/EPA 8260d m	BV
	Bromoform	µg/L	0.5	EPA 5021a/8260d m	BV
	Ethylbenzene	µg/L	0.4	EPA 5021a/8260d m	BV
	Bromomethane	µg/L	2	EPA 5021a/8260d m	BV
	m & p-Xylene	µg/L	0.8	CCME CWS/EPA 8260d m	BV
	Carbon tetrachloride	µg/L	0.5	EPA 5021a/8260d m	BV
	o-Xylene	µg/L	0.4	CCME CWS/EPA 8260d m	BV
	Chlorobenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	Dibromochloromethane	µg/L	1	EPA 5021a/8260d m	BV
	Xylenes (Total)	µg/L	0.89	CCME CWS/EPA 8260d m	BV



**Table A1.1 (Cont'd.)**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
	Chloroethane	µg/L	1	EPA 5021a/8260d m	BV
	F1 (C6-C10) - BTEX	µg/L	100	CCME CWS/EPA 8260d m	BV
	Chloroform	µg/L	0.5	EPA 5021a/8260d m	BV
	Chloromethane	µg/L	2	EPA 5021a/8260d m	BV
	F1 (C6-C10)	µg/L	100	EPA 5021a/8260d m	BV
	1,2-dibromoethane	µg/L	0.2	EPA 5021a/8260d m	BV
	1,2-dichlorobenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,3-dichlorobenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,4-dichlorobenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,1-dichloroethane	µg/L	0.5	EPA 5021a/8260d m	BV
	1,2-dichloroethane	µg/L	0.5	EPA 5021a/8260d m	BV
	1,1-dichloroethene	µg/L	0.5	EPA 5021a/8260d m	BV
	cis-1,2-dichloroethene	µg/L	0.5	EPA 5021a/8260d m	BV
	trans-1,2-dichloroethene	µg/L	0.5	EPA 5021a/8260d m	BV
	Dichloromethane	µg/L	2	EPA 5021a/8260d m	BV
	1,2-dichloropropane	µg/L	0.5	EPA 5021a/8260d m	BV
	cis-1,3-dichloropropene	µg/L	0.5	EPA 5021a/8260d m	BV
	trans-1,3-dichloropropene	µg/L	0.5	EPA 5021a/8260d m	BV
	Methyl methacrylate	µg/L	0.5	EPA 5021a/8260d m	BV
	Methyl-tert-butylether (MTBE)	µg/L	0.5	EPA 5021a/8260d m	BV
	Styrene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,1,1,2-tetrachloroethane	µg/L	1	EPA 5021a/8260d m	BV
	1,1,2,2-tetrachloroethane	µg/L	2	EPA 5021a/8260d m	BV
	Tetrachloroethene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,2,3-trichlorobenzene	µg/L	1	EPA 5021a/8260d m	BV
	1,2,4-trichlorobenzene	µg/L	1	EPA 5021a/8260d m	BV
	1,3,5-trichlorobenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,1,1-trichloroethane	µg/L	0.5	EPA 5021a/8260d m	BV
	1,1,2-trichloroethane	µg/L	0.5	EPA 5021a/8260d m	BV
	Trichloroethene	µg/L	0.5	EPA 5021a/8260d m	BV
	Trichlorofluoromethane	µg/L	0.5	EPA 5021a/8260d m	BV
	1,2,4-trimethylbenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	1,3,5-trimethylbenzene	µg/L	0.5	EPA 5021a/8260d m	BV
	Vinyl chloride	µg/L	0.5	EPA 5021a/8260d m	BV
<b>Periphyton and Fish Tissue</b>					
Metals	Aluminum	mg/kg	5	EPA 200.3/6020B (mod)	ALS
	Antimony	mg/kg	0.01	EPA 200.3/6020B (mod)	ALS
	Arsenic	mg/kg	0.03	EPA 200.3/6020B (mod)	ALS
	Barium	mg/kg	0.05	EPA 200.3/6020B (mod)	ALS
	Beryllium	mg/kg	0.01	EPA 200.3/6020B (mod)	ALS
	Bismuth	mg/kg	0.01	EPA 200.3/6020B (mod)	ALS
	Boron	mg/kg	1	EPA 200.3/6020B (mod)	ALS
	Cadmium	mg/kg	0.01	EPA 200.3/6020B (mod)	ALS
	Calcium	mg/kg	20	EPA 200.3/6020B (mod)	ALS
	Cesium	mg/kg	0.005	EPA 200.3/6020B (mod)	ALS
	Chromium	mg/kg	0.2	EPA 200.3/6020B (mod)	ALS
	Cobalt	mg/kg	0.02	EPA 200.3/6020B (mod)	ALS
	Copper	mg/kg	0.2	EPA 200.3/6020B (mod)	ALS
	Iron	mg/kg	5	EPA 200.3/6020B (mod)	ALS
	Lead	mg/kg	0.05	EPA 200.3/6020B (mod)	ALS
	Lithium	mg/kg	0.5	EPA 200.3/6020B (mod)	ALS
	Magnesium	mg/kg	2	EPA 200.3/6020B (mod)	ALS



**Table A1.1 (Cont'd.)**

Group	Analyte	Units	Detection Limit	Analytical Method	Lab
	Manganese	mg/kg	0.05	EPA 200.3/6020B (mod)	ALS
	Mercury	mg/kg	0.005	EPA 200.3/6020B (mod)	ALS
	Molybdenum	mg/kg	0.04	EPA 200.3/6020B (mod)	ALS
	Nickel	mg/kg	0.2	EPA 200.3/6020B (mod)	ALS
	Phosphorus	mg/kg	10	EPA 200.3/6020B (mod)	ALS
	Potassium	mg/kg	20	EPA 200.3/6020B (mod)	ALS
	Rubidium	mg/kg	0.05	EPA 200.3/6020B (mod)	ALS
	Selenium	mg/kg	0.1	EPA 200.3/6020B (mod)	ALS
	Sodium	mg/kg	20	EPA 200.3/6020B (mod)	ALS
	Strontium	mg/kg	0.1	EPA 200.3/6020B (mod)	ALS
	Tellurium	mg/kg	0.02	EPA 200.3/6020B (mod)	ALS
	Thallium	mg/kg	0.002	EPA 200.3/6020B (mod)	ALS
	Tin	mg/kg	0.1	EPA 200.3/6020B (mod)	ALS
	Uranium	mg/kg	0.002	EPA 200.3/6020B (mod)	ALS
	Vanadium	mg/kg	0.1	EPA 200.3/6020B (mod)	ALS
	Zinc	mg/kg	1	EPA 200.3/6020B (mod)	ALS
	Zirconium	mg/kg	0.2	EPA 200.3/6020B (mod)	ALS



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**Appendix A1.2**

**Water Quality QA/QC Assessment**

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# QUALITY ASSURANCE AND QUALITY CONTROL ASSESSMENT

*Prepared for:*

**SYNCRUDE CANADA LTD.**  
RESEARCH AND DEVELOPMENT  
9424 17 AVENUE NW  
EDMONTON, ALBERTA  
CANADA T6N 1H4

*Prepared by:*

**HATFIELD CONSULTANTS LLP**  
SUITE A, 300 MACKENZIE BOULEVARD  
FORT MCMURRAY, ALBERTA  
CANADA T9H 4C4  
TEL: 1.780.743.4290 • [WWW.HATFIELDGROUP.COM](http://WWW.HATFIELDGROUP.COM)

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## A1.2 INTRODUCTION

Quality assurance and quality control (QA/QC) are key to data integrity and relevant to all aspects of an environmental study, from sample collection to data analysis and reporting. Quality assurance (QA) deals with the management and technical aspects of a project, to ensure that the data generated are of consistently high quality. Quality control (QC) is an aspect of QA and includes the procedures used to measure and evaluate data quality, and to take corrective actions when data quality objectives are not met. This appendix describes the QA/QC program undertaken in support of the surface water quality component of the 2021 ecotoxicology assessment of treated oil sands process-affected water mesocosm study. This QA/QC report presents and evaluates the QC data and describes the implications of the QC results as they relate to the interpretation of the water quality dataset for this experiment.

### A1.2.1 Quality Assurance

#### A1.2.1.1 Field Staff Training and Operations

The 2021 field sampling was carried by Hatfield Consultants LLP (Hatfield) and Limnotek field personnel. Hatfield staff are well-trained in standardized field sampling procedures, data recording, and equipment operations applicable to water quality sampling. Field work was completed according to approved field work instructions (FWIs) and Hatfield standard operating procedures (SOPs). FWIs and SOPs are standardized technical documents that describe exact sampling locations and provide specific sampling instructions, equipment needs and calibration requirements, sample labeling and shipping protocols, and laboratory contacts. These documents also provide specific guidelines for field record-keeping and sample tracking. The SOPs are consistent with standard field methods described in the relevant scientific literature (e.g., Environment Canada 1993; APHA 2012; Alberta Environment 2006). All field programs were preceded by a pre-field meeting with the field crews and the project manager, where the purpose of the field program was discussed, roles of crew members specified, questions regarding the FWI addressed, and equipment needs, field logistics, and contingency plans confirmed. During field work, field data were recorded on standardized field data sheets, according to established field record-keeping procedures. In addition, field crews checked in with the project manager regularly to provide updates on work completed. Samples were documented and tracked using electronic chain-of-custody forms and receipt of samples by the analytical laboratory was confirmed.

The crew lead was responsible for managing the sample shipping process to ensure that:

- All required samples were collected;
- Electronic chain-of-custody and analytical request forms were accurately completed;
- Proper labeling and documentation procedures were followed; and
- Samples were delivered to the designated lab in a timely manner.

#### A1.2.1.2 Laboratory Operations

One member of the project team was designated as the laboratory liaison. To ensure that high quality data were generated, Bureau Veritas (Calgary, AB) was selected for the laboratory analyses. Bureau Veritas is



accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Under CALA's accreditation program, performance evaluation assessments are conducted annually for laboratory procedures, methods, and internal quality control.

### **A1.2.1.3 Office Operations**

Office-related QA included the use of appropriately trained personnel for each task and senior review of work products. A data management system was established using R Core Team (R Studio, v. 4.0.3; RStudio Team 2021) and standardized data manipulation/summary tools were used to ensure an organized and consistent system of data storage, QC, and retrieval.

## **A1.2.2 Quality Control**

### **A1.2.2.1 Field Quality Control Procedures**

The water quality field QC program consisted of the collection and analysis of field blanks, and duplicate samples. The QC samples collected during the field program accounted for approximately 20% of the total number of samples submitted for analysis. Consistent with previous procedures these samples were handled, stored, and shipped along with field-collected surface water samples, and were submitted “blind” to the analytical laboratories. The QC samples were analyzed for the same set of water quality variables as the samples collected from surface water.

The different types of QC samples are described below:

- Field blanks consist of de-ionized water provided by the analytical laboratory, which are exposed to the sampling environment at the sample site and handled in the same manner (e.g., preserved) as the surface water samples collected during the field program. Field blanks are used to detect potential sample contamination during sample collection, handling, shipping, and analysis. Five field blanks were analyzed during the 2021 QA/QC program, including water, snow, and ice samples.
- Duplicate samples are additional samples collected at the same time and the same location as the primary sample, using the same collection methods. Duplicate sample bottles were filled in the same manner as described in section 2.3.2.4. Duplicates are used to check within-site variation, and the precision of field sampling methods and laboratory analyses. Five sets of duplicate samples were collected and analyzed during the 2021 QA/QC program and duplicated samples locations were randomly assigned prior to the experiment according to the Table A1.2.1.

**Table A1.2.1 Duplicate sample location and dates.**

Sample date	Treatment	Sample location
2021-09-06	3.2% T-OSPW	Table 4
2021-09-09	10% T-OSPW	Table 3
2021-09-14	100% River water	Table 7
2021-09-19	100% T-OSPW	Table 1
2021-09-24	32% T-OSPW	Table 2



### A1.2.2.2 Initial Laboratory Data Screening

Upon receipt of water quality data from the analytical laboratory, a series of standard checks were performed to identify any potential data quality issues. This approach allowed for the re-analysis of samples to verify questionable data, or to generate data for missing variables. The following data checks were performed:

- Whether all required variables and samples were analyzed;
- Whether data were reported using the appropriate units;
- Whether analyses were done with the appropriate detection limits;
- Field versus laboratory data comparisons for variables with parallel field and laboratory data (e.g., pH, specific conductivity);
- Logic checks: presence of zero values, comparisons of total dissolved solids (TDS) and conductivity, hardness and alkalinity, total and dissolved phosphorus, total and dissolved organic carbon, total and dissolved metals, and measured and calculated TDS;
- Checking blanks for evidence of contamination;
- Checking the ratio of total to dissolved are within acceptable tolerance;
- Checking duplicate samples for evidence of unacceptable variation;
- Checking laboratory QC data (sample temperature and integrity of containers upon receipt, laboratory qualifiers, holding times, internal duplicates, ion balance, recovery of spiked variables); and
- Checking field-collected data for completeness, and identification of any unexpected values or trends.

If results of initial data screening indicated that there were deficiencies or potential data quality issues, the analytical laboratory was contacted and re-analysis of the variables in question in the affected samples was requested. If data were verified by the analytical laboratory but remained questionable based on the above evaluation, qualifiers were added to affected concentrations in the project database/tables for consideration during data analysis (and identified in the report as excluded, with the corresponding reason). These qualifiers identify a value as acceptable, questionable, or rejected as well as the reason for qualification (e.g. sample exceeded the upper metal dissolved-total data quality objective ratio). If multiple evaluations flag a result as questionable then that data flag is upgraded to rejected.

### A1.2.2.3 Quality Control Data Evaluation

#### ***Field Blanks***

Concentrations in field blanks were considered notable if they were greater than or equal to five times the corresponding analytical detection limit (DL). This threshold is based on the Practical Quantitation Limit (PQL) defined by the United States Environmental Protection Agency (US EPA 1985). This criterion was



not applied to pH, which is expected to be above the laboratory-reported detection limit in the deionized water used to prepare the blanks.

The data quality implications of notable results in blanks were evaluated relative to concentrations observed in mesocosm table and source tanks water during the study. The aim of this evaluation was to determine: (1) whether contamination was limited to a blank or was also apparent in the corresponding sample water, (2) whether it resulted in a consistent bias, and (3) whether it was severe enough to invalidate the affected data. To address these questions, notable concentrations in blanks were interpreted as follows:

- If the detectable concentration in the blank was higher greater than five times the corresponding analytical DL it was assumed that the concentration in the blank was the result of an isolated field or laboratory error. In this case, the corresponding water samples were considered un-acceptable for analysis (rejected (R) data qualifier and removed from the data);
- If the detectable concentration in the blank was less than than five times the corresponding analytical DL, the data for the corresponding samples were considered acceptable for the parameter in question and were included in further analysis (acceptable (A) data qualifier);

### **Duplicate Samples**

Differences between concentrations measured in duplicate mesocosm table water samples were calculated as the relative percent difference (RPD) for each variable. The RPD was calculated using the following formula:

$$\text{RPD} = (|\text{difference in concentration between duplicate samples}| / \text{mean concentration}) \times 100$$

The RPD value for a given variable was considered unacceptable (did not meet assessment criteria) if:

- It was greater than the upper RPD threshold; and
- Concentration in one or both samples was greater than or equal to five times the DL.

RPD thresholds varied based on the analyte group. Conventional variables, major ions, nutrients, biological indicators, total metals, and dissolved metals were assigned a lower RPD threshold of 20% and an upper RPD threshold of 40%. Hydrocarbons, volatile organics, and general organics were assigned a lower RPD threshold of 25% and an upper RPD threshold of 50%. Parent PAH and alkylated PAH were assigned a lower RPD threshold of 50% and an upper RPD threshold of 75%.

Analytes with RPDs above the upper threshold were considered contaminated and analytes with RPDs above the lower threshold were considered questionable and potentially contaminated in the data tables and the project database.

The above criteria are consistent with those used by analytical laboratories as part of internal QC procedures for duplicate samples.

The number of variables with exceedances of the assessment criteria was compared with the total number of variables analyzed to categorize analytical precision. Analytical precision was rated as follows:

- High: if less than 10% of the total number of variables were notably different from each other;



- Moderate: if 10 to 30% of the total number of variables were notably different from one another; and
- Low: if more than 30% of the total number of variables were notably different from one another.

## A1.2.3 Quality Control Results

### *Field Blanks*

Five field blanks were collected during the 2021 QA/QC program with 234 variables in each field blank. The following variables were detected at notable concentrations in the field blanks, (i.e., greater than five times the DL; Table A1.2.2):

- Concentrations of total dissolved solids, dissolved aluminum, barium, copper, lead, strontium, and zinc; total aluminum, boron, sodium, and zinc were more than five times the DL in at least one field blanks. Corresponding mesocosm and source tank sample results for these variables were reviewed and interpreted cautiously, with no evidence found that blank samples were contaminated.

All of the field blank samples collected indicated some potential for contamination or imprecision in the measurement of this short list of analytes, particularly aluminum and zinc.

### *Duplicates*

Five sets of duplicate samples were collected during the 2021 QA/QC program with 234 variables analyzed. Among the duplicate samples, notable RPD values (>20% and at least five times the DL in one or both samples) were observed at least once in the concentrations of 42 unique variables (Table A1.2.3). Individual notable RPD values (>20% and at least five times the DL in one or both samples) included: 5 conventional variables, 1 major ions, 5 nutrient and biological indicators, 14 dissolved metals, and 36 total metals (Table A1.2.3):

- Concentrations of total alkalinity, colour, total suspended solids, turbidity, bicarbonate, total nitrogen, total phosphorus, total organic carbon; dissolved aluminum, cobalt, copper, lead, mercury, vanadium, zinc, and zirconium; total aluminum, antimony, arsenic, barium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silicon, sodium, strontium, sulphur, thallium, titanium, vanadium, zinc, and zirconium were above their RPD thresholds in at least one duplicate sample. These duplicate samples may indicate less than ideal analytical precision.

Four of the five water duplicate sample sets had high analytical precision (less than 10% of the total number of variables had RPD >20% and concentrations at least five times the DL in at least one sample). The third week sample set (2021-09-14; Table 7) had a moderate analytical precision, 11.6% of the total number of variables had RPD >20% and concentrations at least five times the DL in at least one sample.



#### **A1.2.4 Conclusions**

- QA/QC protocols were performed from sample collection through to data analysis and reporting. These procedures were applied to ensure that the data generated during the Program were of consistently high quality and appropriate to address the objectives of the study;
- Few water quality variables measured in field had potential contamination, with the majority having no potential for contamination;
- Several variables in duplicate samples had RPD values above the 20% QC assessment criterion (5% of the total number of measurements for duplicate water quality samples), which represents a 'high' level of field sampling and analytical precision for the dataset; and
- Overall, data generated from the water quality QA/QC program were of acceptable quality and adequate to address objectives of the study.



**Table A1.2.2 Field blank samples that exceeded the five-time detection limit concentration criterion during the mescosm study, 2021.**

Variable	Lab Sample number	Experimental day	Sample Date	Unit	Blank Detection Limit	Blank Conc.
<b>Conventional variables</b>						
Total Dissolved Solids	AFJ086	1	2021-09-06	mg/L	10	76
<b>Dissolved Metals</b>						
Aluminum	AFY391	10	2021-09-14	µg/L	0.5	5.33
Aluminum	AGX293	20	2021-09-24	µg/L	0.5	2.9
Barium	AFJ086	1	2021-09-06	µg/L	0.02	0.115
Barium	AFO008	5	2021-09-09	µg/L	0.02	0.112
Barium	AFY391	10	2021-09-14	µg/L	0.02	0.166
Copper	AFY391	10	2021-09-14	µg/L	0.05	0.903
Lead	AFY391	10	2021-09-14	µg/L	0.005	0.711
Strontium	AFY391	10	2021-09-14	µg/L	0.05	0.668
Zinc	AFJ086	1	2021-09-06	µg/L	0.1	0.54
Zinc	AFO008	5	2021-09-09	µg/L	0.1	2.41
Zinc	AFY391	10	2021-09-14	µg/L	0.1	1.15
Zinc	AGH689	15	2021-09-19	µg/L	0.1	0.69
<b>Total Metals</b>						
Aluminum	AFJ086	1	2021-09-06	µg/L	0.5	3.55
Boron	AFO008	5	2021-09-09	µg/L	10	59
Sodium	AFO008	5	2021-09-09	µg/L	0.05	0.441
Zinc	AFJ086	1	2021-09-06	µg/L	0.1	10.8
Zinc	AFO008	5	2021-09-09	µg/L	0.1	1.16

Note: Conc. = concentration.



**Table A1.2.3 Duplicate samples that exceeded 20% relative percent difference criterion during the mesocosm study, 2021.**

Group/Variable	Sample location	Sample Date	Unit	Sample Result	Duplicate Result	RPD (%)
<b>Conventional Variables</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	Table 2	2021-09-24	mg/L	240	190	23.3
Colour	Table 1	2021-09-19	PtCo	20	15	28.6
Total Suspended Solids	Table 7	2021-09-14	mg/L	13	45	110.3
Turbidity	Table 3	2021-09-09	NTU	13	17	26.7
Turbidity	Table 7	2021-09-14	NTU	22	44	66.7
<b>Major Ions</b>						
Bicarbonate	Table 2	2021-09-24	mg/L	270	200	29.8
<b>Nutrients and Biological Indicators</b>						
Total Nitrogen (as N)	Table 7	2021-09-14	mg/L	0.29	0.38	26.9
Total Phosphorus (as P)	Table 1	2021-09-19	mg/L	0.062	0.083	29.0
Total Phosphorus (as P)	Table 2	2021-09-24	mg/L	0.03	0.023	26.4
Total Phosphorus (as P)	Table 7	2021-09-14	mg/L	0.055	0.017	105.6
Total Organic Carbon	Table 7	2021-09-14	mg/L	5.5	7.1	25.4
<b>Dissolved Metals</b>						
Aluminum	Table 4	2021-09-05	µg/L	23.1	47.8	69.7
Aluminum	Table 7	2021-09-14	µg/L	9.47	13.4	34.4
Cobalt	Table 4	2021-09-06	µg/L	0.0609	0.0764	22.6
Copper	Table 3	2021-09-09	µg/L	0.708	1.19	50.8
Lead	Table 7	2021-09-14	µg/L	0.0335	0.177	136.3
Mercury	Table 7	2021-09-14	µg/L	0.00191	0.0014	30.8
Vanadium	Table 2	2021-09-24	µg/L	3.38	2.02	50.4
Zinc	Table 1	2021-09-19	µg/L	1880	1530	20.5
Zinc	Table 1	2021-09-19	µg/L	3.77	8.54	77.5
Zinc	Table 2	2021-09-24	µg/L	3.59	2.67	29.4
Zinc	Table 3	2021-09-09	µg/L	2.19	2.92	28.6
Zinc	Table 4	2021-09-05	µg/L	2.76	4	36.7



Table A1.2.3 (Cont'd.)

Group/Variable	Sample location	Sample Date	Unit	Sample Result	Duplicate Result	RPD (%)
<b>Dissolved Metals (Cont.)</b>						
Zinc	Table 7	2021-09-14	µg/L	1.25	1.68	29.4
Zirconium	Table 1	2021-09-19	µg/L	0.7	0.9	25.0
<b>Total Metals</b>						
Aluminum	Table 1	2021-09-19	µg/L	129	220	52.1
Aluminum	Table 7	2021-09-14	µg/L	709	1840	88.7
Antimony	Table 3	2021-09-09	µg/L	0.176	0.144	20.0
Arsenic	Table 7	2021-09-14	µg/L	0.647	1.05	47.5
Barium	Table 7	2021-09-14	µg/L	60.6	74.4	20.4
Chromium	Table 7	2021-09-14	µg/L	1.08	2.75	87.2
Cobalt	Table 2	2021-09-24	µg/L	0.289	0.219	27.6
Cobalt	Table 7	2021-09-14	µg/L	0.394	1.04	90.1
Copper	Table 3	2021-09-09	µg/L	1.24	0.99	22.4
Copper	Table 7	2021-09-14	µg/L	1.88	3.04	47.2
Iron	Table 1	2021-09-19	µg/L	785	632	21.6
Iron	Table 7	2021-09-14	µg/L	824	2350	96.2
Lead	Table 7	2021-09-14	µg/L	0.489	1.15	80.7
Magnesium	Table 1	2021-09-19	mg/L	7.86	9.91	23.1
Magnesium	Table 2	2021-09-24	mg/L	10.3	8.09	24.0
Manganese	Table 2	2021-09-24	µg/L	19.5	15.4	23.5
Manganese	Table 7	2021-09-14	µg/L	26.3	88.1	108.0
Mercury	Table 7	2021-09-14	µg/L	0.0029	0.00383	27.6
Molybdenum	Table 2	2021-09-24	µg/L	242	190	24.1
Nickel	Table 1	2021-09-19	µg/L	4.53	6.46	35.1
Nickel	Table 2	2021-09-24	µg/L	2.43	1.84	27.6
Nickel	Table 7	2021-09-14	µg/L	2.19	3.56	47.7
Potassium	Table 7	2021-09-14	mg/L	1.32	1.72	26.3



**Table A1.2.3 (Cont'd.)**

Group/Variable	Station ID	Sample Date	Unit	Sample Result	Duplicate Result	RPD (%)
<b>Total Metals (Cont'd.)</b>						
Selenium	Table 7	2021-09-14	µg/L	0.22	0.326	38.8
Silicon	Table 7	2021-09-14	µg/L	2980	5130	53.0
Sodium	Table 2	2021-09-24	mg/L	206	166	21.5
Strontium	Table 1	2021-09-19	µg/L	443	542	20.1
Strontium	Table 2	2021-09-24	µg/L	338	269	22.7
Sulphur	Table 3	2021-09-09	mg/L	20.2	28.8	35.1
Thallium	Table 7	2021-09-14	µg/L	0.0177	0.0311	54.9
Titanium	Table 7	2021-09-14	µg/L	18.7	48.2	88.2
Vanadium	Table 7	2021-09-14	µg/L	1.26	4.59	113.8
Zinc	Table 2	2021-09-24	µg/L	7.73	2.89	91.1
Zinc	Table 4	2021-09-06	µg/L	5.81	7.22	21.6
Zirconium	Table 1	2021-09-19	µg/L	0.77	1.06	31.7
Zirconium	Table 7	2021-09-14	µg/L	0.61	1.38	77.4

Note: ID = identifier; RPD = Relative percent difference



**Table A1.2.4 Analytical chemistry concentrations from field blank samples collected during mesocosm experiment, 2021.**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Conventional Variables</b>							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	1	<1	<1	<1	<1	<1
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	1	<1	<1	<1	<1	<1
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH	pH	-	4.92	4.74	4.75	5.2	5.07
Specific Conductivity	µS/cm	2	<2	<2	<2	<2	<2
Total Dissolved Solids	mg/L	10	76	<10	<10	<10	<10
Total Dissolved Solids (Calculated)	mg/L	10	<10	<10	<10	<10	<10
Total Hardness (as CaCO <sub>3</sub> )	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Suspended Solids	mg/L	1	<1	<1	<1	<1	<1
True Colour	PtCo units	2	<2	<2	<2	<2	<2
Turbidity	NTU	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<b>Major Ions</b>							
Anion Sum	meq/L	-	0	0	0	0	0
Bicarbonate	mg/L	1	<1	<1	<1	<1	<1
Calcium	mg/L	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carbonate	mg/L	1	<1	<1	<1	<1	<1
Cation Sum	meq/L	-	0.012	0.018	0.018	0.006	0.009
Chloride (Cl)	mg/L	1	<1	<1	<1	<1	<1
Fluoride (F)	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hydroxide	mg/L	1	<1	<1	<1	<1	<1
Ion Balance	%	-	-	-	-	-	-
Magnesium	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Potassium	mg/L	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Sodium	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (as SO <sub>4</sub> )	mg/L	1	<1	<1	<1	<1	<1

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Nutrients and Biological Indicators</b>							
Biochemical Oxygen Demand	mg/L	2	<2	<1	<2	<2	<2
Chemical Oxygen Demand	mg/L	10	<10	<10	<10	<10	<10
Nitrate (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (as NO <sub>3</sub> )	mg/L	0.044	<0.044	<0.044	<0.044	<0.044	<0.044
Nitrate plus Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L	0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L	0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L	0.02	<0.02	<0.02	<0.02	0.023	<0.02
Total Organic Carbon	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Orthophosphate (as P)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Phosphorus (as P)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.002
<b>Dissolved Metals</b>							
Dissolved Aluminum	µg/L	0.5	<0.5	1		0.75	
Dissolved Antimony	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dissolved Arsenic	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dissolved Barium	µg/L	0.02				0.045	<0.1
Dissolved Beryllium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L	10	11	<10	20	<10	<10
Dissolved Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Chromium	µg/L	0.1	<0.1	<0.1	0.13	<0.1	<0.1
Dissolved Cobalt	µg/L	0.005	<0.005	<0.005	0.0082	<0.005	0.0059
Dissolved Copper	µg/L	0.05	<0.05	0.094		<0.05	<0.05

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Dissolved Metals (Cont'd.)</b>							
Dissolved Iron	mg/L	0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L	0.005	<0.005	<0.005		<0.005	0.0063
Dissolved Lithium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Manganese	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L	0.0001	<0.0002187	<0.00014372	<1e-04	<1e-04	0.00013
Dissolved Molybdenum	µg/L	0.05	<0.05	<0.05	0.168	<0.05	<0.05
Dissolved Nickel	µg/L	0.02	<0.02	<0.02	0.024	0.039	0.22
Dissolved Selenium	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dissolved Silicon	µg/L	50	<50	<50	<50	<50	<50
Dissolved Silver	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L	0.05	<0.05	<0.05		<0.05	0.101
Dissolved Sulphur	mg/L	3	<3	<3	<3	<3	<15
Dissolved Thallium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dissolved Tin	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Uranium	µg/L	0.002	<0.002	<0.002	0.0033	<0.002	0.0028
Dissolved Vanadium	µg/L	0.2	<0.2	<0.2	0.44	<0.2	<0.2
Dissolved Zinc	µg/L	0.1					<0.5
Dissolved Zirconium	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<b>Total Metals</b>							
Total Aluminum	µg/L	0.5		1.29	0.99	1.09	1.17
Total Antimony	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Arsenic	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Total Metals (Cont'd.)</b>							
Total Barium	µg/L	0.02	<0.02	0.072	<0.02	<0.02	<0.02
Total Beryllium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Bismuth	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Boron	µg/L	10	<10		<10	13	<10
Total Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Calcium	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Chromium	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Cobalt	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Copper	µg/L	0.05	<0.05	0.057	<0.05	<0.05	<0.05
Total Iron	µg/L	1	<1	<1	<1	<1	<1
Total Lead	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Lithium	µg/L	0.5	<0.5	0.62	<0.5	<0.5	<0.5
Total Magnesium	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Manganese	µg/L	0.05	<0.05	0.065	<0.05	<0.05	<0.05
Total Mercury	µg/L	0.0001	<0.0002137	<0.0003167	0.00019	0.00016	0.00016
Total Molybdenum	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Nickel	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Potassium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Selenium	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Total Silicon	µg/L	50	<50	<50	<50	<50	<50
Total Silver	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Sodium	mg/L	0.05	<0.05		<0.05	<0.05	<0.05
Total Strontium	µg/L	0.05	<0.05	0.155	<0.05	<0.05	<0.05

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Total Metals (Cont'd.)</b>							
Total Sulphur	mg/L	3	<3	<3	<3	<3	<3
Total Thallium	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Tin	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Uranium	µg/L	0.002	<0.002	<0.002	0.0032	<0.002	<0.002
Total Vanadium	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Zinc	µg/L	0.1			0.19	0.41	<0.1
Total Zirconium	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<b>General Organics</b>							
Naphthenic Acids	mg/L	2	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>							
F1 (C6-C10)-BTEX	µg/L	100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L	100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L	200	<200	<200	<200	<200	<200
<b>Volatile Organics</b>							
Benzene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	0.89	<0.89	<0.89	<0.89	<0.89	<0.89

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Phenols</b>							
Cresols	mg/L	0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.0001	2e-04	<1e-04	<1e-04	2e-04	2e-04
2-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L	-	0.00584	<0.00574	<0.00574	0.00584	0.00584

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Parent PAH</b>							
1-Methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Parent PAH (Cont'd.)</b>							
Perylene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L	-	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L	-	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>							
C1 Substituted Acenaphthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Alkylated PAH (Cont'd.)</b>							
C2 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L	-	<1.099	<1.099	<1.099	<1.099	<1.099
<b>Additional Volative Organics</b>							
1,1,1,2-tetrachloroethane	µg/L	1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L	2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Additional Volative Organics (Cont'd.)</b>							
1,2,3-trichlorobenzene	µg/L	1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L	2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L	1	<1	<1	<1	<1	<1
Chloroform	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L	2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L	1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	2	<2	<2	<2	<2	<2

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.4 (Cont'd.)**

Water Quality Variables	Units	Min DL	Week 1	Week 2	Week 3	Week 4	Week 5
<b>Additional Volative Organics (Cont'd.)</b>							
Methyl methacrylate	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L	1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5

- Data not available / not applicable

# Indicates samples concentrations is greater than five time the detection limit



**Table A1.2.5 Analytical chemistry concentrations from duplicate samples collected during mesocosm experiment, 2021.**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Conventional Variables												
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	1	<1	<1	<1	3.9	<1	<1	59	60	8.5	10
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	1	110	110	140	140	110	110	380	370	240	190
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L	0.5	140	138	131	132	145	146	79.6	77	122	121
pH	pH	-	7.72	7.75	8.23	8.56	8.14	8.11	9.08	9.05	8.73	8.72
Specific Conductivity	µS/cm	2	390	390	600	600	280	280	3100	3100	1200	1200
Total Dissolved Solids	mg/L	10	270	320	320	310	160	160	1900	2000	710	680
Total Dissolved Solids (Calculated)	mg/L	10	230	230	350	340	170	170	1900	1900	730	700
Total Hardness (as CaCO <sub>3</sub> )	mg/L	0.5	119	120	124	127	141	126	75	80.1	113	99.7
Total Suspended Solids	mg/L	0.99	6.2	6.5	15	15	45	13	16	19	11	9.3
True Colour	PtCo units	2	12	11	11	10	30	26	20	15	14	16
Turbidity	NTU	0.1	7.6	8.4	17	13	44	22	13	12	7.9	8.4
Major Ions												
Anion Sum	meq/L	-	4.1	4.1	6	5.9	3	3	31	30	13	12
Bicarbonate	mg/L	1	140	140	170	160	130	130	310	300	270	200
Calcium	mg/L	0.3	37	37	34	35	40	40	15	15	31	30
Carbonate	mg/L	1	<1	<1	<1	4.7	<1	<1	71	73	10	12
Cation Sum	meq/L	-	4.3	4.2	5.9	6	3.4	3.4	33	31	12	12
Chloride (Cl)	mg/L	1	19	20	44	40	3.7	3.4	400	370	130	130
Fluoride (F)	mg/L	0.05	0.17	0.17	0.31	0.27	0.085	0.083	2.5	2.5	0.76	0.79

- Data not available / not applicable

# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
		Major Ions (Cont'd.)										
Hydroxide	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ion Balance	%	-	2.4	1.5	0.73	1.4	6.5	5.7	4.2	2.6	3.4	0.67
Magnesium	mg/L	0.2	12	11	11	11	11	11	9.9	9.6	11	11
Potassium	mg/L	0.3	1.6	1.6	2.3	2.4	1.2	1.2	11	11	4.4	4.4
Sodium	mg/L	0.5	33	33	75	76	10	10	720	680	210	210
Sulphate (as SO <sub>4</sub> )	mg/L	1	60	60	93	95	36	36	560	560	190	200
Nutrients and Biological Indicators												
Biochemical Oxygen Demand	mg/L	2	<2	<2	<1.6	<1.6	<2	<2	4.9	4.8	<2	<2
Chemical Oxygen Demand	mg/L	10	15	13	22	24	31	24	106	104	43	55
Nitrate (as N)	mg/L	0.01	0.018	0.028	<0.01	<0.01	0.083	0.026	0.017	0.048	0.02	0.021
Nitrate (as NO <sub>3</sub> )	mg/L	0.044	0.08	0.12	<0.044	<0.044	0.37	0.12	0.077	0.21	0.087	0.092
Nitrate plus Nitrite (as N)	mg/L	0.01	0.018	0.028	<0.01	<0.01	0.083	0.026	0.017	0.048	0.02	0.021
Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L	0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L	0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.038	0.034	0.017	0.018
Total Nitrogen (as N)	mg/L	0.02	0.29	0.26	0.32	0.33	0.38	0.29	1.5	1.7	0.77	0.75
Total Organic Carbon	mg/L	0.5	3.8	3.9	5.7	5.8	7.1	5.5	23	21	10	10
Total Orthophosphate (as P)	mg/L	0.001	0.0013	0.0017	0.0	0.0017	0.0023	0.0029	0.0056	0.0042	0.0022	0.004
Total Phosphorus (as P)	mg/L	0.001	0.013	0.013	0.019	0.019	0.055	0.017	0.062	0.083	0.03	0.023

- Data not available / not applicable

# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
<b>Dissolved Metals</b>												
Dissolved Aluminum	µg/L	0.5	47.8	23.1	19.8	20.7	13.4	9.47	79.4	81.8	29.3	32.1
Dissolved Antimony	µg/L	0.02	0.066	0.067	0.142	0.133	0.065	0.063	0.824	0.845	0.33	0.32
Dissolved Arsenic	µg/L	0.02	0.587	0.582	1.21	1.25	0.37	0.391	9.55	9.48	3.57	3.37
Dissolved Barium	µg/L	0.02	42.6	43.5	45.2	46.4	39	39.3	37.7	39	45.8	45.6
Dissolved Beryllium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05
Dissolved Bismuth	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025
Dissolved Boron	µg/L	10	106	95	287	281	60	40	2620	2560	634	731
Dissolved Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	0.015	0.0125	<0.005	<0.005	<0.025	0.03
Dissolved Chromium	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	0.15	0.15	0.21	0.21	<0.5	<0.5
Dissolved Cobalt	µg/L	0.005	0.0764	0.0609	0.103	0.0998	0.0593	0.0673	0.265	0.279	0.184	0.155
Dissolved Copper	µg/L	0.05	0.504	0.458	1.19	0.708	1.09	1.17	0.439	0.42	<0.25	<0.25
Dissolved Iron	mg/L	0.06	0.25	0.27	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L	0.005	0.0663	0.0171	0.0192	0.0176	0.177	0.0335	0.0119	0.0132	<0.025	<0.025
Dissolved Lithium	µg/L	0.5	8.29	8.23	15.7	15.8	4.95	5.05	112	133	31.4	31.3
Dissolved Manganese	mg/L	0.004	0.024	0.023	<0.004	<0.004	<0.004	<0.004	0.0044	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L	0.0001	0.000784	0.000619	0.000924	0.000841	0.0014	0.00191	0.00068	0.00063	0.00087	0.00106
Dissolved Molybdenum	µg/L	0.05	16.7	17.2	64.4	66.3	0.771	0.726	685	711	228	228
Dissolved Nickel	µg/L	0.02	0.847	0.837	1.04	1.07	0.871	0.851	3.52	3.52	3.38	2.02
Dissolved Selenium	µg/L	0.04	0.225	0.207	0.511	0.503	0.245	0.232	2.55	2.42	0.86	0.93

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# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Dissolved Metals (Cont'd.)												
Dissolved Silicon	µg/L	50	965	940	1040	1050	1140	1160	1680	1770	1240	1220
Dissolved Silver	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025
Dissolved Strontium	µg/L	0.05	231	235	241	254	192	194	403	425	314	307
Dissolved Sulphur	mg/L	3	9.2	9.7	20.2	21.8	4.7	5.2	159	165	47	49
Dissolved Thallium	µg/L	0.002	0.0058	0.0054	0.0048	0.0054	0.0033	0.0043	0.0056	0.0054	<0.01	<0.01
Dissolved Tin	µg/L	0.2	<0.2	<0.2	0.27	0.24	<0.2	<0.2	<0.2	<0.2	<1	<1
Dissolved Titanium	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<2.5
Dissolved Uranium	µg/L	0.002	0.532	0.55	0.983	0.99	0.398	0.414	6.93	6.83	2.44	2.46
Dissolved Vanadium	µg/L	0.2	43.8	44.8	167	169	0.25	0.25	1880	1530	540	528
Dissolved Zinc	µg/L	0.1	4	2.76	2.92	2.19	1.68	1.25	3.77	8.54	3.59	2.67
Dissolved Zirconium	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	0.9	<0.5	<0.5
Total Metals												
Total Aluminum	µg/L	0.5	123	127	294	303	1840	709	129	220	164	159
Total Antimony	µg/L	0.02	0.073	0.07	0.144	0.176	0.095	0.098	0.844	0.981	0.33	0.249
Total Arsenic	µg/L	0.02	0.604	0.605	1.59	1.78	1.05	0.647	11	10.5	3.58	2.98
Total Barium	µg/L	0.02	44.9	45.2	57.8	64.2	74.4	60.6	50.8	50.2	49.2	41.9
Total Beryllium	µg/L	0.01	<0.01	<0.01	0.014	0.019	0.077	0.043	0.015	0.021	<0.05	<0.01
Total Bismuth	µg/L	0.005	<0.005	<0.005	<0.01	<0.01	0.019	<0.01	<0.005	<0.01	<0.025	<0.005
Total Boron	µg/L	10	97	94	229	241	49	24	2360	2060	618	654
Total Cadmium	µg/L	0.005	<0.005	<0.005	0.0312	0.0289	0.036	0.0207	<0.005	<0.005	<0.025	<0.005

- Data not available / not applicable

# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Total Metals (Cont'd.)												
Total Calcium	mg/L	0.05	33.1	33.5	32.5	36.2	38.6	34.3	17.1	15.7	28.2	26.6
Total Chromium	µg/L	0.1	0.22	0.23	0.47	0.5	2.75	1.08	0.34	0.47	<0.5	0.32
Total Cobalt	µg/L	0.005	0.22	0.236	0.301	0.359	1.04	0.394	0.485	0.541	0.289	0.219
Total Copper	µg/L	0.05	0.847	0.96	0.99	1.24	3.04	1.88	0.48	0.48	0.81	0.629
Total Iron	µg/L	1	295	293	459	508	2350	824	785	632	337	331
Total Lead	µg/L	0.005	0.144	0.135	0.293	0.32	1.15	0.489	0.203	0.169	0.131	0.116
Total Lithium	µg/L	0.5	8.5	8.58	15.1	17	7.57	6.36	102	107	32.9	30.3
Total Magnesium	mg/L	0.05	8.78	8.77	10.5	8.83	10.9	9.74	7.86	9.91	10.3	8.09
Total Manganese	µg/L	0.05	20	17.9	28.6	34.1	88.1	26.3	31.6	26.6	19.5	15.4
Total Mercury	µg/L	0.0001	0.00119	0.00129	0.00202	0.00155	0.00383	0.0029	0.00183	0.00167	0.00169	0.00154
Total Molybdenum	µg/L	0.05	16.9	17.1	70.9	78.9	1.04	0.861	694	813	242	190
Total Nickel	µg/L	0.02	0.983	0.935	1.61	2.1	3.56	2.19	4.53	6.46	2.43	1.84
Total Potassium	µg/L	0.05	1.28	1.28	2.22	1.89	1.72	1.32	9.68	11.2	4.06	3.51
Total Selenium	µg/L	0.04	0.236	0.23	0.449	0.492	0.326	0.22	2.53	2.35	0.87	0.813
Total Silicon	µg/L	50	1260	1250	1540	1740	5130	2980	1830	2210	1540	1480
Total Silver	µg/L	0.005	<0.005	<0.005	<0.01	<0.01	0.011	<0.01	<0.005	<0.01	<0.025	<0.005
Total Sodium	mg/L	0.05	26.9	26.9	70.7	67.1	9.57	9.37	753	680	206	166
Total Strontium	µg/L	0.05	233	236	309	365	278	263	443	542	338	269
Total Sulphur	mg/L	3	9.1	8.8	28.8	20.2	10.2	10.2	167	192	65	42.6
Total Thallium	µg/L	0.002	0.0068	0.006	0.0083	0.0103	0.0311	0.0177	0.0083	0.0092	<0.01	0.0052

- Data not available / not applicable

# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Total Metals (Cont'd.)												
Total Tin	µg/L	0.2	<0.2	<0.2	0.25	0.27	<0.2	<0.2	<0.2	<0.2	<1	<0.2
Total Titanium	µg/L	0.5	2.03	2.19	6.1	7.3	48.2	18.7	1.6	6.1	4.2	5.19
Total Uranium	µg/L	0.002	0.549	0.561	1.17	1.27	0.551	0.516	7.03	7.41	2.52	2.14
Total Vanadium	µg/L	0.2	48.8	49	189	227	4.59	1.26	2100	1750	525	443
Total Zinc	µg/L	0.1	7.22	5.81	9.9	5.6	8.3	5.1	4.46	4	7.73	2.89
Total Zirconium	µg/L	0.1	0.13	0.12	0.36	0.48	1.38	0.61	0.77	1.06	<0.5	0.38
General Organics												
Naphthenic Acids	mg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hydrocarbons												
F1 (C6-C10)-BTEX	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L	200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L											
Volatile Organics												
Benzene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89

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# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
			Phenols									
Cresols	mg/L	0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L	0.0001	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L	-	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574

- Data not available / not applicable

# Analytes differ by >20% between duplicate but 1 or both concentrations are ≤5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Parent PAH												
1-Methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085

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# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

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**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Parent PAH (Cont'd.)												
Indeno[1,2,3-cd]pyrene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L	-	<2.2935	2.2936	<2.2935	<2.2935	<2.2935	<2.2935	2.3775	2.4405	2.3045	2.3005
Total Parent PAH	µg/L	-	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
Alkylated PAH												
C1 Substituted Acenaphthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.036	0.048	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Alkylated PAH (Cont'd.)												
C1 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L	0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.068	0.092	0.031	0.027
C2 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	0.0086	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.022	0.037	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.021	<0.02	<0.02
C3 Substituted Fluorene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.068	0.079	<0.05	<0.05
C3 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L	0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085

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**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
Alkylated PAH (Cont'd.)												
C4 Substituted Dibenzothiophene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L	-	<1.099	1.0991	<1.099	<1.099	<1.099	<1.099	1.183	1.246	1.11	1.106
Additional Volative Organics												
1,1,1,2-tetrachloroethane	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



**Table A1.2.5 (Cont'd.)**

Water Quality Variables	Units	min.dl	Week 1 sample	Week 1 dup	Week 2 sample	Week 2 dup	Week 3 sample	Week 3 dup	Week 4 sample	Week 4 dup	Week 5 sample	Week 5 dup
			Table 4		Table 3		Table 7		Table 1		Table 2	
		Additional Volative Organics (Cont'd.)										
Bromodichloromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L	1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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# Analytes differ by >20% between duplicate but 1 or both concentrations are <5 times the detection limit

# Analytes differ by >20% between duplicate but 1 or both concentrations are >5 times the detection limit



## A1.2.5 References

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**Appendix A1.3**

**Water Quality Data by Treatment**

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**Table A1.3.1 Analytical chemistry results from 100% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 4 duplicate	Week 5 sample	
Conventional Variables												
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	71	21.9	63	63	60	59	60	110	
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	374	5.5	370	370	380	380	370	370	
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	84.72	4.6	88	82.6	91	79.6	77	82.4	
pH	pH		5	9.144	0.1	9.19	9.19	9.17	9.08	9.05	9.09	
Specific Conductivity	µS/cm		5	3080	44.7	3100	3000	3100	3100	3100	3100	
Total Dissolved Solids	mg/L		5	1900	0.0	1900	1900	1900	1900	2000	1900	
Total Dissolved Solids (Calculated)	mg/L		5	1920	83.7	2000	1900	2000	1900	1900	1800	
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	74.9	2.6	74.1	78.3	75.9	75	80.1	71.2	
Total Suspended Solids	mg/L		5	13.82	2.8	16	14	9.1	16	19	14	
True Colour	PtCo units		5	16.4	2.3	14	16	17	20	15	15	
Turbidity	NTU	5	9.9	2.4	8.3	12	8	13	12	8.2		
Major Ions												
Anion Sum	meq/L	120	5	30.8	0.4	31	31	31	31	30	30	
Bicarbonate	mg/L		5	282	57.6	300	300	320	310	300	180	
Calcium	mg/L		5	16	1.2	16	15	18	15	15	16	
Carbonate	mg/L		5	86.8	29.8	75	76	72	71	73	740	
Cation Sum	meq/L		5	33.6	1.9	35	33	36	33	31	31	
Chloride (Cl)	mg/L		5	404	5.5	400	410	410	400	370	400	
Fluoride (F)	mg/L		5	1.922	0.9	2.3	0.31	2.2	2.5	2.5	2.3	
Hydroxide	mg/L		5	1	0.0	<1	<1	<1	<1	<1	<1	
Ion Balance	%		5	4.3	1.7	5.9	2.9	6.2	4.2	2.6	2.3	
Magnesium	mg/L		5	10.58	0.6	11	11	11	9.9	9.6	10	
Potassium	mg/L	5	12	0.7	10.6	9.97	10	9.68	11.2	9.47		
Sodium	mg/L	5	724	41.6	760	700	770	720	680	670		
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	562	32.7	590	560	590	560	560	510	
Nutrients and Biological Indicators												
Biochemical Oxygen Demand	mg/L	3	5	4.52	1.5	<2	6.1	4.8	4.9	4.8	4.8	
Chemical Oxygen Demand	mg/L		5	102.6	4.0	107	101	97	106	104	102	
Nitrate (as N)	mg/L		5	0.0242	0.0	0.056	>0.01	0.018	0.017	0.048	0.02	
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.1078	0.1	0.25	>0.044	0.079	0.077	0.21	0.089	
Nitrate plus Nitrite (as N)	mg/L		5	0.0434	0.0	0.13	0.032	0.018	0.017	0.048	0.02	
Nitrite (as N)	mg/L		0.02-0.1	5	0.0254	0.0	0.056	>0.01	0.018	0.017	0.048	0.02
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.0826	0.1	0.24	0.074	>0.033	>0.033	>0.033	>0.033	>0.033
Total Ammonia (as N)	mg/L		0.03-73	5	0.034	0.0	0.025	>0.015	0.068	0.038	0.034	0.024
Total Nitrogen (as N)	mg/L		5	1.7	0.2	1.9	1.6	1.6	1.5	1.7	1.9	1.9
Total Organic Carbon	mg/L		5	19.2	3.0	17	20	20	23	21	19	19
Total Orthophosphate (as P)	mg/L	5	0.00598	0.0	0.0063	0.0051	0.007	0.0056	0.0042	0.0059	0.0059	
Total Phosphorus (as P)	mg/L	5	0.069	0.0	0.089	0.06	0.067	0.062	0.083	0.067	0.067	

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



Table A1.3.1 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 4 duplicate	Week 5 sample
<b>Dissolved Metals</b>											
Dissolved Aluminum	µg/L	17-50	5	93.74	16.4	<b>94.3</b>	<b>115</b>	<b>104</b>	<b>79.4</b>	<b>81.8</b>	<b>76</b>
Dissolved Antimony	µg/L		5	0.8486	0.1	0.788	0.911	0.9	0.824	0.845	0.82
Dissolved Arsenic	µg/L		5	10.218	0.6	10.5	9.97	11.2	9.55	9.48	9.87
Dissolved Barium	µg/L		5	45.1	6.7	52.5	47.3	49.5	37.7	39	38.5
Dissolved Beryllium	µg/L		5	0.026	0.0	<0.01	<0.01	<0.05	<0.01	<0.01	<0.05
Dissolved Bismuth	µg/L		5	0.013	0.0	<0.005	<0.005	<0.025	<0.005	<0.005	<0.025
Dissolved Boron	µg/L		5	2398	357.1	2340	2860	2240	2620	2560	1930
Dissolved Cadmium	µg/L		5	0.013	0.0	<0.005	<0.005	<0.025	<0.005	<0.005	<0.025
Dissolved Chromium	µg/L		5	0.328	0.3	<0.1	0.11	0.72	0.21	0.21	<0.5
Dissolved Cobalt	µg/L		5	0.2432	0.1	0.141	0.21	0.236	0.265	0.279	0.364
Dissolved Copper	µg/L		5	0.3758	0.1	0.284	0.496	0.41	0.439	0.42	<0.25
Dissolved Iron	mg/L	0.3	5	0.112	0.1	<b>0.31</b>	<0.06	<0.06	<0.06	<0.06	0.07
Dissolved Lead	µg/L		5	0.03116	0.0	0.0564	0.0375	<0.025	0.0119	0.0132	<0.025
Dissolved Lithium	µg/L		5	104.94	9.9	98.8	115	108	112	133	90.9
Dissolved Manganese	mg/L		5	0.0088	0.010	0.027	<0.004	<0.004	0.0044	<0.004	0.0044
Dissolved Mercury	µg/L		5	0.000887	0.0002	0.000718	0.000915	0.00085	0.00068	0.00063	0.00127
Dissolved Molybdenum	µg/L		5	669.2	76.1	543	685	683	685	711	750
Dissolved Nickel	µg/L		5	3.844	0.5	3.68	3.44	3.83	3.52	3.52	4.75
Dissolved Selenium	µg/L		5	2.802	0.5	2.95	3.23	3.23	2.55	2.42	2.05
Dissolved Silicon	µg/L		5	1654	224.7	1800	1770	1760	1680	1770	1260
Dissolved Silver	µg/L		5	0.013	0.0	<0.005	<0.005	<0.025	<0.005	<0.005	<0.025
Dissolved Strontium	µg/L		5	431	22.0	463	435	421	403	425	433
Dissolved Sulphur	mg/L		5	153.8	28.7	125	123	183	159	165	179
Dissolved Thallium	µg/L		5	0.00802	0.0	0.008	0.0065	<0.01	0.0056	0.0054	<0.01
Dissolved Tin	µg/L		5	1.04	0.8	0.75	2.25	<1	<0.2	<0.2	<1
Dissolved Titanium	µg/L		5	1.326	1.1	<0.5	0.63	<2.5	<0.5	<0.5	<2.5
Dissolved Uranium	µg/L		5	6.786	0.5	6.18	6.54	7.49	6.93	6.83	6.79
Dissolved Vanadium	µg/L		5	1800	255.0	1480	2170	1790	1880	1530	1680
Dissolved Zinc	µg/L		5	3.452	1.6	4.17	2.19	1.49	3.77	8.54	5.64
Dissolved Zirconium	µg/L		5	0.706	0.1	0.74	0.82	0.7	0.7	0.9	0.57
<b>Total Metals</b>											
Total Aluminum	µg/L		5	163	26.7	191	188	161	129	220	146
Total Antimony	µg/L		5	0.8444	0.1	0.842	0.905	0.891	0.844	0.981	0.74
Total Arsenic	µg/L	5	5	10.058	0.6	<b>10.1</b>	<b>9.89</b>	<b>9.57</b>	<b>11</b>	<b>10.5</b>	<b>9.73</b>
Total Barium	µg/L		5	50.42	6.8	58.1	52.8	51	50.8	50.2	39.4
Total Beryllium	µg/L		5	0.019	0.0	<0.01	<0.01	<0.01	0.015	0.021	<0.05
Total Bismuth	µg/L		5	0.01016	0.0	0.0075	0.0083	<0.005	<0.005	<0.01	<0.025
Total Boron	µg/L	1500	5	1885.4	889.8	307	2380	2290	2360	2060	2090
Total Cadmium	µg/L	0.13-0.22	5	0.009	0.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025
Total Calcium	mg/L		5	15.3	1.2	15	15.3	15.2	17.1	15.7	13.9

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



Table A1.3.1 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4		Week 5
				(excluding duplicate)		sample	sample	sample	sample	duplicate	sample
Total Chromium	µg/L	1	5	0.274	0.1	0.23	0.15	0.15	0.34	0.47	<0.5
Total Cobalt	µg/L	0.94-2.2	5	0.335	0.1	0.266	0.275	0.243	0.485	0.541	0.406
Total Copper	µg/L	7	5	0.5228	0.2	0.877	0.357	0.36	0.48	0.48	0.54
Total Iron	µg/L		5	426.4	214.4	208	364	369	785	632	406
Total Lead	µg/L	2.5-5.2	5	0.16014	0.1	0.283	0.143	0.0787	0.203	0.169	0.093
Total Lithium	µg/L		5	107.62	14.5	109	118	123	102	107	86.1
Total Magnesium	mg/L		5	8.908	0.7	8.93	9.71	9.18	7.86	9.91	8.86
Total Manganese	µg/L		5	20.92	6.2	21.2	17.6	17.6	31.6	26.6	16.6
Total Mercury	µg/L	0.005	5	0.0017427	0.0	0.00146	0.00150	0.00172	0.00183	0.00167	0.0022
Total Molybdenum	µg/L	73	5	644.6	56.2	<b>548</b>	<b>654</b>	<b>659</b>	<b>694</b>	<b>813</b>	<b>668</b>
Total Nickel	µg/L	44-72	5	4.072	0.3	3.94	3.8	3.74	4.53	6.46	4.35
Total Potassium	µg/L		5	9.944	0.4	10.6	9.97	10	9.68	11.2	9.47
Total Selenium	µg/L	1	5	2.734	0.5	<b>2.88</b>	<b>3.42</b>	<b>2.85</b>	<b>2.53</b>	<b>2.35</b>	<b>1.99</b>
Total Silicon	µg/L		5	1832	227.3	2140	1920	1750	1830	2210	1520
Total Silver	µg/L	0.1-0.25	5	0.009	0.0	<0.005	<0.005	<0.005	<0.005	<0.01	<0.025
Total Sodium	mg/L		5	639.2	71.9	639	599	644	753	680	561
Total Strontium	µg/L		5	455.6	27.9	489	464	467	443	542	415
Total Sulphur	mg/L		5	150.4	27.2	162	123	120	167	192	180
Total Thallium	µg/L	0.8	5	0.00742	0.0	0.0066	0.0067	0.0055	0.0083	0.0092	<0.01
Total Tin	µg/L		5	0.922	0.9	0.82	2.39	<0.2	<0.2	<0.2	<1
Total Titanium	µg/L		5	1.788	0.6	2.33	1.57	0.94	1.6	6.1	<2.5
Total Uranium	µg/L	15	5	6.708	0.3	6.34	6.81	6.73	7.03	7.41	6.63
Total Vanadium	µg/L		5	1924	310.7	2320	1870	1840	2100	1750	1490
Total Zinc	µg/L	30	5	8.276	5.9	18.4	8.67	4.09	4.46	4	5.76
Total Zirconium	µg/L		5	0.754	0.0	0.8	0.78	0.7	0.77	1.06	0.72
General Organics											
Naphthenic Acids	mg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
Hydrocarbons											
F1 (C6-C10)-BTX	µg/L		5	100	0.0	<100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.0	<100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.0	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.0	<100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.0	<200	<200	<200	<200	<200	<200
Volatile Organics											
Benzene	µg/L	40	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.0	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



Table A1.3.1 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 4 duplicate	Week 5 sample
<b>Phenols</b>											
Cresols	mg/L		5	0.00014	0.0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.00014	0.0	3e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00578	0.0	0.00594	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>											
1-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Anthracene	µg/L	0.012	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)<sup>1</sup> number of replicate samples in project



Table A1.3.1 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4		Week 5
				(excluding duplicate)	sample	sample	sample	sample	duplicate	sample	
Indeno[1,2,3-cd]fluoranthene	µg/L	1	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L		0.4	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L		0.025	5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L		3.4	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L			5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L			5							
Total Parent PAH	µg/L			5	1.1945	0.0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
Alkylated PAH											
C1 Substituted Acenaphthene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.0234	0.0	<0.02	0.021	<0.02	0.036	0.048	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.00854	0.0	<0.0085	<0.0085	0.0087	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyren	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.0492	0.0	<0.02	0.039	0.051	0.068	0.092	0.068
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0092	0.0	0.012	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.0212	0.0	<0.02	<0.02	<0.02	0.022	0.037	0.024
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	0.021	<0.02
C3 Substituted Fluorene	µg/L		5	0.0536	0.0	<0.05	<0.05	<0.05	0.068	0.079	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.13714	0.0	1.1025	1.119	1.1302	1.183	1.246	1.151
Additional Volative organics											
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



Table A1.3.1 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4		Week 5
				(excluding duplicate)		sample	sample	sample	sample	duplicate	sample
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

- Data not available / not applicable

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



**Table A1.3.2 Analytical chemistry results from 32% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5		
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate	
Conventional Variables												
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	12.64	4	16	17	13	8.7	8.5	10	
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	206	20.7	190	200	190	210	240	190	
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	124.2	6.1	126	127	131	115	122	121	
pH	pH		5	8.802	0.1	8.86	8.88	8.85	8.69	8.73	8.72	
Specific Conductivity	µS/cm		5	1200	0	1200	1200	1200	1200	1200	1200	
Total Dissolved Solids	mg/L		5	686	30.5	640	670	700	710	710	680	
Total Dissolved Solids (Calculated)	mg/L		5	736	13.4	750	730	750	720	730	700	
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	110	3.7	107	113	112	105	113	99.7	
Total Suspended Solids	mg/L		5	16	8.2	10	16	13	30	11	9.3	
True Colour	PtCo units		5	15.48	6	9.4	12	25	17	14	16	
Turbidity	NTU		5	13.08	5	8.5	14	15	20	7.9	8.4	
Major Ions												
Anion Sum	meq/L	120	5	12.2	0.4	12	12	12	12	13	12	
Bicarbonate	mg/L		5	218	32.7	190	200	200	230	270	200	
Calcium	mg/L		5	31.4	1.8	31	32	34	29	31	30	
Carbonate	mg/L		5	15	4.8	19	20	16	10	10	12	
Cation Sum	meq/L		5	12	0.7	12	12	13	11	12	12	
Chloride (Cl)	mg/L		5	134	5.5	<b>140</b>	<b>130</b>	<b>140</b>	<b>130</b>	<b>130</b>	<b>130</b>	
Fluoride (F)	mg/L		5	0.778	0	0.77	0.76	0.77	0.83	0.76	0.79	
Hydroxide	mg/L		5	1	0	<1	<1	<1	<1	<1	<1	
Ion Balance	%		5	2.612	1.8	0.16	1.5	3.2	4.8	3.4	0.67	
Magnesium	mg/L		5	11	0.7	12	11	11	10	11	11	
Potassium	mg/L	5	4.64	0.3	4.8	4.9	4.9	4.2	4.4	4.4		
Sodium	mg/L	5	220	15.8	230	220	240	200	210	210		
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	208	11	220	210	210	210	190	200	
Nutrients and Biological Indicators												
Biochemical Oxygen Demand	mg/L	3	5	2.22	0.5	<2	3.1	<2	<2	<2	<2	
Chemical Oxygen Demand	mg/L		5	43.2	3.8	39	40	46	48	43	55	
Nitrate (as N)	mg/L		5	0.025	0	0.026	0.014	0.038	0.027	0.02	0.021	
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.1118	0	0.12	0.062	0.17	0.12	0.087	0.092	
Nitrate plus Nitrite (as N)	mg/L		5	0.0288	0	0.045	0.014	0.038	0.027	0.02	0.021	
Nitrite (as N)	mg/L		0.02-0.1	5	0.0118	0	0.019	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.039	0	0.063	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		0.03-73	5	0.0432	0	0.016	0.07	0.038	<0.075	0.017	0.018
Total Nitrogen (as N)	mg/L		5	0.696	0.1	0.016	0.07	0.038	<0.075	0.017	0.018	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018) <sup>1</sup>

number of replicate samples in project

<sup>2</sup> st dev abbreviation for standard deviation



Table A1.3.2 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate
Total Organic Carbon	mg/L		5	9.72	0.4	9.2	10	9.5	9.9	10	10
Total Orthophosphate (as P)	mg/L		5	0.0023	0	0.0024	0.002	0.0026	0.0023	0.0022	0.004
Total Phosphorus (as P)	mg/L		5	0.00418	0	0.0019	0.0037	0.0041	0.0032	0.008	0.0037
<b>Dissolved Metals</b>											
Dissolved Aluminum	µg/L	17-50	5	35	6.1	40.1	40.6	37.3	27.7	29.3	32.1
Dissolved Antimony	µg/L		5	0.314	0	0.283	0.324	0.321	0.312	0.33	0.32
Dissolved Arsenic	µg/L		5	3.356	0.2	3.29	3.25	3.5	3.17	3.57	3.37
Dissolved Barium	µg/L		5	45.48	1.3	47	46.2	44.7	43.7	45.8	45.6
Dissolved Beryllium	µg/L		5	0.018	0	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05
Dissolved Bismuth	µg/L		5	0.009	0	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025
Dissolved Boron	µg/L		5	809	139.9	731	778	964	938	634	731
Dissolved Cadmium	µg/L		5	0.009	0	<0.005	<0.005	<0.005	<0.005	<0.025	0.03
Dissolved Chromium	µg/L		5	0.21	0.2	<0.1	<0.1	0.22	0.13	<0.5	<0.5
Dissolved Cobalt	µg/L		5	0.12974	0	0.0837	0.134	0.115	0.132	0.184	0.155
Dissolved Copper	µg/L		5	0.6066	0.3	0.433	0.696	0.919	0.735	<0.25	<0.25
Dissolved Iron	mg/L	0.3	5	0.114	0.1	<b>0.33</b>	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.02302	0	0.0165	0.0282	0.0304	0.015	<0.025	<0.025
Dissolved Lithium	µg/L		5	36.68	3.8	33.9	39.4	39.8	38.9	31.4	31.3
Dissolved Manganese	mg/L		5	0.0082	0	0.025	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.00092716	0	0.000657	0.000969	0.00134	8.00E-04	0.00087	0.00106
Dissolved Molybdenum	µg/L		5	203.2	22.7	168	217	199	204	228	228
Dissolved Nickel	µg/L		5	1.998	0.8	1.61	1.61	1.72	1.67	3.38	2.02
Dissolved Selenium	µg/L		5	1.0442	0.2	0.999	1.16	1.27	0.932	0.86	0.93
Dissolved Silicon	µg/L		5	1408	247.9	1300	1210	1810	1480	1240	1220
Dissolved Silver	µg/L		5	0.009	0	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025
Dissolved Strontium	µg/L		5	292.8	18.2	297	302	266	285	314	307
Dissolved Sulphur	mg/L		5	45.7	2.8	45.8	48.9	45.4	41.4	47	49
Dissolved Thallium	µg/L		5	0.00624	0	0.0054	0.006	0.0045	0.0053	<0.01	<0.01
Dissolved Tin	µg/L		5	0.564	0.4	0.76	0.66	<0.2	<0.2	<1	<1
Dissolved Titanium	µg/L		5	0.9	0.9	<0.5	<0.5	<0.5	<0.5	<2.5	<2.5
Dissolved Uranium	µg/L		5	2.366	0.2	2.18	2.22	2.47	2.52	2.44	2.46
Dissolved Vanadium	µg/L		5	565.4	108	472	624	722	469	540	528
Dissolved Zinc	µg/L		5	3.086	1.7	2.47	5.81	2.06	1.5	3.59	2.67
Dissolved Zirconium	µg/L		5	0.298	0.1	0.22	0.23	0.3	0.24	<0.5	<0.5
<b>Total Metals</b>											
Total Aluminum	µg/L		5	260.2	109.6	199	231	445	262	164	159

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018) <sup>1</sup>

number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.2 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate
Total Antimony	µg/L		5	0.3232	0	0.329	0.328	0.35	0.279	0.33	0.249
Total Arsenic	µg/L	5	5	3.832	0.3	3.86	4.06	4.2	3.46	3.58	2.98
Total Barium	µg/L		5	54.04	4.2	55.4	58.1	57.6	49.9	49.2	41.9
Total Beryllium	µg/L		5	0.0264	0	0.012	0.016	0.028	0.026	<0.05	<0.01
Total Bismuth	µg/L		5	0.01148	0	<0.01	0.0066	<0.01	0.0058	<0.025	<0.005
Total Boron	µg/L	1500	5	652	36.9	669	644	707	622	618	654
Total Cadmium	µg/L	0.13-0.22	5	0.009	0	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005
Total Calcium	mg/L		5	28.32	0.9	26.9	28.5	28.5	29.5	28.2	26.6
Total Chromium	µg/L	1	5	0.496	0.1	0.47	0.3	0.71	0.5	<0.5	0.32
Total Cobalt	µg/L	0.94-2.2	5	0.3016	0.1	0.221	0.269	0.364	0.365	0.289	0.219
Total Copper	µg/L	7	5	0.9338	0.3	0.69	0.756	1.44	0.973	0.81	0.629
Total Iron	µg/L		5	479.6	182.4	344	362	644	711	337	331
Total Lead	µg/L	2.5-5.2	5	0.247	0.1	0.215	0.222	0.325	0.342	0.131	0.116
Total Lithium	µg/L		5	35.96	2.9	36.1	36.3	40.4	34.1	32.9	30.3
Total Magnesium	mg/L		5	9.552	1	9.69	10.1	9.94	7.73	10.3	8.09
Total Manganese	µg/L		5	24.28	6	21.1	25	21.4	34.4	19.5	15.4
Total Mercury	µg/L	0.005	5	0.00203217	0	0.001452	0.001879	0.0027	0.00244	0.00169	0.00154
Total Molybdenum	µg/L	73	5	227.4	21.1	<b><u>226</u></b>	<b><u>233</u></b>	<b><u>244</u></b>	<b><u>192</u></b>	<b><u>242</u></b>	<b><u>190</u></b>
Total Nickel	µg/L	44-72	5	2.34	0.3	2.14	1.96	2.84	2.33	2.43	1.84
Total Potassium	µg/L		5	4.084	0.4	4.26	4.39	4.36	3.35	4.06	3.51
Total Selenium	µg/L	1	5	1.0136	0.1	<b><u>1.11</u></b>	<b><u>1.11</u></b>	<b><u>1.09</u></b>	0.888	0.87	0.813
Total Silicon	µg/L		5	1892	456.5	1610	1700	2660	1950	1540	1480
Total Silver	µg/L	0.1-0.25	5	0.011	0	<0.01	<0.005	<0.01	<0.005	<0.025	<0.005
Total Sodium	mg/L		5	195.4	23.6	202	202	213	154	206	166
Total Strontium	µg/L		5	341	40	356	378	359	274	338	269
Total Sulphur	mg/L		5	60.48	11	63.8	68.1	64.4	41.1	65	42.6
Total Thallium	µg/L	0.8	5	0.00744	0	0.005	0.0044	0.0098	0.008	<0.01	0.0052
Total Tin	µg/L		5	0.694	0.5	1.34	0.73	<0.2	<0.2	<1	<0.2
Total Titanium	µg/L		5	6.422	2.9	2.7	6.83	9.4	8.98	4.2	5.19
Total Uranium	µg/L	15	5	2.546	0.1	2.53	2.49	2.75	2.44	2.52	2.14
Total Vanadium	µg/L		5	565	66.6	619	565	639	477	525	443
Total Zinc	µg/L	30	5	6.57	2.8	9.9	4.18	7.8	3.24	7.73	2.89
Total Zirconium	µg/L		5	0.506	0.2	0.42	0.43	0.78	0.4	<0.5	0.38
<b>General Organics</b>											
Naphthenic Acids	mg/L		5	2	0	<2	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>											

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018) 1

number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.2 (Cont'd.)**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate
F1 (C6-C10)-BTEX	µg/L		5	100	0	<100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0	<100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0	<100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0	<200	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L		5								
<b>Volatile Organics</b>											
Benzene	µg/L	40	5	0.4	0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89
<b>Phenols</b>											
Cresols	mg/L		5	0.00014	0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.00012	0	2.00E-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00576	0	0.00584	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574

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number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.2 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5		
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate	
Parent PAH												
1-Methylnaphthalene	µg/L	5.8	5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
2-Methylnaphthalene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Acenaphthene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Acenaphthylene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Acridine	µg/L	4.4	5	0.04	0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	
Anthracene	µg/L	0.012	5	0.01	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	
Benzo[a]pyrene equivalency	µg/L		5	0.01	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Benzo[c]phenanthrene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Benzo[e]pyrene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Benzo[g,h,i]perylene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Benzo[k]fluoranthene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Biphenyl	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Chrysene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	
Dibenzothiophene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Fluoranthene	µg/L	0.04	5	0.01	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Fluorene	µg/L	3	5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
Naphthalene	µg/L	1	5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Perylene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Phenanthrene	µg/L	0.4	5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Pyrene	µg/L	0.025	5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Quinoline	µg/L	3.4	5	0.2	0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Retene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Total PAH	µg/L		5									
Total Parent PAH	µg/L		5	1.1945	0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	
Alkylated PAH												
C1 Substituted Acenaphthene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	
C1 Substituted Biphenyl	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018) 1

number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.2 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
				(excluding duplicate)	sample	sample	sample	sample	sample	duplicate	
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.0228	0	<0.02	<0.02	<0.02	0.023	0.031	0.027
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.00862	0	0.0091	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.10192	0	1.0996	<1.099	<1.099	1.102	1.11	1.106
Additional Volative organics											
1,1,1,2-tetrachloroethane	µg/L		5	1	0	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018) 1

number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.2 (Cont'd.)**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
				(excluding duplicate)		sample	sample	sample	sample	sample	duplicate
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.3 Analytical chemistry results from 10% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5		
						sample	sample	duplicate	sample	sample	sample	
Conventional Variables												
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1.44	0.98	<1	<1	3.9	3.2	<1	<1	
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	150	29.15	130	140	140	130	150	200	
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	132.8	5.76	134	131	132	141	125	133	
pH	pH		5	8.258	0.12	8.21	8.23	8.56	8.45	8.26	8.14	
Specific Conductivity	µS/cm		5	588	10.95	590	600	600	570	590	590	
Total Dissolved Solids	mg/L		5	332	8.37	340	320	310	330	330	340	
Total Dissolved Solids (Calculated)	mg/L		5	354	20.74	340	350	340	350	340	390	
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	123.6	9.21	115	124	127	137	127	115	
Total Suspended Solids	mg/L		5	12.9	4.95	8.1	15	15	13	20	8.4	
True Colour	PtCo units		5	15.26	7.94	7.3	11	10	28	17	13	
Turbidity	NTU		5	14.88	5.45	11	17	13	19	20	7.4	
Major Ions												
Anion Sum	meq/L	120	5	6.22	0.68	5.7	6	5.9	5.9	6.1	7.4	
Bicarbonate	mg/L		5	184	33.62	160	170	160	160	190	240	
Calcium	mg/L		5	35	1.87	35	34	35	38	33	35	
Carbonate	mg/L		5	1.58	1.30	<1	<1	4.7	3.9	<1	<1	
Cation Sum	meq/L		5	6	0.31	6.2	5.9	6	6.4	5.6	5.9	
Chloride (Cl)	mg/L		5	45.2	5.26	43	44	40	45	40	54	
Fluoride (F)	mg/L		5	0.312	0.01	0.33	0.31	0.27	0.3	0.32	0.3	
Hydroxide	mg/L		5	1	0.00	<1	<1	<1	<1	<1	<1	
Ion Balance	%		5	4.786	3.77	3.8	0.73	1.4	4.2	4.2	11	
Magnesium	mg/L		5	10.8	0.45	11	11	11	11	10	11	
Potassium	mg/L		5	2.26	0.11	2.4	2.3	2.4	2.3	2.1	2.2	
Sodium	mg/L		5	75.6	4.16	78	75	76	81	70	74	
Sulphate (as SO <sub>4</sub> )	mg/L		309	5	91.6	1.14	91	93	95	92	90	92
Nutrients and Biological Indicators												
Biochemical Oxygen Demand	mg/L	3	5	1.92	0.18	<2	<1.6	<1.6	<2	<2	<2	
Chemical Oxygen Demand	mg/L		5	26.4	5.68	24	22	24	36	27	23	
Nitrate (as N)	mg/L		5	0.0196	0.01	0.022	<0.01	<0.01	0.038	0.015	0.013	
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.0866	0.05	0.095	<0.044	<0.044	0.17	0.067	0.057	
Nitrate plus Nitrite (as N)	mg/L		5	0.0196	0.01	0.022	<0.01	<0.01	0.038	0.015	0.013	
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.00	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.00	<0.015	<0.015	<0.015	<0.015	<0.015	
Total Nitrogen (as N)	mg/L		5	0.376	0.04	0.35	0.32	0.33	0.4	0.4	0.41	
Total Organic Carbon	mg/L		5	6.28	0.88	5.1	5.7	5.8	7.3	6.8	6.5	
Total Orthophosphate (as P)	mg/L		5	0.00142	0.00	0.0014	0.0014	0.0017	0.0015	0.0013	0.0015	
Total Phosphorus (as P)	mg/L		5	0.0208	0.00	0.02	0.019	0.019	0.022	0.028	0.015	
Dissolved Metals												
Dissolved Aluminum	µg/L	17-50	5	15.88	3.35	18.5	19.8	20.7	15.3	11.4	14.4	
Dissolved Antimony	µg/L		5	0.1344	0.01	0.121	0.142	0.133	0.142	0.122	0.145	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.3 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2		Week 3	Week 4	Week 5	
						sample	sample	duplicate	sample	sample	sample	
Dissolved Arsenic	µg/L	0.3	5	1.248	0.07	1.23	1.21	1.25	1.33	1.16	1.31	
Dissolved Barium	µg/L		5	44.12	2.76	44.4	45.2	46.4	41	42	48	
Dissolved Beryllium	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Dissolved Bismuth	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Dissolved Boron	µg/L		5	261.2	38.99	249	287	281	303	265	202	
Dissolved Cadmium	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Dissolved Chromium	µg/L		5	0.114	0.03	<0.1	<0.1	<0.1	0.16	0.11	<0.1	
Dissolved Cobalt	µg/L		5	0.08956	0.02	0.063	0.103	0.0998	0.0785	0.0843	0.119	
Dissolved Copper	µg/L		5	0.7874	0.30	0.431	1.19	0.708	0.991	0.692	0.633	
Dissolved Iron	mg/L		5	0.106	0.10	0.29	<0.06	<0.06	<0.06	<0.06	<0.06	
Dissolved Lead	µg/L		5	0.01766	0.01	0.0081	0.0192	0.0176	0.0252	0.013	0.0228	
Dissolved Lithium	µg/L		5	15.12	1.31	14.2	15.7	15.8	16.2	16.2	13.3	
Dissolved Manganese	mg/L		5	0.0082	0.01	0.025	<0.004	<0.004	<0.004	<0.004	<0.004	
Dissolved Mercury	µg/L		5	0.000983937	0.00	0.000635	0.000924	0.000841	0.00132	0.00098	0.00106	
Dissolved Molybdenum	µg/L		5	61.82	7.83	52.1	64.4	66.3	59.4	59.8	73.4	
Dissolved Nickel	µg/L		5	1.098	0.13	1.01	1.04	1.07	1.08	1.04	1.32	
Dissolved Selenium	µg/L		5	0.4686	0.06	0.404	0.511	0.503	0.55	0.47	0.408	
Dissolved Silicon	µg/L		5	1292	283.85	1150	1040	1050	1740	1400	1130	
Dissolved Silver	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Dissolved Strontium	µg/L		5	243	26.67	246	241	254	213	230	285	
Dissolved Sulphur	mg/L		5	19.92	4.37	17.5	20.2	21.8	17.5	17	27.4	
Dissolved Thallium	µg/L		5	0.00448	0.00	0.0061	0.0048	0.0054	0.0051	0.0044	<0.002	
Dissolved Tin	µg/L		5	0.214	0.03	<0.2	0.27	0.24	<0.2	<0.2	<0.2	
Dissolved Titanium	µg/L		5	0.5	0.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Dissolved Uranium	µg/L		5	1.0054	0.06	0.914	0.983	0.99	1.03	1.03	1.07	
Dissolved Vanadium	µg/L		5	154	16.23	136	167	169	158	138	171	
Dissolved Zinc	µg/L		5	4.246	3.90	0.72	2.92	2.19	9.61	1.02	6.96	
Dissolved Zirconium	µg/L		5	0.108	0.02	<0.1	<0.1	<0.1	0.14	<0.1	<0.1	
Total Metals												
Total Aluminum	µg/L	5	5	551.2	613.79	167	294	303	1620	510	165	
Total Antimony	µg/L		5	0.145	0.02	0.13	0.144	0.176	0.175	0.159	0.117	
Total Arsenic	µg/L		5	1.578	0.40	1.24	1.59	1.78	2.21	1.64	1.21	
Total Barium	µg/L		5	56.22	11.27	46.5	57.8	64.2	73.5	57.6	45.7	
Total Beryllium	µg/L		5	0.0278	0.02	<0.01	0.014	0.019	0.068	0.034	0.013	
Total Bismuth	µg/L		5	0.0102	0.01	<0.005	<0.01	<0.01	0.021	<0.01	<0.005	
Total Boron	µg/L		1500	5	232.4	11.87	240	229	241	241	239	213
Total Cadmium	µg/L		0.13-0.22	5	0.0173	0.01	<0.005	0.0312	0.0289	0.0315	0.0138	<0.005
Total Calcium	mg/L		1	5	33.24	2.30	31.5	32.5	36.2	37.1	33.5	31.6
Total Chromium	µg/L		0.94-2.2	5	0.842	0.95	0.25	0.47	0.5	<u>2.51</u>	0.71	0.27
Total Cobalt	µg/L	7	5	0.4368	0.37	0.242	0.301	0.359	1.09	0.372	0.179	
Total Copper	µg/L		5	1.3798	0.93	0.865	0.99	1.24	2.99	1.33	0.724	
Total Iron	µg/L		5	851.2	887.50	298	459	508	2400	784	315	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.3 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	duplicate	sample	sample
Total Lead	µg/L	2.5-5.2	5	0.4404	0.44	0.156	0.293	0.32	1.21	0.398
Total Lithium	µg/L		5	15.16	1.69	15	15.1	17	17.9	14.5
Total Magnesium	mg/L		5	9.868	1.01	8.8	10.5	8.83	10.8	10.5
Total Manganese	µg/L		5	38.7	32.20	19.1	28.6	34.1	95	33.7
Total Mercury	µg/L	0.005	5	0.002180364	0.00	0.00141	0.00202	0.00155	0.00346	0.00252
Total Molybdenum	µg/L	73	5	66.6	9.42	52.5	70.9	<b>78.9</b>	<b>75.6</b>	72.3
Total Nickel	µg/L	44-72	5	1.974	1.20	1.13	1.61	2.1	4.06	1.84
Total Potassium	µg/L		5	2.13	0.34	1.89	2.22	1.89	2.61	2.2
Total Selenium	µg/L	1	5	0.4566	0.03	0.441	0.449	0.492	0.513	0.442
Total Silicon	µg/L		5	2278	1377.98	1380	1540	1740	4620	2430
Total Silver	µg/L	0.1-0.25	5	0.0086	0.00	<0.005	<0.01	<0.01	0.013	<0.01
Total Sodium	mg/L		5	67.76	5.63	64.8	70.7	67.1	74	69.7
Total Strontium	µg/L		5	282.6	32.88	250	309	365	311	299
Total Sulphur	mg/L		5	24.52	5.70	16.7	28.8	20.2	27.3	29.5
Total Thallium	µg/L	0.8	5	0.0122	0.01	0.0067	0.0083	0.0103	0.0272	0.013
Total Tin	µg/L		5	0.21	0.02	<0.2	0.25	0.27	<0.2	<0.2
Total Titanium	µg/L		5	16.574	23.48	2.91	6.1	7.3	58.2	11.3
Total Uranium	µg/L	15	5	1.1066	0.14	0.941	1.17	1.27	1.26	1.18
Total Vanadium	µg/L		5	172.8	29.93	156	189	227	215	166
Total Zinc	µg/L	30	5	5.932	4.52	3.74	9.9	5.6	11.6	3
Total Zirconium	µg/L		5	0.504	0.42	0.2	0.36	0.48	1.22	0.52
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.00	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTEX	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.00	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.00	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	<200	0.00	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.8	0.00	<0.8	<0.8	<0.8	<0.8	<0.8
m,p-Xylene	µg/L		5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
o-Xylene	µg/L		5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.00	<0.89	<0.89	<0.89	<0.89	<0.89
<b>Phenols</b>										
Cresols	mg/L		5	0.00014	0.00	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.3 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2		Week 3	Week 4	Week 5
						sample	sample	duplicate	sample	sample	sample
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.00	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>											
1-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.00	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	1	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.3 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2		Week 3	Week 4	Week 5
						sample	sample	duplicate	sample	sample	sample
Perylene	µg/L	0.4 0.025 3.4	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.29352	0.00	2.2936	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.00	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
Alkylated PAH											
C1 Substituted Acenaphthene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.00852	0.00	0.0086	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.09902	0.00	1.0991	<1.099	<1.099	<1.099	<1.099	<1.099
Additional Volative organics											
1,1,1,2-tetrachloroethane	µg/L	21	5	1	0.0	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.3 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2		Week 3	Week 4	Week 5
						sample	sample	duplicate	sample	sample	sample
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.4 Analytical chemistry results from 3.2% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
Conventional Variables											
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.00	<1	<1	<1	<1	<1	<1
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	128	16.43	110	110	120	120	150	140
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	137	5.24	140	138	136	143	129	137
pH	pH		5	8	0.26	7.72	7.75	7.72	8.25	8.2	8.11
Specific Conductivity	µS/cm		5	390	12.25	390	390	400	370	400	390
Total Dissolved Solids	mg/L		5	222	40.25	270	320	180	180	240	240
Total Dissolved Solids (Calculated)	mg/L		5	234	5.48	230	230	230	230	240	240
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	128	6.75	119	120	128	134	135	124
Total Suspended Solids	mg/L		5	11.94	6.80	6.2	6.5	12	12	23	6.5
True Colour	PtCo units		5	16.08	7.86	12	11	7.4	28	19	14
Turbidity	NTU		5	13.5	8.29	7.6	8.4	7.8	24	21	7.1
Major Ions											
Anion Sum	meq/L	120	5	4.26	0.29	4.1	4.1	4.2	3.9	4.6	4.5
Bicarbonate	mg/L		5	156	18.17	140	140	150	140	180	170
Calcium	mg/L		5	36.6	1.52	37	37	36	39	35	36
Carbonate	mg/L		5	1	0.00	<1	<1	<1	<1	<1	<1
Cation Sum	meq/L		5	4.1	0.21	4.3	4.2	4.1	4.3	3.8	4
Chloride (Cl)	mg/L		5	16.8	1.30	19	20	16	17	16	16
Fluoride (F)	mg/L		5	0.164	0.01	0.17	0.17	0.17	0.15	0.18	0.15
Hydroxide	mg/L		5	1	0.00	<1	<1	<1	<1	<1	<1
Ion Balance	%		5	4.304	3.06	2.4	1.5	0.72	4.5	8.8	5.1
Magnesium	mg/L		5	11	0.71	12	11	11	11	10	11
Potassium	mg/L		5	1.52	0.15	1.6	1.6	1.7	1.5	1.3	1.5
Sodium	mg/L	5	30.8	2.28	33	33	31	33	28	29	
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	57.4	2.30	60	60	59	54	57	57
Nutrients and Biological Indicators											
Biochemical Oxygen Demand	mg/L	3	5	1.82	0.40	<2	<2	<1.1	<2	<2	<2
Chemical Oxygen Demand	mg/L		5	20.2	3.70	15	13	23	24	21	18
Nitrate (as N)	mg/L		5	0.0184	0.01	0.018	0.028	<0.01	0.028	0.024	0.012
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.0832	0.04	0.08	0.12	<0.044	0.13	0.11	0.052
Nitrate plus Nitrite (as N)	mg/L		5	0.0184	0.01	0.018	0.028	<0.01	0.028	0.024	0.012
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.00	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.00	<0.015	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L		5	0.306	0.06	0.29	0.26	0.24	0.39	0.32	0.29
Total Organic Carbon	mg/L		5	4.94	1.00	3.8	3.9	4.1	6.2	5.6	5
Total Orthophosphate (as P)	mg/L		5	0.00172	0.00	0.0013	0.0017	0.0016	0.0023	0.0013	0.0021
Total Phosphorus (as P)	mg/L	5	0.0188	0.01	0.013	0.013	0.016	0.019	0.031	0.015	
Dissolved Metals											
Dissolved Aluminum	µg/L	17-50	5	17.718	16.99	47.8	23.1	13.8	10.9	7.25	8.84
Dissolved Antimony	µg/L		5	0.082	0.01	0.066	0.067	0.086	0.095	0.083	0.08
Dissolved Arsenic	µg/L		5	0.6176	0.05	0.587	0.582	0.583	0.698	0.586	0.634
Dissolved Barium	µg/L		5	44.4	2.63	42.6	43.5	45.4	42.5	42.9	48.6

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.4 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
Dissolved Beryllium	µg/L	0.3	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	107.6	17.39	106	95	123	122	107	80
Dissolved Cadmium	µg/L		5	0.00518	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	0.0059
Dissolved Chromium	µg/L		5	0.12	0.04	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Dissolved Cobalt	µg/L		5	0.08434	0.01	0.0764	0.0609	0.0964	0.0738	0.0803	0.0948
Dissolved Copper	µg/L		5	0.7678	0.21	0.504	0.458	0.762	1.1	0.758	0.715
Dissolved Iron	mg/L		5	0.0988	0.08	0.25	0.27	<0.06	0.064	<0.06	<0.06
Dissolved Lead	µg/L		5	0.03348	0.02	0.0663	0.0171	0.0183	0.0519	0.0173	0.0136
Dissolved Lithium	µg/L		5	8.31	0.63	8.29	8.23	8.65	8.38	8.95	7.28
Dissolved Manganese	mg/L		5	0.008	0.01	0.024	0.023	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.000975763	0.00	0.000784	0.000619	0.001044	0.00141	0.00085	0.00079
Dissolved Molybdenum	µg/L		5	20.36	2.51	16.7	17.2	21.4	20.1	20	23.6
Dissolved Nickel	µg/L		5	0.9258	0.08	0.847	0.837	0.885	1.02	0.879	0.998
Dissolved Selenium	µg/L		5	0.2798	0.04	0.225	0.207	0.286	0.348	0.275	0.265
Dissolved Silicon	µg/L		5	1098.6	294.74	965	940	825	1570	1190	943
Dissolved Silver	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L		5	232.2	21.43	231	235	234	208	222	266
Dissolved Sulphur	mg/L		5	11.72	1.99	9.2	9.7	12.3	12.8	10.2	14.1
Dissolved Thallium	µg/L		5	0.00458	0.00	0.0058	0.0054	0.0053	0.005	0.0048	<0.002
Dissolved Tin	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium	µg/L		5	0.5	0.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Uranium	µg/L		5	0.6054	0.04	0.532	0.55	0.613	0.618	0.638	0.626
Dissolved Vanadium	µg/L		5	49.72	4.81	43.8	44.8	52.7	53.1	45.2	53.8
Dissolved Zinc	µg/L		5	2.772	2.41	4	2.76	6.43	1.62	0.99	0.82
Dissolved Zirconium	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Metals											
Total Aluminum	µg/L	5	5	440.8	435.11	123	127	287	1170	496	128
Total Antimony	µg/L		5	0.098	0.02	0.073	0.07	0.096	0.12	0.111	0.09
Total Arsenic	µg/L		5	0.8634	0.22	0.604	0.605	0.811	1.18	0.98	0.742
Total Barium	µg/L		5	55.66	7.99	44.9	45.2	58.1	66.3	57.5	51.5
Total Beryllium	µg/L		5	0.0284	0.02	<0.01	<0.01	0.02	0.07	0.032	<0.01
Total Bismuth	µg/L	1500	5	0.009	0.00	<0.005	<0.005	<0.01	0.015	<0.01	<0.005
Total Boron	µg/L		5	100.4	12.66	97	94	88	90	110	117
Total Cadmium	µg/L		5	0.01472	0.01	<0.005	<0.005	0.0162	0.0252	0.0146	0.0126
Total Calcium	mg/L	0.13-0.22	5	34.36	1.69	33.1	33.5	33.9	36.6	35.6	32.6
Total Chromium	µg/L		5	0.678	0.62	0.22	0.23	0.51	<u>1.72</u>	0.71	0.23
Total Cobalt	µg/L	0.94-2.2	5	0.3744	0.21	0.22	0.236	0.325	0.72	0.41	0.197
Total Copper	µg/L		5	1.3516	0.62	0.847	0.96	1.15	2.34	1.55	0.871
Total Iron	µg/L	7	5	699.8	543.16	295	293	496	1590	826	292
Total Lead	µg/L		5	0.3748	0.27	0.144	0.135	0.306	0.814	0.436	0.174
Total Lithium	µg/L		5	8.87	1.14	8.5	8.58	8.36	10.3	9.74	7.45
Total Magnesium	mg/L		5	10.236	0.88	8.78	8.77	10.4	10.4	11.2	10.4
Total Manganese	µg/L		5	33.4	15.39	20	17.9	29.9	56.7	40	20.4

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.4 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
Total Mercury	µg/L	0.005	5	0.002110162	0.00	0.00119	0.00129	0.00167	0.0031	0.00286	0.00173
Total Molybdenum	µg/L	73	5	22.08	2.95	16.9	17.1	23	24.3	22.8	23.4
Total Nickel	µg/L	44-72	5	1.9206	0.82	0.983	0.935	2.79	2.75	1.72	1.36
Total Potassium	µg/L		5	1.516	0.21	1.28	1.28	1.57	1.8	1.58	1.35
Total Selenium	µg/L	1	5	0.2678	0.04	0.236	0.23	0.249	0.333	0.263	0.258
Total Silicon	µg/L		5	2058	1117.19	1260	1250	1440	3900	2340	1350
Total Silver	µg/L	0.1-0.25	5	0.0082	0.00	<0.005	<0.005	<0.01	0.011	<0.01	<0.005
Total Sodium	mg/L		5	28.78	1.37	26.9	26.9	28.7	30	30.2	28.1
Total Strontium	µg/L		5	271.6	22.92	233	236	286	284	287	268
Total Sulphur	mg/L		5	14.04	4.26	9.1	8.8	16.3	15.4	19.2	10.2
Total Thallium	µg/L	0.8	5	0.00976	0.01	0.0068	0.006	0.0092	0.0202	0.0102	0.0024
Total Tin	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L		5	9.292	9.47	2.03	2.19	5.8	25.3	10.1	3.23
Total Uranium	µg/L	15	5	0.665	0.08	0.549	0.561	0.699	0.747	0.694	0.636
Total Vanadium	µg/L		5	58.24	8.20	48.8	49	60.7	70.5	57.8	53.4
Total Zinc	µg/L	30	5	7.158	3.15	7.22	5.81	11	9.4	4.8	3.37
Total Zirconium	µg/L		5	0.506	0.33	0.13	0.12	0.73	0.93	0.51	0.23
<b>General Organics</b>											
Naphthenic Acids	mg/L		5	2	0.00	<2	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>											
F1 (C6-C10)-BTX	µg/L		5	100	0.00	<100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.00	<100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.00	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.00	<100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.00	<200	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L										
<b>Volatile Organics</b>											
Benzene	µg/L	40	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.00	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.00	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89
<b>Phenols</b>											
P Cresols	mg/L		5	0.00014	0.00	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
P 2-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P Pentachlorophenol	mg/L	0.0005	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.4 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
P 2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P Phenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P 3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P 2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 4-chloro-3-methylphenol	mg/L		5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
P 2,4-dinitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P 4-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P Total phenols	mg/L		5	0.00574	0.00	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>											
1-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.00	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	1	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.4	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.025	5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.00	<2.2935	2.2936	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.00	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.4 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
Alkylated PAH											
C1 Substituted Acenaphthene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	0.0086	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.00	<1.099	1.0991	<1.099	<1.099	<1.099	<1.099
Additional Volative organics											
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.4 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1		Week 2	Week 3	Week 4	Week 5
						sample	duplicate	sample	sample	sample	sample
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.5 Analytical chemistry results from 1% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
Conventional Variables										
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.0	<1	<1	<1	<1	<1
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	120	12.2	110	120	110	120	140
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	138.8	5.6	142	139	145	130	138
pH	pH		5	7.864	0.4	7.53	7.41	8.19	8.15	8.04
Specific Conductivity	µS/cm		5	332	13.0	330	340	310	340	340
Total Dissolved Solids	mg/L		5	196	37.8	250	160	160	210	200
Total Dissolved Solids (Calculated)	mg/L		5	192	4.5	190	190	190	190	200
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	129	3.9	123	129	128	132	133
Total Suspended Solids	mg/L		5	12.98	7.8	5.9	13	12	26	8
True Colour	PtCo units		5	14.98	7.7	9.2	8.7	27	18	12
Turbidity	NTU		5	14.98	6.3	8.9	16	22	20	8
Major Ions										
Anion Sum	meq/L	120	5	3.6	0.3	3.4	3.5	3.4	3.7	4
Bicarbonate	mg/L		5	146	15.2	130	140	140	150	170
Calcium	mg/L		5	37.4	1.8	38	37	40	35	37
Carbonate	mg/L		5	1	0.0	<1	<1	<1	<1	<1
Cation Sum	meq/L		5	3.56	0.2	3.7	3.6	3.7	3.3	3.5
Chloride (Cl)	mg/L		5	8.52	1.0	10	7.3	8.4	8.2	8.7
Fluoride (F)	mg/L		5	0.146	0.0	0.12	0.12	0.11	0.19	0.19
Hydroxide	mg/L		5	1	0.0	<1	<1	<1	<1	<1
Ion Balance	%		5	4.114	2.3	3.7	0.37	4.5	5.7	6.3
Magnesium	mg/L		5	11	0.7	12	11	11	10	11
Potassium	mg/L		5	1.32	0.2	1.5	1.5	1.3	1.1	1.2
Sodium	mg/L		5	17.4	1.1	19	17	18	16	17
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	46	2.4	49	47	43	47	44
Nutrients and Biological Indicators										
Biochemical Oxygen Demand	mg/L	3	5	1.8	0.4	<2	<1	<2	<2	<2
Chemical Oxygen Demand	mg/L		5	21.2	6.4	17	20	32	21	16
Nitrate (as N)	mg/L		5	0.016	0.0	0.013	<0.01	0.031	0.015	0.011
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.071	0.0	0.056	<0.044	0.14	0.067	0.048
Nitrate plus Nitrite (as N)	mg/L		5	0.016	0.0	0.013	<0.01	0.031	0.015	0.011
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.0	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.0	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L		5	0.252	0.1	0.25	0.2	0.34	0.23	0.24
Total Organic Carbon	mg/L		5	4.62	1.1	3.3	3.8	5.8	5.8	4.4
Total Orthophosphate (as P)	mg/L	5	0.00196	0.0	0.0018	0.0016	0.0029	0.0015	0.002	
Total Phosphorus (as P)	mg/L	5	0.0164	0.0	0.013	0.014	0.021	0.023	0.011	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

<sup>1</sup> number of replicate samples in project



Table A1.3.5 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Dissolved Metals										
Dissolved Aluminum	µg/L	17-50	5	8.486	2.4	12	9.87	7.1	6.35	7.11
Dissolved Antimony	µg/L		5	0.0678	0.0	0.055	0.069	0.079	0.072	0.064
Dissolved Arsenic	µg/L		5	0.4226	0.1	0.378	0.38	0.508	0.412	0.435
Dissolved Barium	µg/L		5	43.46	3.1	42.2	44.8	40.6	41.5	48.2
Dissolved Beryllium	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	54.6	6.2	57	52	60	59	45
Dissolved Cadmium	µg/L		5	0.00664	0.0	<0.005	0.0067	0.0073	0.0064	0.0078
Dissolved Chromium	µg/L		5	0.114	0.0	<0.1	<0.1	0.17	<0.1	<0.1
Dissolved Cobalt	µg/L		5	0.0773	0.0	0.0528	0.108	0.0636	0.076	0.0861
Dissolved Copper	µg/L	0.3	5	0.7644	0.3	0.454	0.676	1.25	0.788	0.654
Dissolved Iron	mg/L		5	0.1	0.1	0.26	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.01358	0.0	<0.005	0.0124	0.0216	0.0186	0.0103
Dissolved Lithium	µg/L		5	6.308	0.4	6.32	6.6	6.16	6.81	5.65
Dissolved Manganese	mg/L		5	0.008	0.0	0.024	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.000934234	0.0	0.000523	0.000848	0.00157	0.00086	0.00087
Dissolved Molybdenum	µg/L		5	7.414	0.8	6.28	7.76	7.12	7.32	8.59
Dissolved Nickel	µg/L		5	0.8386	0.1	0.738	0.814	0.914	0.776	0.951
Dissolved Selenium	µg/L		5	0.2254	0.0	0.151	0.218	0.268	0.245	0.245
Dissolved Silicon	µg/L		5	986.8	184.0	929	780	1230	1120	875
Dissolved Silver	µg/L		5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L		5	225.4	20.2	230	226	200	216	255
Dissolved Sulphur	mg/L		5	9.8	2.2	7.5	9	8.2	12.1	12.2
Dissolved Thallium	µg/L		5	0.00426	0.0	0.0051	0.0051	0.0044	0.0047	<0.002
Dissolved Tin	µg/L	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	
Dissolved Titanium	µg/L	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Dissolved Uranium	µg/L	5	0.482	0.0	0.434	0.489	0.486	0.503	0.498	
Dissolved Vanadium	µg/L	5	16.86	1.3	15.1	17.6	18.1	15.9	17.6	
Dissolved Zinc	µg/L	5	1.642	1.5	0.87	4.36	0.83	1.28	0.87	
Dissolved Zirconium	µg/L	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	
Total Metals										
Total Aluminum	µg/L	5	5	360.2	253.2	106	286	669	583	157
Total Antimony	µg/L		5	0.0776	0.0	0.056	0.082	0.089	0.096	0.065
Total Arsenic	µg/L		5	0.6238	0.2	0.423	0.631	0.819	0.729	0.517
Total Barium	µg/L		5	54.2	5.3	45.8	57.7	58.9	56.3	52.3
Total Beryllium	µg/L		5	0.0218	0.0	<0.01	0.024	0.034	0.029	0.012
Total Bismuth	µg/L	1500	5	0.009	0.0	<0.005	<0.01	<0.01	<0.01	<0.01
Total Boron	µg/L		5	56.4	10.7	51	60	45	73	53
Total Cadmium	µg/L		5	0.01348	0.0	<0.005	0.0165	0.017	0.0157	0.0132
Total Calcium	mg/L		5	34.5	0.3	34.4	34.1	34.5	35	34.5
Total Chromium	µg/L		1	5	0.564	0.3	0.2	0.46	0.97	0.81
Total Copper	µg/L	0.13-0.22	5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cobalt	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Iron	mg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Lead	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Manganese	mg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Mercury	µg/L	1	5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Molybdenum	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Nickel	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Selenium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Silicon	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Silver	µg/L	0.1	5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Strontium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Sulphur	mg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Thallium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Tin	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Titanium	µg/L	0.1	5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Uranium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Vanadium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Zinc	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Total Zirconium	µg/L		5	0.0001	0.0	<0.005	<0.005	<0.005	<0.005	<0.005

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

<sup>1</sup> number of replicate samples in project



Table A1.3.5 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Total Cobalt	µg/L	0.94-2.2	5	0.3138	0.1	0.245	0.318	0.382	0.418	0.206
Total Copper	µg/L	7	5	1.2886	0.4	0.993	1.07	1.84	1.46	1.08
Total Iron	µg/L		5	557.2	267.0	277	470	819	860	360
Total Lead	µg/L	2.5-5.2	5	0.2988	0.1	0.131	0.305	0.46	0.427	0.171
Total Lithium	µg/L		5	6.858	0.6	6.83	6.4	7.24	7.57	6.25
Total Magnesium	mg/L		5	10.376	1.0	8.88	10.6	10.1	10.9	11.4
Total Manganese	µg/L		5	27.06	7.9	18	29.9	26.4	38.8	22.2
Total Mercury	µg/L	0.005	5	0.001885489	0.0	0.00117	0.00171	0.00273	0.00239	0.00143
Total Molybdenum	µg/L	73	5	8.032	1.0	6.33	8.5	8.85	8.2	8.28
Total Nickel	µg/L	44-72	5	1.4022	0.4	0.861	1.28	1.85	1.72	1.3
Total Potassium	µg/L		5	1.304	0.1	1.11	1.36	1.46	1.38	1.21
Total Selenium	µg/L	1	5	0.2358	0.1	0.171	0.244	0.267	0.197	0.3
Total Silicon	µg/L		5	1910	759.5	1240	1450	2980	2440	1440
Total Silver	µg/L	0.1-0.25	5	0.009	0.0	<0.005	<0.01	<0.01	<0.01	<0.01
Total Sodium	mg/L		5	16.26	0.4	15.6	16.1	16.6	16.4	16.6
Total Strontium	µg/L		5	266.8	19.1	233	279	275	275	272
Total Sulphur	mg/L		5	10.7	4.0	6.8	13.7	11.8	15	6.2
Total Thallium	µg/L	0.8	5	0.0085	0.0	0.0066	0.0077	0.0129	0.0085	0.0068
Total Tin	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L		5	10.406	10.4	1.73	5	26	16	3.3
Total Uranium	µg/L	15	5	0.5328	0.1	0.447	0.579	0.58	0.538	0.52
Total Vanadium	µg/L		5	20.36	2.5	17.2	21.4	23.8	20.6	18.8
Total Zinc	µg/L	30	5	3.64	1.9	2.1	2.6	4.1	6.7	2.7
Total Zirconium	µg/L			0.384	0.2	0.15	0.3	0.63	0.66	0.18
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.0	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTX	µg/L		5	100	0.0	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.0	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.0	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.0	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.0	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.0	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.0	<0.89	<0.89	<0.89	<0.89	<0.89

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



Table A1.3.5 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Phenols										
Cresols	mg/L		5	0.00014	0.0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.0	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
Parent PAH										
1-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.0	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

<sup>1</sup> number of replicate samples in project



Table A1.3.5 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Fluoranthene	µg/L	0.04	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	1	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.4	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.025	5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.0	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>										
C1 Substituted Acenaphthene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.0	<1.099	<1.099	<1.099	<1.099	<1.099

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

<sup>1</sup> number of replicate samples in project



Table A1.3.5 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5	
						sample	sample	sample	sample	sample	
Additional Volative organics											
1,1,1,2-tetrachloroethane	µg/L	21	5	1	0.0	<1	<1	<1	<1	<1	
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	
1,1,2-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,1-dichloroethene	µg/L	8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,2,3-trichlorobenzene	µg/L		5	1	0.0	<1	<1	<1	<1	<1	
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1	
1,2,4-trimethylbenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	
1,2-Dichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,2-dichloroethane	µg/L		100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,3-dichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
1,4-Dichlorobenzene	µg/L		26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Chlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Chloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2	
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	
Dichloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	
Methyl methacrylate	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Methyl-tert-butylether (MTBE)	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Styrene	µg/L		72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3	
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project



**Table A1.3.6 Analytical chemistry results from 0.32% Treated OSPW mesocosm table, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample	
Conventional Variables											
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.00	<1	<1	<1	<1	<1	
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	116	15.17	100	110	110	120	140	
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	141	7.04	145	145	147	130	138	
pH	pH		5	7.908	0.36	7.5	7.54	8.17	8.13	8.2	
Specific Conductivity	µS/cm		5	304	8.94	300	310	290	310	310	
Total Dissolved Solids	mg/L		5	174	27.93	220	160	150	160	180	
Total Dissolved Solids (Calculated)	mg/L		5	180	7.07	180	180	170	180	190	
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	233.4	245.21	120	127	127	672	121	
Total Suspended Solids	mg/L		5	13.66	6.48	14	8.3	14	24	8	
True Colour	PtCo units		5	15.22	7.77	8.1	10	27	19	12	
Turbidity	NTU		5	15.72	7.29	16	12	21	24	5.6	
Major Ions											
Anion Sum	meq/L	120	5	3.36	0.32	3.2	3.2	3.1	3.4	3.9	
Bicarbonate	mg/L		5	144	21.91	130	130	130	150	180	
Calcium	mg/L		5	38.2	2.28	39	39	41	35	37	
Carbonate	mg/L		5	1	0.00	<1	<1	<1	<1	<1	
Cation Sum	meq/L		5	3.38	0.18	3.5	3.5	3.5	3.1	3.3	
Chloride (Cl)	mg/L		5	5.3	0.77	6.6	4.6	5	5	5.3	
Fluoride (F)	mg/L		5	0.1136	0.03	0.11	0.1	0.088	0.16	0.11	
Hydroxide	mg/L		5	1	0.00	<1	<1	<1	<1	<1	
Ion Balance	%		5	5.54	2.09	4.6	3.4	5.5	5.2	9	
Magnesium	mg/L		5	11.2	0.84	12	12	11	10	11	
Potassium	mg/L	5	1.26	0.13	1.4	1.4	1.2	1.1	1.2		
Sodium	mg/L	5	11.8	0.84	13	12	12	11	11		
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	42.4	2.88	46	43	38	43	42	
Nutrients and Biological Indicators											
Biochemical Oxygen Demand	mg/L	3	5	2.12	0.93	3.6	<1	<2	<2	<2	
Chemical Oxygen Demand	mg/L		5	16	5.10	12	<10	20	22	16	
Nitrate (as N)	mg/L		5	0.015	0.01	<0.01	<0.01	0.027	0.014	0.014	
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.066	0.03	<0.044	<0.044	0.12	0.06	0.062	
Nitrate plus Nitrite (as N)	mg/L		5	0.015	0.01	<0.01	<0.01	0.027	0.014	0.014	
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.00	<0.033	<0.033	<0.033	<0.033	<0.033	
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.00	<0.015	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L		5	0.238	0.04	0.21	0.19	0.27	0.24	0.28	
Total Organic Carbon	mg/L		5	4.5	1.20	3.2	3.4	6	5.3	4.6	
Total Orthophosphate (as P)	mg/L	5	0.0018	0.00	<0.001	0.002	0.0017	0.0013	0.003		
Total Phosphorus (as P)	mg/L	5	0.0178	0.00	0.015	0.014	0.02	0.024	0.016		

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.6 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Dissolved Metals</b>										
Dissolved Aluminum	µg/L	17-50	5	8.492	2.57	11.3	11.1	6.19	6.03	7.84
Dissolved Antimony	µg/L		5	0.0562	0.01	0.043	0.055	0.066	0.065	0.052
Dissolved Arsenic	µg/L		5	0.3476	0.06	0.288	0.313	0.448	0.344	0.345
Dissolved Barium	µg/L		5	44.24	3.11	42.4	46.3	40.6	43.5	48.4
Dissolved Beryllium	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	60.2	52.65	154	38	42	38	29
Dissolved Cadmium	µg/L		5	0.0099	0.00	<0.005	0.0107	0.0119	0.0094	0.0125
Dissolved Chromium	µg/L		5	0.12	0.03	<0.1	<0.1	0.18	0.12	<0.1
Dissolved Cobalt	µg/L		5	0.07386	0.02	0.053	0.0949	0.0687	0.0649	0.0878
Dissolved Copper	µg/L		5	0.7356	0.23	0.436	0.69	1.09	0.77	0.692
Dissolved Iron	mg/L	0.3	5	0.176	0.26	<b>0.64</b>	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.01454	0.01	0.0058	0.0119	0.025	0.0153	0.0147
Dissolved Lithium	µg/L		5	5.536	0.42	5.79	5.78	5.35	5.88	4.88
Dissolved Manganese	mg/L		5	0.0114	0.02	0.041	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.000868412	0.00	0.000574	0.000658	0.00154	0.00081	0.00076
Dissolved Molybdenum	µg/L		5	2.23	0.23	2.08	2.26	2.03	2.17	2.61
Dissolved Nickel	µg/L		5	0.8294	0.07	0.719	0.829	0.849	0.832	0.918
Dissolved Selenium	µg/L		5	0.2042	0.05	0.129	0.204	0.25	0.216	0.222
Dissolved Silicon	µg/L		5	1077.4	182.57	981	1000	1360	1150	896
Dissolved Silver	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L		5	225.6	22.06	225	229	195	222	257
Dissolved Sulphur	mg/L		5	7.74	1.16	6.7	8	7.5	6.9	9.6
Dissolved Thallium	µg/L		5	0.00396	0.00	0.0053	0.0047	0.0044	0.0034	<0.002
Dissolved Tin	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium	µg/L		5	0.5	0.00	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Uranium	µg/L		5	0.4314	0.03	0.376	0.445	0.431	0.459	0.446
Dissolved Vanadium	µg/L		5	3.568	0.44	2.86	3.83	3.76	3.44	3.95
Dissolved Zinc	µg/L		5	1.138	0.49	0.83	0.61	1.89	1.31	1.05
Dissolved Zirconium	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
<b>Total Metals</b>										
Total Aluminum	µg/L		5	731.78	1156.35	95.7	74.1	666	2750	73.1
Total Antimony	µg/L		5	0.1578	0.19	0.043	0.065	0.091	0.49	<0.1
Total Arsenic	µg/L	5	5	0.9642	1.17	0.338	0.419	0.674	3.05	0.34
Total Barium	µg/L		5	99.12	106.27	44.6	55	57.9	289	49.1
Total Beryllium	µg/L		5	0.0538	0.06	<0.01	0.011	0.036	0.162	<0.05
Total Bismuth	µg/L		5	0.0168	0.01	<0.005	<0.005	<0.01	0.039	<0.025
Total Boron	µg/L	1500	5	116.8	172.63	31	51	27	425	<50
Total Cadmium	µg/L	0.13-0.22	5	0.02846	0.03	0.0057	0.0142	0.0211	0.0763	<0.025
Total Calcium	mg/L		5	62.66	65.04	33.5	33.9	34.3	179	32.6
Total Chromium	µg/L	1	5	1.25	1.69	0.2	0.29	<b>1.04</b>	<b>4.22</b>	<0.5

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1 number of replicate samples in project

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Table A1.3.6 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Total Cobalt	µg/L	0.94-2.2	5	0.6244	0.81	0.249	0.241	0.392	<b>2.06</b>	0.18
Total Copper	µg/L	7	5	2.452	2.82	0.85	1.38	1.85	<b>7.43</b>	0.75
Total Iron	µg/L		5	1180.8	1760.73	273	246	824	4300	261
Total Lead	µg/L	2.5-5.2	5	0.6328	0.87	0.143	0.22	0.462	2.17	0.169
Total Lithium	µg/L		5	11.364	13.18	5.85	5.38	6.29	34.9	4.4
Total Magnesium	mg/L		5	18.682	20.14	8.77	10.3	9.93	54.7	9.71
Total Manganese	µg/L		5	56.84	75.10	19	27.7	26.8	191	19.7
Total Mercury	µg/L	0.005	5	0.002028991	0.00	0.00135	0.00187	0.00314	0.00247	0.00131
Total Molybdenum	µg/L	73	5	4.23	4.46	1.86	2.39	2.41	12.2	2.29
Total Nickel	µg/L	44-72	5	2.7716	3.53	0.858	1.17	1.92	9.04	0.87
Total Potassium	µg/L		5	2.21	2.41	1	1.21	1.33	6.52	0.99
Total Selenium	µg/L	1	5	0.3516	0.36	0.143	0.149	0.246	0.99	0.23
Total Silicon	µg/L		5	3696	4766.77	1210	1080	2990	12100	1100
Total Silver	µg/L	0.1-0.25	5	0.013	0.01	<0.005	<0.005	<0.01	0.02	<0.025
Total Sodium	mg/L		5	19.606	20.46	10.4	10.9	10.9	56.2	9.63
Total Strontium	µg/L		5	475.6	505.90	225	268	266	1380	239
Total Sulphur	mg/L		5	22.42	25.15	6.2	13.7	10.2	67	<15
Total Thallium	µg/L	0.8	5	0.01584	0.02	0.006	0.0041	0.0115	0.0476	<0.01
Total Tin	µg/L		5	0.362	0.36	<0.2	<0.2	<0.2	0.21	<1
Total Titanium	µg/L		5	15.662	22.61	1.37	1.14	19.7	53.6	<2.5
Total Uranium	µg/L	15	5	0.8682	0.92	0.379	0.49	0.514	2.51	0.448
Total Vanadium	µg/L		5	8.808	10.92	3.7	4.61	5.53	28.2	2
Total Zinc	µg/L	30	5	4.978	4.36	2.18	3.08	7.1	11.6	0.93
Total Zirconium	µg/L		5	0.79	1.01	<0.1	0.15	0.65	2.55	<0.5
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.00	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTX	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.00	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.00	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.00	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.00	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.00	<0.89	<0.89	<0.89	<0.89	<0.89
<b>Phenols</b>										
Cresols	mg/L		5	0.00014	0.00	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.6 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.00	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>										
1-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.00	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	1	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.6 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Perylene	µg/L	0.4 0.025 3.4	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.00	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.00	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
Alkylated PAH										
C1 Substituted Acenaphthene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.00	<1.099	<1.099	<1.099	<1.099	<1.099

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.6 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Additional Volatile organics</b>										
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.7 Analytical chemistry results from 100% River water mesocosm table replicate 1, September 2021**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5	
						sample	sample	sample	duplicate	sample	sample	
Conventional Variables												
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.0	<1	<1	<1	<1	<1	<1	
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	110	7.1	100	110	110	110	120	110	
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	139.4	5.3	141	142	145	146	131	138	
pH	pH		5	7.992	0.3	7.47	8.29	8.14	8.11	8.05	8.01	
Specific Conductivity	µS/cm		5	296	13.4	290	310	280	280	310	290	
Total Dissolved Solids	mg/L		5	184	33.6	240	160	160	160	190	170	
Total Dissolved Solids (Calculated)	mg/L		5	172	4.5	170	170	170	170	180	170	
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	132.4	8.5	119	130	141	126	137	135	
Total Suspended Solids	mg/L		5	20.34	16.0	7.2	15	45	13	27	7.5	
True Colour	PtCo units		5	15.7	8.7	11	8.5	30	26	18	11	
Turbidity	NTU		5	17.6	15.2	8.4	17	44	22	11	7.6	
Major Ions												
Anion Sum	meq/L	120	5	3.2	0.2	3.1	3.3	3	3	3.4	3.2	
Bicarbonate	mg/L		5	138	8.4	130	140	130	130	150	140	
Calcium	mg/L		5	37.6	1.8	38	38	40	40	35	37	
Carbonate	mg/L		5	1	0.0	<1	<1	<1	<1	<1	<1	
Cation Sum	meq/L		5	3.28	0.1	3.4	3.3	3.4	3.4	3.1	3.2	
Chloride (Cl)	mg/L		5	4.34	0.8	5.5	3.7	3.7	3.4	4.2	4.6	
Fluoride (F)	mg/L		5	0.0952	0.0	0.1	0.086	0.085	0.083	0.11	0.095	
Hydroxide	mg/L		5	1	0.0	<1	<1	<1	<1	<1	<1	
Ion Balance	%		5	3.4	2.9	3.5	0.62	6.5	5.7	6	0.38	
Magnesium	mg/L		5	10.8	0.4	11	11	11	11	10	11	
Potassium	mg/L		5	1.2	0.1	1.3	1.3	1.2	1.2	1	1.2	
Sodium	mg/L		5	9.98	0.6	11	9.9	10	10	9.3	9.7	
Sulphate (as SO <sub>4</sub> )	mg/L		309	5	41.2	3.3	43	43	36	36	44	40
Nutrients and Biological Indicators												
Biochemical Oxygen Demand	mg/L	3	5	1.96	0.1	<2	<1.8	<2	<2	<2	<2	
Chemical Oxygen Demand	mg/L		5	27	14.3	50	15	31	24	22	17	
Nitrate (as N)	mg/L		5	0.0258	0.0	<0.01	<0.01	0.083	0.026	0.015	0.011	
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.115	0.1	0.045	<0.044	0.37	0.12	0.068	0.048	
Nitrate plus Nitrite (as N)	mg/L		5	0.0258	0.0	<0.01	<0.01	0.083	0.026	0.015	0.011	
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.0	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.0	<0.015	<0.015	<0.015	<0.015	<0.015	
Total Nitrogen (as N)	mg/L		5	0.278	0.1	0.3	0.21	0.38	0.29	0.25	0.25	
Total Organic Carbon	mg/L		5	4.56	1.5	3	3.8	7.1	5.5	4.6	4.3	
Total Orthophosphate (as P)	mg/L	0.03-73	5	0.00246	0.0	0.0026	0.0022	0.0023	0.0029	0.0022	0.003	
Total Phosphorus (as P)	mg/L		5	0.033	0.0	0.049	0.02	0.055	0.017	0.027	0.014	

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.7 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5
						sample	sample	sample	duplicate	sample	sample
Dissolved Metals											
Dissolved Aluminum	µg/L	17-50	5	10.372	4.0	15	10.5	13.4	9.47	5.58	7.38
Dissolved Antimony	µg/L		5	0.056	0.0	0.045	0.053	0.065	0.063	0.064	0.053
Dissolved Arsenic	µg/L		5	0.3062	0.0	0.288	0.272	0.37	0.391	0.314	0.287
Dissolved Barium	µg/L		5	43.52	3.3	43.4	43.7	39	39.3	43.2	48.3
Dissolved Beryllium	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	41.4	13.1	41	40	60	40	43	23
Dissolved Cadmium	µg/L		5	0.01038	0.0	0.0052	0.0113	0.015	0.0125	0.0108	0.0096
Dissolved Chromium	µg/L		5	0.11	0.0	<0.1	<0.1	0.15	0.15	<0.1	<0.1
Dissolved Cobalt	µg/L		5	0.0727	0.0	0.0619	0.0931	0.0593	0.0673	0.0666	0.0826
Dissolved Copper	µg/L	0.3	5	0.7458	0.2	0.499	0.661	1.09	1.17	0.76	0.719
Dissolved Iron	mg/L		5	0.106	0.1	0.29	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.04696	0.1	0.0148	0.0138	0.177	0.0335	0.0158	0.0134
Dissolved Lithium	µg/L		5	5.152	0.3	5.23	5.38	4.95	5.05	5.5	4.7
Dissolved Manganese	mg/L		5	0.0086	0.0	0.027	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.0011051	0.0	0.000659	0.001527	0.0014	0.00191	9e-04	0.00104
Dissolved Molybdenum	µg/L		5	0.8546	0.1	0.781	0.875	0.771	0.726	0.868	0.978
Dissolved Nickel	µg/L		5	0.8092	0.1	0.746	0.758	0.871	0.851	0.804	0.867
Dissolved Selenium	µg/L		5	0.1866	0.0	0.12	0.178	0.245	0.232	0.22	0.17
Dissolved Silicon	µg/L		5	964.6	160.5	954	771	1140	1160	1110	848
Dissolved Silver	µg/L	5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Dissolved Strontium	µg/L	5	224.4	23.3	230	220	192	194	223	257	
Dissolved Sulphur	mg/L	5	7.38	2.0	6.5	8.4	4.7	5.2	7.4	9.9	
Dissolved Thallium	µg/L	5	0.00392	0.0	0.0052	0.0058	0.0033	0.0043	0.0033	<0.002	
Dissolved Tin	µg/L	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Dissolved Titanium	µg/L	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Dissolved Uranium	µg/L	5	0.406	0.0	0.366	0.417	0.398	0.414	0.427	0.422	
Dissolved Vanadium	µg/L	5	0.228	0.0	0.26	<0.2	0.25	0.25	0.23	<0.2	
Dissolved Zinc	µg/L	5	1.32	0.9	0.91	0.5	1.68	1.25	2.71	0.8	
Dissolved Zirconium	µg/L	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Total Metals											
Total Aluminum	µg/L	5	5	623.4	710.1	187	287	1840	709	661	142
Total Antimony	µg/L		5	0.0788	0.0	0.06	0.071	0.095	0.098	0.089	0.079
Total Arsenic	µg/L		5	0.5988	0.3	0.438	0.457	1.05	0.647	0.672	0.377
Total Barium	µg/L		5	59.44	9.4	50.1	58.6	74.4	60.6	60.8	53.3
Total Beryllium	µg/L		5	0.0338	0.0	0.013	0.023	0.077	0.043	0.042	0.014
Total Bismuth	µg/L	1500	5	0.0118	0.0	<0.01	<0.01	0.019	<0.01	<0.01	<0.01
Total Boron	µg/L		5	56.2	38.5	122	29	49	24	53	28
Total Cadmium	µg/L		5	0.02154	0.0	0.0144	0.0185	0.036	0.0207	0.0269	0.0119
Total Calcium	mg/L		5	35.42	2.5	31.9	34.6	38.6	34.3	36.8	35.2

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.7 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5
						sample	sample	sample	duplicate	sample	sample
Total Chromium	µg/L	1	5	1.012	1.0	0.44	0.49	2.75	<b>1.08</b>	0.99	0.39
Total Cobalt	µg/L	0.94-2.2	5	0.4526	0.3	0.215	0.338	1.04	0.394	0.454	0.216
Total Copper	µg/L	7	5	1.626	0.8	1.16	1.28	3.04	1.88	1.63	1.02
Total Iron	µg/L		5	925.2	834.8	397	523	2350	824	990	366
Total Lead	µg/L	2.5-5.2	5	0.4836	0.4	0.211	0.356	1.15	0.489	0.514	0.187
Total Lithium	µg/L		5	5.93	0.9	5.46	5.32	7.57	6.36	5.9	5.4
Total Magnesium	mg/L		5	10.73	0.7	9.65	10.6	10.9	9.74	11	11.5
Total Manganese	µg/L		5	41.96	27.0	22.9	34.2	88.1	26.3	41.6	23
Total Mercury	µg/L	0.005	5	0.002138268	0.0	0.00131	0.00212	0.00383	0.0029	0.0021	0.00133
Total Molybdenum	µg/L	73	5	0.994	0.1	1.04	0.995	1.04	0.861	1	0.895
Total Nickel	µg/L	44-72	5	1.99	1.1	1.18	1.38	3.56	2.19	2.65	1.18
Total Potassium	µg/L		5	1.324	0.2	1.15	1.27	1.72	1.32	1.34	1.14
Total Selenium	µg/L	1	5	0.23	0.1	0.141	0.183	0.326	0.22	0.261	0.239
Total Silicon	µg/L		5	2370	1624.7	1340	1400	5130	2980	2560	1420
Total Silver	µg/L	0.1-0.25	5	0.0102	0.0	<0.01	<0.01	0.011	<0.01	<0.01	<0.01
Total Sodium	mg/L		5	9.8	0.4	10.4	9.46	9.57	9.37	9.69	9.88
Total Strontium	µg/L		5	273.8	11.5	254	276	278	263	284	277
Total Sulphur	mg/L		5	10.44	1.9	10.8	12.6	10.2	10.2	11.1	7.5
Total Thallium	µg/L	0.8	5	0.01318	0.0	0.0044	0.0071	0.0311	0.0177	0.0159	0.0074
Total Tin	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L		5	14.56	19.2	2.3	5.8	48.2	18.7	12.8	3.7
Total Uranium	µg/L	15	5	0.4898	0.0	0.434	0.499	0.551	0.516	0.512	0.453
Total Vanadium	µg/L		5	1.78	1.6	0.81	0.96	4.59	1.26	1.81	0.73
Total Zinc	µg/L	30	5	5.68	1.8	5.4	6.5	8.3	5.1	4.1	4.1
Total Zirconium	µg/L		5	0.576	0.5	0.18	0.36	1.38	0.61	0.46	0.5
<b>General Organics</b>											
Naphthenic Acids	mg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>											
F1 (C6-C10)-BTEX	µg/L		5	100	0.0	<100	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.0	<100	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.0	<100	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.0	<100	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.0	<200	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L										
<b>Volatile Organics</b>											
Benzene	µg/L	40	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.0	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.0	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.7 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5
						sample	sample	sample	duplicate	sample	sample
Phenols											
Cresols	mg/L		5	0.00014	0.0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.0	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
Parent PAH											
1-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.7 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5
						sample	sample	sample	duplicate	sample	sample
Dibenzothiophene	µg/L	0.04	5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L	1	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L	0.4	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.0	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>											
C1 Substituted Acenaphthene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.7 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3		Week 4	Week 5
						sample	sample	sample	duplicate	sample	sample
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.0	<1.099	<1.099	<1.099	<1.099	<1.099	<1.099
<b>Additional Volatile organics</b>											
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.8 Analytical chemistry results from 100% River water mesocosm table replicate 2, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
Conventional Variables										
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.00	<1	<1	<1	<1	<1
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	122	17.89	100	120	110	140	140
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	140.2	6.61	140	145	147	130	139
pH	pH		5	7.992	0.34	7.4	8.26	8.16	8.14	8
Specific Conductivity	µS/cm		5	298	10.95	300	300	280	310	300
Total Dissolved Solids	mg/L		5	180	39.37	240	140	150	190	180
Total Dissolved Solids (Calculated)	mg/L		5	180	10.00	170	180	170	190	190
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	129.2	7.22	119	131	125	137	134
Total Suspended Solids	mg/L		5	12.96	5.50	5.8	13	11	21	14
True Colour	PtCo units		5	15.96	8.38	10	7.8	28	21	13
Turbidity	NTU		5	15.7	5.33	8.5	17	20	21	12
Major Ions										
Anion Sum	meq/L	120	5	3.42	0.33	3.2	3.4	3	3.8	3.7
Bicarbonate	mg/L		5	148	20.49	130	140	130	170	170
Calcium	mg/L		5	37.8	2.28	37	39	41	35	37
Carbonate	mg/L		5	1	0.00	<1	<1	<1	<1	<1
Cation Sum	meq/L		5	3.26	0.17	3.3	3.4	3.4	3	3.2
Chloride (Cl)	mg/L		5	4.1	1.09	5.6	3.7	2.6	4.2	4.4
Fluoride (F)	mg/L		5	0.0914	0.01	0.1	0.084	0.085	0.11	0.078
Hydroxide	mg/L		5	1	0.00	<1	<1	<1	<1	<1
Ion Balance	%		5	5.5426	4.31	2.5	0.013	7.1	11	7.1
Magnesium	mg/L		5	11	0.71	11	12	11	10	11
Potassium	mg/L		5	1.2	0.10	1.2	1.3	1.3	1.1	1.1
Sodium	mg/L		5	9.98	0.66	11	10	10	9.2	9.7
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	40.6	3.36	43	43	35	42	40
Nutrients and Biological Indicators										
Biochemical Oxygen Demand	mg/L	3	5	1.96	0.09	<2	<1.8	<2	<2	<2
Chemical Oxygen Demand	mg/L		5	21.6	8.11	13	19	35	21	20
Nitrate (as N)	mg/L		5	0.0146	0.01	0.012	<0.01	0.027	0.013	0.011
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.064	0.03	0.051	<0.044	0.12	0.057	0.048
Nitrate plus Nitrite (as N)	mg/L		5	0.0146	0.01	0.012	<0.01	0.027	0.013	0.011
Nitrite (as N)	mg/L		0.02-0.1	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.00	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		0.03-73	5	0.015	0.00	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L		5	0.234	0.05	0.22	0.19	0.31	0.21	0.24
Total Organic Carbon	mg/L		5	4.52	1.31	3.3	3.5	6.6	4.6	4.6
Total Orthophosphate (as P)	mg/L		5	0.00238	0.00	0.0018	0.0025	0.0039	0.0016	0.0021
Total Phosphorus (as P)	mg/L		5	0.0176	0.00	0.012	0.014	0.021	0.024	0.017

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.8 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Dissolved Metals</b>										
Dissolved Aluminum	µg/L	17-50	5	8.498	2.28	12.1	8.3	7.57	5.87	8.65
Dissolved Antimony	µg/L		5	0.0618	0.01	0.051	0.079	0.065	0.063	0.051
Dissolved Arsenic	µg/L		5	0.311	0.04	0.291	0.289	0.375	0.289	0.311
Dissolved Barium	µg/L		5	43.06	3.34	41.4	43.7	40.3	41.3	48.6
Dissolved Beryllium	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	52.8	27.68	36	51	35	101	41
Dissolved Cadmium	µg/L		5	0.01106	0.01	<0.005	0.0207	0.0143	0.0087	0.0066
Dissolved Chromium	µg/L		5	0.112	0.03	<0.1	<0.1	0.16	<0.1	<0.1
Dissolved Cobalt	µg/L		5	0.07372	0.01	0.0553	0.0928	0.0694	0.0671	0.084
Dissolved Copper	µg/L		5	0.733	0.21	0.511	0.667	1.09	0.692	0.705
Dissolved Iron	mg/L	0.3	5	0.102	0.09	0.27	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.01856	0.01	0.0137	0.016	0.0323	0.017	0.0138
Dissolved Lithium	µg/L		5	5.136	0.37	5.04	5.44	4.96	5.58	4.66
Dissolved Manganese	mg/L		5	0.008	0.01	0.024	<0.004	<0.004	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.000856296	0.00	0.000634	0.000737	0.00139	8e-04	0.00072
Dissolved Molybdenum	µg/L		5	0.9268	0.20	0.725	1.16	0.709	1.03	1.01
Dissolved Nickel	µg/L		5	0.8068	0.07	0.731	0.784	0.859	0.757	0.903
Dissolved Selenium	µg/L		5	0.194	0.05	0.111	0.183	0.249	0.23	0.197
Dissolved Silicon	µg/L		5	1042	254.46	916	784	1400	1210	900
Dissolved Silver	µg/L		5	0.005	0.00	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L		5	220	21.95	225	218	193	211	253
Dissolved Sulphur	mg/L		5	7.32	1.87	6.3	7.7	6.9	5.4	10.3
Dissolved Thallium	µg/L		5	0.00398	0.00	0.0045	0.0052	0.0048	0.0034	<0.002
Dissolved Tin	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium	µg/L		5	0.5	0.00	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Uranium	µg/L		5	0.401	0.03	0.358	0.425	0.397	0.399	0.426
Dissolved Vanadium	µg/L		5	0.3	0.16	0.24	0.59	0.23	0.24	<0.2
Dissolved Zinc	µg/L		5	2.648	3.31	8.48	0.85	0.78	2.12	1.01
Dissolved Zirconium	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
<b>Total Metals</b>										
Total Aluminum	µg/L		5	347.4	241.71	85	269	645	555	183
Total Antimony	µg/L		5	0.072	0.02	0.04	0.074	0.08	0.094	0.072
Total Arsenic	µg/L	5	5	0.4554	0.13	0.298	0.459	0.634	0.531	0.355
Total Barium	µg/L		5	54.14	6.61	43.3	58.1	57	59.7	52.6
Total Beryllium	µg/L		5	0.0222	0.01	<0.01	0.019	0.031	0.03	0.021
Total Bismuth	µg/L		5	0.009	0.00	<0.005	<0.01	<0.01	<0.01	<0.01
Total Boron	µg/L	1500	5	46	27.69	29	31	26	92	52
Total Cadmium	µg/L	0.13-0.22	5	0.01826	0.01	0.0063	0.0229	0.0234	0.0277	0.011
Total Calcium	mg/L		5	34.72	1.22	33.4	34.9	33.9	36.6	34.8

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.8 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Total Chromium	µg/L	1	5	0.558	0.29	0.17	0.51	0.95	0.72	0.44
Total Cobalt	µg/L	0.94-2.2	5	0.2966	0.08	0.211	0.314	0.365	0.38	0.213
Total Copper	µg/L	7	5	1.2546	0.39	0.873	1.12	1.86	1.4	1.02
Total Iron	µg/L		5	553.2	250.00	267	468	798	832	401
Total Lead	µg/L	2.5-5.2	5	0.3126	0.16	0.127	0.317	0.465	0.47	0.184
Total Lithium	µg/L		5	5.672	0.32	5.56	5.36	6.07	5.96	5.41
Total Magnesium	mg/L		5	10.324	1.10	8.61	10.7	9.91	11.1	11.3
Total Manganese	µg/L		5	27.08	7.34	17.5	30.7	26.1	37.1	24
Total Mercury	µg/L	0.005	5	0.001758141	0.00	0.00136	0.00159	0.00271	0.00191	0.00122
Total Molybdenum	µg/L	73	5	0.9358	0.17	0.68	1.01	0.921	1.14	0.928
Total Nickel	µg/L	44-72	5	1.4124	0.46	0.772	1.35	1.96	1.72	1.26
Total Potassium	µg/L		5	1.2	0.15	0.97	1.27	1.31	1.31	1.14
Total Selenium	µg/L	1	5	0.209	0.06	0.138	0.152	0.221	0.265	0.269
Total Silicon	µg/L		5	1874	749.22	1170	1400	2900	2430	1470
Total Silver	µg/L	0.1-0.25	5	0.009	0.00	<0.005	<0.01	<0.01	<0.01	<0.01
Total Sodium	mg/L		5	9.54	0.25	9.27	9.48	9.37	9.88	9.7
Total Strontium	µg/L		5	264.4	26.43	219	281	264	283	275
Total Sulphur	mg/L		5	9.22	2.82	5.8	11.6	9.8	12.1	6.8
Total Thallium	µg/L	0.8	5	0.01104	0.00	0.0053	0.0151	0.0141	0.0125	0.0082
Total Tin	µg/L		5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L		5	9.424	10.45	1.92	3.5	26.6	12.2	2.9
Total Uranium	µg/L	15	5	0.4658	0.06	0.365	0.52	0.48	0.507	0.457
Total Vanadium	µg/L		5	1.18	0.62	0.37	1.08	1.83	1.76	0.86
Total Zinc	µg/L	30	5	4.54	1.56	2.2	5.7	6.2	4.3	4.3
Total Zirconium	µg/L		5	0.33	0.20	<0.1	0.28	0.6	0.46	0.21
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.00	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTEX	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.00	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.00	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.00	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.00	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
m,p-Xylene	µg/L		5	0.8	0.00	<0.8	<0.8	<0.8	<0.8	<0.8
o-Xylene	µg/L		5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.00	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.00	<0.89	<0.89	<0.89	<0.89	<0.89

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.8 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Phenols</b>										
Cresols	mg/L		5	0.00014	0.00	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.00	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.00	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>										
1-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.00	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.00	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05

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2 st dev abbreviation for standard deviation



Table A1.3.8 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Indeno[1,2,3-cd]fluoranthene	µg/L	1	5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.4	5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.025	5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.00	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.00	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.00	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>										
C1 Substituted Acenaphthene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.00	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.00	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.00	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.00	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.00	<1.099	<1.099	<1.099	<1.099	<1.099
<b>Additional Volative organics</b>										
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.8 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



**Table A1.3.9 Surface water quality analytical results for Athabasca River water head tank, September 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
Conventional Variables										
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	1	0.0	<1	<1	<1	<1	<1
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	122	13.0	110	120	110	130	140
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	140.2	5.6	141	143	146	131	140
pH	pH		5	7.978	0.3	7.39	8.28	8.15	8.11	7.96
Specific Conductivity	µS/cm		5	296	11.4	290	310	280	300	300
Total Dissolved Solids	mg/L		5	208	58.1	300	180	160	230	170
Total Dissolved Solids (Calculated)	mg/L		5	178	8.4	170	180	170	180	190
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	125.6	4.7	124	130	131	123	120
Total Suspended Solids	mg/L		5	20.56	14.6	6.3	19	43	25	9.5
True Colour	PtCo units		5	16.3	9.5	10	8.5	32	18	13
Turbidity	NTU		5	20.56	12.9	9.8	18	41	24	10
Major Ions										
Anion Sum	meq/L	120	5	3.38	0.3	3.2	3.4	3	3.6	3.7
Bicarbonate	mg/L		5	148	17.9	130	150	130	160	170
Calcium	mg/L		5	37.8	1.5	38	38	40	36	37
Carbonate	mg/L		5	1	0.0	<1	<1	<1	<1	<1
Cation Sum	meq/L		5	3.28	0.1	3.4	3.3	3.4	3.1	3.2
Chloride (Cl)	mg/L		5	4.2	1.1	5.8	3	3.5	4.2	4.5
Fluoride (F)	mg/L		5	0.1042	0.0	0.1	0.086	0.087	0.17	0.078
Hydroxide	mg/L		5	1	0.0	<1	<1	<1	<1	<1
Ion Balance	%		5	5.14	2.9	2.8	1.4	6.4	8.5	6.6
Magnesium	mg/L		5	11.2	0.8	12	12	11	10	11
Potassium	mg/L	5	1.2	0.1	1.3	1.3	1.2	1	1.2	
Sodium	mg/L	5	9.86	0.7	11	9.4	10	9.2	9.7	
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	40.8	2.8	43	44	37	40	40
Nutrients and Biological Indicators										
Biochemical Oxygen Demand	mg/L	3	5	10.6	19.8	<2	<1	<2	<2	46
Chemical Oxygen Demand	mg/L		5	18	3.2	13	18	22	18	19
Nitrate (as N)	mg/L		5	0.0194	0.0	0.03	0.011	0.023	0.016	0.017
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.0844	0.0	0.13	0.048	0.1	0.07	0.074
Nitrate plus Nitrite (as N)	mg/L	0.02-0.1	5	0.0194	0.0	0.03	0.011	0.023	0.016	0.017
Nitrite (as N)	mg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L		5	0.033	0.0	<0.033	<0.033	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		5	0.015	0.0	<0.015	<0.015	<0.015	<0.015	<0.015
Total Nitrogen (as N)	mg/L	0.03-73	5	0.238	0.1	0.19	0.18	0.35	0.22	0.25
Total Organic Carbon	mg/L		5	4.46	1.1	3.4	3.3	5.5	5.6	4.5
Total Orthophosphate (as P)	mg/L		5	0.00236	0.0	0.0016	0.0018	0.0024	0.003	0.003
Total Phosphorus (as P)	mg/L		5	0.02138	0.0	0.011	0.017	0.044	0.026	0.0089

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation

3 value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Dissolved Metals</b>										
Dissolved Aluminum	µg/L	17-50	5	10.886	3.9	14.1	11	15.3	6.79	7.24
Dissolved Antimony	µg/L		5	0.0536	0.0	0.045	0.055	0.056	0.057	0.055
Dissolved Arsenic	µg/L		5	0.3058	0.0	0.292	0.29	0.378	0.289	0.28
Dissolved Barium	µg/L		5	44.56	2.9	44	46.1	41.5	42.5	48.7
Dissolved Beryllium	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Bismuth	µg/L		5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Boron	µg/L		5	52.2	45.3	34	28	36	133	30
Dissolved Cadmium	µg/L		5	0.00986	0.0	0.0054	0.0107	0.0165	0.0089	0.0078
Dissolved Chromium	µg/L		5	0.11	0.0	<0.1	<0.1	0.15	<0.1	<0.1
Dissolved Cobalt	µg/L		5	0.08342	0.0	0.062	0.0945	0.0842	0.0801	0.0963
Dissolved Copper	µg/L		5	0.681	0.2	0.448	0.645	1	0.7	0.612
Dissolved Iron	mg/L	0.3	5	0.108	0.1	<b>0.3</b>	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.02166	0.0	0.0147	0.0176	0.0491	0.0185	0.0084
Dissolved Lithium	µg/L		5	5.214	0.5	5.34	5.31	4.85	5.86	4.71
Dissolved Manganese	mg/L		5	0.00888	0.0	0.025	<0.004	<0.004	0.0074	<0.004
Dissolved Mercury	µg/L		5	0.000851309	0.0	0.000617	0.000780	0.00127	0.00065	0.00094
Dissolved Molybdenum	µg/L		5	1.5324	1.4	0.76	0.845	4.06	1.02	0.977
Dissolved Nickel	µg/L		5	0.841	0.1	0.768	0.763	0.895	0.779	1
Dissolved Selenium	µg/L		5	0.1952	0.0	0.126	0.194	0.221	0.213	0.222
Dissolved Silicon	µg/L		5	1290	348.6	1060	1020	1850	1410	1110
Dissolved Silver	µg/L		5	0.005	0.0	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Strontium	µg/L		5	224.8	24.8	235	227	192	212	258
Dissolved Sulphur	mg/L		5	7.96	1.4	7	7.5	9.3	6.4	9.6
Dissolved Thallium	µg/L		5	0.00376	0.0	0.0041	0.005	0.0046	0.0031	<0.002
Dissolved Tin	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Dissolved Titanium	µg/L		5	0.506	0.0	<0.5	<0.5	0.53	<0.5	<0.5
Dissolved Uranium	µg/L		5	0.4062	0.0	0.371	0.427	0.39	0.42	0.423
Dissolved Vanadium	µg/L		4 <sup>3</sup>	0.225 <sup>3</sup>	0.025 <sup>3</sup>	0.25	<0.2	8.25	0.25	<0.2
Dissolved Zinc	µg/L		5	3.284	1.8	5.65	2.92	2.49	4.42	0.94
Dissolved Zirconium	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
<b>Total Metals</b>										
Total Aluminum	µg/L		5	338.84	403.9	95.9	370	1030	102	96.3
Total Antimony	µg/L		5	0.0666	0.0	0.047	0.071	0.099	0.064	0.052
Total Arsenic	µg/L	5	5	0.4872	0.2	0.336	0.5	0.775	0.485	0.34
Total Barium	µg/L		5	53.64	8.0	45.6	60.8	63.2	51.6	47
Total Beryllium	µg/L		5	0.0256	0.0	<0.01	0.029	0.059	0.019	0.011
Total Bismuth	µg/L		5	0.00786	0.0	<0.005	<0.01	0.014	0.0053	<0.005

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation

3 value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Total Boron	µg/L	1500	5	39.2	32.4	28	25	22	97	24
Total Cadmium	µg/L	0.13-0.22	5	0.0157	0.0	0.008	0.016	0.0255	0.0189	0.0101
Total Calcium	mg/L		5	34.82	0.9	34.9	34.6	35.7	35.5	33.4
Total Chromium	µg/L	1	5	0.602	0.5	0.19	0.65	<b>1.53</b>	0.28	0.36
Total Cobalt	µg/L	0.94-2.2	5	0.3424	0.2	0.278	0.371	0.628	0.258	0.177
Total Copper	µg/L	7	5	1.2872	0.6	1.12	1.26	2.27	1.03	0.756
Total Iron	µg/L		5	609.4	440.9	286	629	1360	454	318
Total Lead	µg/L	2.5-5.2	5	0.3578	0.2	0.15	0.41	0.728	0.339	0.162
Total Lithium	µg/L		5	5.426	0.6	5.74	5.19	6.38	5.09	4.73
Total Magnesium	mg/L		5	9.324	1.0	8.88	10.6	10.1	8.21	8.83
Total Manganese	µg/L		5	32.8	13.8	18.8	35.7	53.4	34.7	21.4
Total Mercury	µg/L	0.005	5	0.002221111	0.0	0.00125	0.00229	0.00397	0.00217	0.00142
Total Molybdenum	µg/L	73	5	1.0118	0.3	0.733	0.986	0.907	1.59	0.843
Total Nickel	µg/L	44-72	5	1.4456	0.6	0.888	1.46	2.54	1.2	1.14
Total Potassium	µg/L		5	1.1188	0.2	1.03	1.25	1.42	0.941	0.953
Total Selenium	µg/L	1	5	0.1976	0.0	0.138	0.198	0.231	0.21	0.211
Total Silicon	µg/L		5	1808	984.1	1210	1580	3550	1420	1280
Total Silver	µg/L	0.1-0.25	5	0.007	0.0	<0.005	<0.01	<0.01	<0.005	<0.005
Total Sodium	mg/L		5	8.62	0.7	9.49	8.66	9.09	7.83	8.03
Total Strontium	µg/L		5	245.2	25.8	229	279	267	225	226
Total Sulphur	mg/L		5	8.16	2.1	5.7	10.7	10	7.1	7.3
Total Thallium	µg/L	0.8	5	0.00934	0.0	0.0064	0.0091	0.0198	0.0055	0.0059
Total Tin	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Total Titanium	µg/L		5	6.794	9.4	1.35	5.3	23.3	1.66	2.36
Total Uranium	µg/L	15	5	0.4514	0.1	0.379	0.518	0.492	0.461	0.407
Total Vanadium	µg/L		5	1.292	1.1	0.41	1.15	2.75	1.95	<0.2
Total Zinc	µg/L	30	5	7.328	4.4	7.55	11.8	11.5	3.65	2.14
Total Zirconium	µg/L		5	0.332	0.3	<0.1	0.43	0.89	0.14	<0.1
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.0	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTEX	µg/L		5	100	0.0	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.0	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.0	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	100	0.0	<100	<100	<100	<100	<100
F4 (C34-C50)	µg/L		5	200	0.0	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									

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<sup>1</sup> number of replicate samples in project

<sup>2</sup> st dev abbreviation for standard deviation

<sup>3</sup> value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.8	0.0	<0.8	<0.8	<0.8	<0.8	<0.8
m,p-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
o-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.0	<0.89	<0.89	<0.89	<0.89	<0.89
<b>Phenols</b>										
Cresols	mg/L		5	0.00014	0.0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.00574	0.0	<0.00574	<0.00574	<0.00574	<0.00574	<0.00574
<b>Parent PAH</b>										
1-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.0	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075

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<sup>1</sup> number of replicate samples in project

<sup>2</sup> st dev abbreviation for standard deviation

<sup>3</sup> value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
Benzo[a]pyrene equivalency	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L	0.04	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	3	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L	1	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L	0.4	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L	0.025	5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.2935	0.0	<2.2935	<2.2935	<2.2935	<2.2935	<2.2935
Total Parent PAH	µg/L		5	1.1945	0.0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>										
C1 Substituted Acenaphthene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation

3 value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
C2 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C3 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.099	0.0	<1.099	<1.099	<1.099	<1.099	<1.099
<b>Additional Volative Organics</b>										
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1

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3 value removed from the determination of average concentration and standard deviation due to dissolve parameter being higher than total concentration



Table A1.3.9 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3
Vinyl Chloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5

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**Table A1.3.10 Surface water quality analytical results for Treated OSPW head tank, 2021.**

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
Conventional Variables										
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	mg/L	20	5	70.2	13.1	67	84	59	57	84
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L		5	372	4.5	370	370	380	370	370
Dissolved Hardness (as CaCO <sub>3</sub> )	mg/L		5	85.6	5.6	88.3	82.4	94	80.2	83.1
pH	pH		5	9.148	0.1	9.21	9.24	9.18	9.06	9.05
Specific Conductivity	µS/cm		5	3120	44.7	3100	3200	3100	3100	3100
Total Dissolved Solids	mg/L		5	1900	0.0	1900	1900	1900	1900	1900
Total Dissolved Solids (Calculated)	mg/L		5	2000	100.0	2100	1900	2100	2000	1900
Total Hardness (as CaCO <sub>3</sub> )	mg/L		5	80.08	3.0	76.5	77.1	82.4	81.8	82.6
Total Suspended Solids	mg/L		5	16.8	1.6	17	18	14	18	17
True Colour	PtCo units		5	16.4	2.8	21	14	15	15	17
Turbidity	NTU		5	13.8	1.9	13	12	13	17	14
Major Ions										
Anion Sum	meq/L	120	5	31	1.0	32	30	32	31	30
Bicarbonate	mg/L		5	282	35.6	290	240	310	320	250
Calcium	mg/L		5	16.2	1.1	16	15	18	16	16
Carbonate	mg/L		5	84	15.2	80	100	71	69	100
Cation Sum	meq/L		5	33.8	2.5	36	33	36	34	30
Chloride (Cl)	mg/L		5	406	18.2	430	380	410	400	410
Fluoride (F)	mg/L		5	2.22	0.1	2.2	2	2.2	2.4	2.3
Hydroxide	mg/L		5	1	0.0	<1	<1	<1	<1	<1
Ion Balance	%		5	4.1246	2.5	5.3	4.6	6.6	4.1	0.023
Magnesium	mg/L		5	10.98	1.0	12	11	12	9.9	10
Potassium	mg/L	5	11.8	0.8	12	12	13	11	11	
Sodium	mg/L	5	730	48.5	770	710	780	730	660	
Sulphate (as SO <sub>4</sub> )	mg/L	309	5	578	21.7	590	560	600	590	550
Nutrients and Biological Indicators										
Biochemical Oxygen Demand	mg/L	3	5	6.84	2.3	7.9	10.2	5.8	4.1	6.2
Chemical Oxygen Demand	mg/L		5	105.2	7.1	111	111	94	103	107
Nitrate (as N)	mg/L		5	0.0244	0.0	0.039	0.02	0.023	0.02	0.02
Nitrate (as NO <sub>3</sub> )	mg/L		5	0.1072	0.0	0.17	0.087	0.1	0.091	0.088
Nitrate plus Nitrite (as N)	mg/L		5	0.04	0.0	0.098	0.039	0.023	0.02	0.02
Nitrite (as N)	mg/L	0.02-0.1	5	0.0216	0.0	0.059	0.019	<0.01	<0.01	<0.01
Nitrite (as NO <sub>2</sub> )	mg/L	0.03-73	5	0.0724	0.1	0.2	0.063	<0.033	<0.033	<0.033
Total Ammonia (as N)	mg/L		5	0.0298	0.0	0.029	0.033	0.042	0.027	0.018
Total Nitrogen (as N)	mg/L		5	1.7	0.1	1.7	1.7	1.7	1.5	1.9
Total Organic Carbon	mg/L		5	19.6	2.6	16	21	19	23	19
Total Orthophosphate (as P)	mg/L		5	0.00654	0.0	0.0059	0.0058	0.0087	0.0056	0.0067
Total Phosphorus (as P)	mg/L		5	0.0838	0.0	0.091	0.087	0.077	0.067	0.097

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1 number of replicate samples in project

2 st dev abbreviation for standard deviation



Table A1.3.10 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1 sample	Week 2 sample	Week 3 sample	Week 4 sample	Week 5 sample
<b>Dissolved Metals</b>										
Dissolved Aluminum	µg/L	17-50	5	100.28	27.4	<b>120</b>	<b>131</b>	<b>107</b>	<b>71.1</b>	<b>72.3</b>
Dissolved Antimony	µg/L		5	0.8938	0.1	0.824	0.936	0.97	0.809	0.93
Dissolved Arsenic	µg/L		5	10.394	0.7	10.4	10.1	11.5	9.47	10.5
Dissolved Barium	µg/L		5	46.52	8.2	54.8	50.7	51.8	37	38.3
Dissolved Beryllium	µg/L		5	0.026	0.0	<0.01	<0.01	<0.05	<0.01	<0.05
Dissolved Bismuth	µg/L		5	0.0141	0.0	0.0103	0.0052	<0.025	<0.005	<0.025
Dissolved Boron	µg/L		5	2368	360.9	2160	2840	2260	2630	1950
Dissolved Cadmium	µg/L		5	0.013	0.0	<0.005	<0.005	<0.025	<0.005	<0.025
Dissolved Chromium	µg/L		5	0.326	0.2	<0.1	0.2	0.63	0.2	<0.5
Dissolved Cobalt	µg/L		5	0.2616	0.1	0.15	0.253	0.247	0.268	0.39
Dissolved Copper	µg/L		5	0.3944	0.2	0.262	0.651	0.47	0.339	<0.25
Dissolved Iron	mg/L	0.3	5	0.114	0.1	<b>0.33</b>	<0.06	<0.06	<0.06	<0.06
Dissolved Lead	µg/L		5	0.04476	0.0	0.0477	0.11	0.028	0.0131	<0.025
Dissolved Lithium	µg/L		5	106.04	9.3	103	116	106	113	92.2
Dissolved Manganese	mg/L		5	0.00946	0.0	0.029	0.0047	0.0056	<0.004	<0.004
Dissolved Mercury	µg/L		5	0.000831	0.0	0.000719	0.001104	0.00057	0.00054	0.00122
Dissolved Molybdenum	µg/L		5	675.2	78.1	545	697	699	680	755
Dissolved Nickel	µg/L		5	3.986	0.6	3.76	3.75	4.23	3.38	4.81
Dissolved Selenium	µg/L		5	2.794	0.4	2.75	3.18	3.15	2.72	2.17
Dissolved Silicon	µg/L		5	1662	216.4	1760	1790	1780	1700	1280
Dissolved Silver	µg/L		5	0.013	0.0	<0.005	<0.005	<0.025	<0.005	<0.025
Dissolved Strontium	µg/L		5	446.8	28.2	488	451	434	411	450
Dissolved Sulphur	mg/L		5	150.4	29.4	119	127	184	144	178
Dissolved Thallium	µg/L		5	0.00726	0.0	0.0046	0.0061	<0.01	0.0056	<0.01
Dissolved Tin	µg/L		5	1.67	1.7	4.56	1.59	<1	<0.2	<1
Dissolved Titanium	µg/L		5	1.362	1.0	<0.5	0.81	<2.5	<0.5	<2.5
Dissolved Uranium	µg/L		5	6.814	0.6	6.16	6.58	7.72	6.65	6.96
Dissolved Vanadium	µg/L		5	1746	230.8	1520	2100	1830	1580	1700
Dissolved Zinc	µg/L		5	6.622	5.3	10.8	13.5	3.53	0.9	4.38
Dissolved Zirconium	µg/L		5	0.724	0.1	0.75	0.78	0.64	0.83	0.62
<b>Total Metals</b>										
Total Aluminum	µg/L		5	191	41.8	233	126	205	215	176
Total Antimony	µg/L		5	0.9914	0.0	0.927	1.02	0.99	1.05	0.97
Total Arsenic	µg/L	5	5	11.78	0.9	12	12.3	12.8	11.4	10.4
Total Barium	µg/L		5	57.06	8.2	66.8	59.2	61.9	50.5	46.9
Total Beryllium	µg/L		5	0.0756	0.1	<0.01	<0.01	<0.05	<0.25	0.058
Total Bismuth	µg/L		5	0.07396	0.1	0.013	0.0068	<0.05	<0.25	<0.05
Total Boron	µg/L	1500	5	2272	319.9	<b>1890</b>	<b>2260</b>	<b>2290</b>	<b>2770</b>	<b>2150</b>
Total Cadmium	µg/L	0.13-0.22	5	0.038	0.1	<0.005	<0.005	<0.025	<0.13	<0.025
Total Calcium	mg/L		5	15.4	0.5	14.8	15.2	15.3	15.8	15.9

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<sup>1</sup> number of replicate samples in project

<sup>2</sup> st dev abbreviation for standard deviation



Table A1.3.10 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Total Chromium	µg/L	1	5	0.924	0.9	0.48	0.42	0.72	<2.5	<0.5
Total Cobalt	µg/L	0.94-2.2	5	0.425	0.2	0.259	0.254	0.421	0.583	0.608
Total Copper	µg/L	7	5	1.4214	1.1	0.42	0.497	0.91	<2.5	2.78
Total Iron	µg/L		5	584	356.8	377	113	641	739	1050
Total Lead	µg/L	2.5-5.2	5	0.25088	0.2	0.3	0.0644	0.13	<0.5	0.26
Total Lithium	µg/L		5	108.8	7.0	111	105	120	106	102
Total Magnesium	mg/L		5	10.098	0.5	9.56	9.53	10.7	10.3	10.4
Total Manganese	µg/L		5	24.436	10.1	24.4	7.58	26	30.6	33.6
Total Mercury	µg/L	0.005	5	0.00195194	0.0	0.00156	0.00196	0.00148	0.00214	0.00262
Total Molybdenum	µg/L	73	5	777	25.8	<b><u>778</u></b>	<b><u>795</u></b>	<b><u>806</u></b>	<b><u>766</u></b>	<b><u>740</u></b>
Total Nickel	µg/L	44-72	5	4.936	0.9	4.17	4.03	5.91	4.8	5.77
Total Potassium	µg/L		5	11.34	0.3	11.5	11.3	11.8	11.2	10.9
Total Selenium	µg/L	1	5	3.038	0.5	<b><u>3.09</u></b>	<b><u>3.73</u></b>	<b><u>3.13</u></b>	<b><u>2.9</u></b>	<b><u>2.34</u></b>
Total Silicon	µg/L		5	2188	250.6	2370	2290	2220	2310	1750
Total Silver	µg/L	0.1-0.25	5	0.073	0.1	<0.01	<0.005	<0.05	<0.25	<0.05
Total Sodium	mg/L		5	659	19.1	651	653	693	651	647
Total Strontium	µg/L		5	545.8	44.1	609	564	545	516	495
Total Sulphur	mg/L		5	193	13.3	191	201	197	205	171
Total Thallium	µg/L	0.8	5	0.01628	0.0	0.0037	0.0077	<0.01	<0.05	<0.01
Total Tin	µg/L		5	2.69	2.0	4.83	1.62	<1	<5	<1
Total Titanium	µg/L		5	14.58	20.3	2.4	<0.5	<10	<50	<10
Total Uranium	µg/L	15	5	7.46	0.3	7.3	7.6	7.83	7.41	7.16
Total Vanadium	µg/L		5	1906	197.3	2020	1910	2170	1720	1710
Total Zinc	µg/L	30	5	17.604	9.8	28.2	4.22	19.2	<25	11.4
Total Zirconium	µg/L		5	1.268	0.7	1.2	0.77	1.07	<2.5	0.8
<b>General Organics</b>										
Naphthenic Acids	mg/L		5	2	0.0	<2	<2	<2	<2	<2
<b>Hydrocarbons</b>										
F1 (C6-C10)-BTEX	µg/L		5	100	0.0	<100	<100	<100	<100	<100
F1 (C6-C10)	µg/L	150	5	100	0.0	<100	<100	<100	<100	<100
F2 (C10-C16)	µg/L	110	5	100	0.0	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L		5	110	14.1	120	<100	<100	<100	130
F4 (C34-C50)	µg/L		5	200	0.0	<200	<200	<200	<200	<200
Total Recoverable Hydrocarbons	mg/L									
<b>Volatile Organics</b>										
Benzene	µg/L	40	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Ethylbenzene	µg/L	90	5	0.8	0.0	<0.8	<0.8	<0.8	<0.8	<0.8
m,p-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
o-Xylene	µg/L		5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Toluene	µg/L	0.5	5	0.4	0.0	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	µg/L	30	5	0.89	0.0	<0.89	<0.89	<0.89	<0.89	<0.89

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1 number of replicate samples in project

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Table A1.3.10 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Phenols										
Cresols	mg/L		5	0.00014	0.0	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
2-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,5-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4-trichlorophenol	mg/L	0.018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,5,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,3,4,6-tetrachlorophenol	mg/L	0.001	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
3 & 4-chlorophenol	mg/L	0.007	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Pentachlorophenol	mg/L	0.0005	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,6-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dichlorophenol	mg/L	0.0002	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4,6-trichlorophenol	mg/L	0.0018	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
Phenol	mg/L	0.004	5	0.00016	0.0	4e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4,6-dinitro-2-methylphenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
3 & 4-methylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-dimethylphenol	mg/L	0.004	5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
4-chloro-3-methylphenol	mg/L		5	0.0001	0.0	<1e-04	<1e-04	<1e-04	<1e-04	<1e-04
2,4-dinitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
4-nitrophenol	mg/L		5	0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001
Total phenols	mg/L		5	0.0058	0.0	0.00604	<0.00574	<0.00574	<0.00574	<0.00574
Parent PAH										
1-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	5.8	5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	µg/L	4.4	5	0.04	0.0	<0.04	<0.04	<0.04	<0.04	<0.04
Anthracene	µg/L	0.012	5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/L	0.018	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[a]pyrene	µg/L	0.015	5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Benzo[a]pyrene equivalency	µg/L									
Benzo[b,j]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[c]phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[e]pyrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Benzo[k]fluoranthene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Dibenzo[a,h]anthracene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075

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Table A1.3.10 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
Dibenzothiophene	µg/L	0.04	5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	µg/L		5	0.01	0.0	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]fluoranthene	µg/L	1	5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Indeno[1,2,3-cd]pyrene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	µg/L	0.4	5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
Quinoline	µg/L	3.4	5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
Retene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	µg/L		5	2.37242	0.1	2.3016	2.3125	2.3505	2.4795	2.418
Total Parent PAH	µg/L		5	1.1945	0.0	<1.1945	<1.1945	<1.1945	<1.1945	<1.1945
<b>Alkylated PAH</b>										
C1 Substituted Acenaphthene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C1 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C1 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Dibenzothiophene	µg/L		5	0.0318	0.0	<0.02	<0.02	0.035	0.045	0.039
C1 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C1 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C1 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C1 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.00912	0.0	0.0091	<0.0085	<0.0085	<0.0085	0.011
C2 Substituted Benzo[b,j,k]fluoranthene / Benzo[a]pyrene	µg/L		5	0.0075	0.0	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
C2 Substituted Biphenyl	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Dibenzothiophene	µg/L		5	0.0642	0.0	0.022	0.039	0.062	0.1	0.098
C2 Substituted Fluoranthene / Pyrene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C2 Substituted Fluorene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C2 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1
C2 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
C3 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0096	0.0	0.014	<0.0085	<0.0085	<0.0085	<0.0085
C3 Substituted Dibenzothiophene	µg/L		5	0.0244	0.0	<0.02	<0.02	<0.02	0.033	0.029
C3 Substituted Fluoranthene / Pyrene	µg/L		5	0.0232	0.0	<0.02	<0.02	<0.02	<0.02	0.036
C3 Substituted Fluorene	µg/L		5	0.0552	0.0	<0.05	<0.05	<0.05	0.076	<0.05
C3 Substituted Naphthalene	µg/L		5	0.104	0.0	<0.1	<0.1	<0.1	0.12	<0.1
C3 Substituted Phenanthrene / Anthracene	µg/L		5	0.0502	0.0	<0.05	<0.05	<0.05	0.051	<0.05
C4 Substituted Benzo[a]anthracene / Chrysene	µg/L		5	0.0085	0.0	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085
C4 Substituted Dibenzothiophene	µg/L		5	0.02	0.0	<0.02	<0.02	<0.02	<0.02	<0.02
C4 Substituted Fluoranthene / Pyrene	µg/L		5	0.0242	0.0	<0.02	<0.02	<0.02	0.041	<0.02
C4 Substituted Naphthalene	µg/L		5	0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

<sup>1</sup> number of replicate samples in project

<sup>2</sup> st dev abbreviation for standard deviation



Table A1.3.10 (Cont'd.)

Water Quality Variables	Units	Guideline	n <sup>1</sup>	Mean (excluding duplicate)	St Dev <sup>2</sup>	Week 1	Week 2	Week 3	Week 4	Week 5
						sample	sample	sample	sample	sample
C4 Substituted Phenanthrene / Anthracene	µg/L		5	0.05	0.0	<0.05	<0.05	<0.05	<0.05	<0.05
Total Alkylated PAH	µg/L		5	1.17792	0.1	1.1071	1.118	1.156	1.285	1.2235
<b>Additional Volative organics</b>										
1,1,1,2-tetrachloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-tetrachloroethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
1,1,2-trichloroethane	µg/L	21	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-trichlorobenzene	µg/L	8	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	24	5	1	0.0	<1	<1	<1	<1	<1
1,2,4-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane	µg/L		5	0.2	0.0	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene	µg/L	0.7	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloroethane	µg/L	100	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dichloropropane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trichlorobenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichlorobenzene	µg/L	150	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/L	26	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/L	1.3	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Chloroform	µg/L	1.8	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	µg/L		5	2	0.0	<2	<2	<2	<2	<2
cis-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	µg/L		5	1	0.0	<1	<1	<1	<1	<1
Dichloromethane	µg/L	98.1	5	2	0.0	<2	<2	<2	<2	<2
Methyl methacrylate	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Methyl-tert-butylether (MTBE)	µg/L	10,000	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/L	72	5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-dichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-dichloropropene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L		5	0.5	0.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trihalomethanes	µg/L		5	1.3	0.0	<1.3	<1.3	<1.3	<1.3	<1.3

**Bold & underlined** values are above Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (GoA 2018)

1 number of replicate samples in project

2 st dev abbreviation for standard deviation



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## **Appendix A1.4**

### **Laboratory Reports (Analytical Chemistry)**

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## ANALYTICAL REPORT

**Client:** Bureau Veritas Laboratories  
 4000 - 19 St NE  
 Calgary AB T2E 6P8

**Attention:** Debra Nordbruet

<b>KaizenLAB JOB #:</b>	<b>317141</b>
<b>DATE RECEIVED:</b>	10-Sep-2021
<b>DATE REPORTED:</b>	16-Sep-2021
<b>PROJECT ID:</b>	C167040
<b>LOCATION:</b>	

**KaizenLAB Sample #:** 317141\_001      **Sample ID:** AFN999-Table 1  
**Date Sampled:** 9-Sep-2021 10:45      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	6.1	1.0

**KaizenLAB Sample #:** 317141\_002      **Sample ID:** AFO000-Table 2  
**Date Sampled:** 9-Sep-2021 11:20      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	3.1	3.0 *

**KaizenLAB Sample #:** 317141\_003      **Sample ID:** AFO001-Table 3  
**Date Sampled:** 9-Sep-2021 11:10      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.6	1.0

**KaizenLAB Sample #:** 317141\_004      **Sample ID:** AFO002-Table 4  
**Date Sampled:** 9-Sep-2021 11:45      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.1	1.0

**KaizenLAB Sample #:** 317141\_005      **Sample ID:** AFO003-Table 5  
**Date Sampled:** 9-Sep-2021 12:05      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	<1.0	1.0

**KaizenLAB Sample #:** 317141\_006      **Sample ID:** AFO004-Table 6  
**Date Sampled:** 9-Sep-2021 9:45      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	<1.0	1.0

**KaizenLAB Sample #:** 317141\_007      **Sample ID:** AFO005-Table 7  
**Date Sampled:** 9-Sep-2021 11:00      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.8	1.0



**KaizenLAB Sample #:** 317141\_008      **Sample ID:** AFO006-Table 8  
**Date Sampled:** 9-Sep-2021 12:05      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.8	1.0

**KaizenLAB Sample #:** 317141\_009      **Sample ID:** AFO007-Duplicate  
**Date Sampled:** 9-Sep-2021 11:25      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.6	1.0

**KaizenLAB Sample #:** 317141\_010      **Sample ID:** AFO008-Blank  
**Date Sampled:** 9-Sep-2021 13:05      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	<1.0	1.0

**KaizenLAB Sample #:** 317141\_011      **Sample ID:** AFO111-River Water Tank  
**Date Sampled:** 9-Sep-2021 14:10      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	1.0	1.0

**KaizenLAB Sample #:** 317141\_012      **Sample ID:** AFO112-Treated OPSW Tank  
**Date Sampled:** 9-Sep-2021 13:20      **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Biochemical Oxygen Demand	mg/L	10.2	3.0 *

\* The detection limit has been adjusted due to sample matrix type and/or insufficient sample volume.

#### Test Methodologies

Biochemical Oxygen Demand in Water: Modified from SM 5210B

Final Review by:



Shirley Lowe  
Client Service Representative / Project Coordinator

Note: The results in this report relate only to the items tested and as received. Information is available for any items in 7.8.2.1 of ISO/IEC 17025:2017 that cannot be put on a test report. The report shall not be reproduced except in full without written approval of KaizenLAB. The validity of results may be affected if the information is provided by the customer.



### QUALITY CONTROL REPORT

**Client:** Bureau Veritas Laboratories  
**Attention:** Debra Nordbruet

<b>KaizenLAB JOB #:</b>	<b>317141</b>
<b>PROJECT:</b>	C167040
<b>LOCATION:</b>	
<b>DATE REPORTED:</b>	16-Sep-2021

		Method Blank	Calibration Verification Standard		Laboratory Control Sample		Duplicate or Matrix Spike Duplicate		
			%Recovery		%Recovery		Rel. % Diff.		
			<b>Test:</b> BOD in Water						
			<b>QC Batch #:</b> BW_BOD_210911_01						
			<b>Date:</b> 11-Sep-2021						
BOD	<1.00 mg/L		74	Pass	74	Pass	7	Pass	

**Final Review by:**



Shirley Lowe

Client Service Representative / Project Coordinator

Note: The results in this report relate only to the items tested and as received. Information is available for any items in 7.8.2.1 of ISO/IEC 17025:2017 that cannot be put on a test report. The report shall not be reproduced except in full without written approval of KaizenLAB. The validity of results may be affected if the information is provided by the customer.

N/A-NC: Not Applicable-Not Calculated: Result does not apply to this test or the difference between duplicate and its parent sample is not significant to perform a calculation (results are too close to the detection limit)



# Total Mercury Results

## Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7  
Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

TMWATR092921ZB1  
Page 1 of 1

### CLIENT: Bureau Veritas - Calgary: C167040

4000 - 19th Street NE  
Calgary, AB T2E 6P8

Date Received: September 15, 2021

Sampling Date(s): September 9, 2021

Date Issued: October 1, 2021

Matrix: Water

Transaction ID: 895

PO/Contract No.:

Date Analysed: September 29, 2021

Analyst(s): Zorica B

Analytical Method: Total Mercury in Water by Oxidation, Purge and Trap, and CVAFS (T00120 version 6)

Comments: Dissolved samples were filtered prior to arrival at Flett.

#### Detection Limit:

0.5 ng/L (ML)

MDL=0.04 ng/L (based on 7 replicates of analytical blanks with 98% confidence level).

For reporting purpose samples will be flagged below a method limit of 0.5 ng/L which is considered a practical detection limit and reflects occasional elevated bottle blanks (< 0.5 ng/L) observed in reused acid-cleaned bottles.

#### Estimated

Uncertainty: The estimated uncertainty of this method has been determined to be  $\pm 13\%$  (95 % confidence) at a concentration level of 0.5-1000 ng/L.

Results authorized by Dr. Robert J. Flett, Chief Scientist

QUALITY DATA

	Blanks		Mean of 3 Bubbler	Standard Deviation	Bubbler 1	Bubbler 2	Bubbler 3		
		Bubbler Blank Mean Peak Area	1140	767	1127	1990	303		
	Method/Bottle Blanks	Bubbler Blank (pg)	0.44	0.32	0.43	0.76	0.12		
			Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L) (including ng Hg in DI)	Net Total Hg in the Method Blank (ng/L) (Bubbler & Reagent Bk Corrected including ng Hg in DI)		
		WB#5 (washed Sept 23/21)	MBk-1	7690	42.96	0.04	0.02		
		WB#10 (washed Sept 24/21)	MBk-2	7347	39.31	0.04	0.02		
		MB#3	MBk-3	5272	31.72	0.04	0.01		
	Mean Calibration Factor (area unit/ing)	2603079 ± 1.1 %RSD							
	Spike Recovery Matrix Spike (MS) and		Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L)	Net Total Hg (ng/L) (Bubbler & Reagent Bk Corrected)	Total Hg Recovery (%)	
		AFO001 TABLE 3 Total	MS1	936195	33.02	0.02	10.92	98	
		AFO001 TABLE 3 Total	MS1D	946540	36.28	0.02	10.05	97	
		Mean of Recoveries						98	
		AFO005 TABLE 7 Total	MS2	928934	33.29	0.02	10.75	96	
		AFO005 TABLE 7 Total	MS2D	947570	33.18	0.02	11.00	98	
		Mean of Recoveries						97	
	QC Samples Ongoing Precision & Recovery (OPR)	OPR (beginning of run)	OPR-1	471042	35.90	0.03	5.00	98	
		OPR (end of run)	OPR-2	491979	37.79	0.03	4.96	97	
		Mean OPR ( 5.12 ng/L)					4.98	97	
		Alternate Source Standard (A.S.S)	Baker QCS (1000 ng/L)	QCS-3	257012	0.10	2.00	981	98

LAB ID	Sample Details	Sample ID/Bottle Number	Date Sampled	Time Sampled	Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L)	Net Total Hg in the sample (ng/L) [Bubbler & Reagent Bk Subtracted]	
106696	AFN999	TABLE 1 Dissolved	September 9, 2021	10:45		84983	34.52	0.02	0.92	
106697	AFN999	TABLE 1 Total	September 9, 2021	10:45		169363	42.58	0.02	1.50	
106698	AFO000	TABLE 2 Dissolved	September 9, 2021	11:20		100575	38.76	0.02	0.97	
106699	AFO000	TABLE 2 Total	September 9, 2021	11:20		153614	30.97	0.02	1.88	
106700	AFO001	TABLE 3 Dissolved	September 9, 2021	11:10		86377	34.75	0.02	0.92	
106701	AFO001	TABLE 3 Total	September 9, 2021	11:10		181200	34.05	0.02	2.02	
106702	AFO002	TABLE 4 Dissolved	September 9, 2021	11:45		98663	35.30	0.02	1.04	
106703	AFO002	TABLE 4 Total	September 9, 2021	11:45		158007	35.76	0.02	1.67	
106704	AFO003	TABLE 5 Dissolved	September 9, 2021	12:05		91504	40.10	0.02	0.85	
106705	AFO003	TABLE 5 Total	September 9, 2021	12:05		201355	44.63	0.02	1.71	
106706	AFO004	TABLE 6 Dissolved	September 9, 2021	09:45		54320	30.12	0.02	0.66	
106707	AFO004	TABLE 6 Total	September 9, 2021	09:45		167993	34.05	0.02	1.87	
106708	AFO005	TABLE 7 Dissolved	September 9, 2021	11:00		154966	38.38	0.02	1.53	
106709	AFO005	TABLE 7 Total	September 9, 2021	11:00		189638	33.92	0.02	2.12	
106710	AFO006	TABLE 8 Dissolved	September 9, 2021	12:05		70666	35.33	0.02	0.74	
106711	AFO006	TABLE 8 Total	September 9, 2021	12:05		149726	35.59	0.02	1.59	
106712	AFO007	DUPLICATE Dissolved	September 9, 2021	11:25		76427	33.63	0.02	0.84	
106713	AFO007	DUPLICATE Total	September 9, 2021	11:25		148460	36.13	0.02	1.55	
106714	AFO008	BLANK Dissolved	September 9, 2021	13:05		16223	34.76	0.02	~ 0.14	
106715	AFO008	BLANK Total	September 9, 2021	13:05	DupA1	29951	31.75	0.02	~ 0.33	
106715	AFO008	BLANK Total	September 9, 2021	13:05	DupA2	32571	36.75	0.02	~ 0.31	

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\* : See 'Comments' section above for discussion.

- : Result below the official detection limit for this analyte in this matrix.

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Note: Results relate only to the items tested.

Dup: Duplicate - two subsamples of the same sample carried through the analytical procedure in an identical manner.



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Template Version 02/23/21



# Total Mercury Results

## Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7  
Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

TMWATR093021ZB2  
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### CLIENT: Bureau Veritas - Calgary: C167040

4000 - 19th Street NE  
Calgary, AB T2E 6P8

Date Received: September 15, 2021

Sampling Date(s): September 9, 2021

Date Issued: October 1, 2021

Matrix: Water

Transaction ID: 895

PO/Contract No.:

Date Analysed: September 30, 2021

Analyst(s): Zorica B

Analytical Method: Total Mercury in Water by Oxidation, Purge and Trap, and CVAFS (T00120 version 6)

Comments: Dissolved samples were filtered prior to arrival at Flett.

**Detection Limit:** 0.5 ng/L (ML), MDL=0.04 ng/L (based on 7 replicates of analytical blanks with 98% confidence level).  
For reporting purpose samples will be flagged below a method limit of 0.5 ng/L which is considered a practical detection limit and reflects occasional elevated bottle blanks (< 0.5 ng/L) observed in reused acid-cleaned bottles.

**Estimated Uncertainty:** The estimated uncertainty of this method has been determined to be  $\pm 13\%$  (95 % confidence) at a concentration level of 0.5-1000 ng/L.

Results authorized by Dr. Robert J. Flett, Chief Scientist

QUALITY DATA	Blanks		Mean of 3 Bubblers	Standard Deviation	Bubbler 1	Bubbler 2	Bubbler 3		
		Bubbler Blank Mean Peak Area	1183	710	647	2012	892		
		Bubbler Blank (pg)	0.45	0.28	0.25	0.76	0.34		
	Method/Bottle Blanks		Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L) (including ng Hg in DI)	Net Total Hg in the Method Blank (ng/L) (Bubbler & Reagent Bk Corrected including ng Hg in DI)		
		MB#4	MBk-1	7506	35.53	0.05	0.02		
		MB#7	MBk-2	6487	34.57	0.04	0.01		
		MB#12	MBk-3	5777	33.70	0.04	0.01		
	Mean Calibration Factor (area unit/ug)		2635213 $\pm$ 1.5 %RSD						
	QC Samples		Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L)	Net Total Hg (ng/L) (Bubbler & Reagent Bk Corrected)	Total Hg Recovery (%)	
		OPR (beginning of run)	OPR-1	482481	35.88	0.03	5.06	99	
		OPR (end of run)	OPR-2	536313	40.68	0.03	4.96	97	
		Mean OPR ( 5.12 ng/L)					5.01	98	
	Alternate Source Standard (A.S.S)		Baker QCS (1000 ng/L)	QCS-3	263361	0.10	2.00	993	99

LAB ID	Sample Details	Sample ID/Bottle Number	Date Sampled	Time Sampled	Sample Type	Gross Peak Area	Volume of Sample Analyzed (=volume of bubbled sample) (ml)	Total Reagent Hg added to the sample during analysis (ng/L)	Net Total Hg in the sample (ng/L) (Bubbler & Reagent Bk Subtracted)	
106716	AFO111	RIVER WATER TANK Dissolved	September 9, 2021	14:10		75715	35.43	0.02	0.78	
106717	AFO111	RIVER WATER TANK Total	September 9, 2021	14:10		225141	36.91	0.02	2.29	
106718	AFO112	TREATED OPSW TANK Dissolved	September 9, 2021	13:20		96210	32.16	0.02	1.10	
106719	AFO112	TREATED OPSW TANK Total	September 9, 2021	13:20		176336	33.72	0.02	1.96	

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\* : See 'Comments' section above for discussion.

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Note: Results relate only to the items tested.



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Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/05**

Report #: R3080934

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C166142**

**Received: 2021/09/07, 09:18**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	9	N/A	2021/09/10	AB SOP-00005	SM 23 2320 B m
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	3	N/A	2021/09/11	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	12	2021/09/10	2021/09/15	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	12	N/A	2021/09/10	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	12	N/A	2021/09/10		Auto Calc
Chloride/Sulphate by Auto Colourimetry	1	N/A	2021/09/10	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	11	N/A	2021/09/28	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
COD by Colorimeter	12	N/A	2021/09/10	AB SOP-00016	SM 23 5220D m
True Colour	10	N/A	2021/09/11	CAL SOP-00049	SM 23 2120 C m
True Colour	2	N/A	2021/09/29	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	12	N/A	2021/09/20		Auto Calc
Carbon (DOC) (3)	12	N/A	2021/09/12	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	9	N/A	2021/09/10	AB SOP-00005	SM 23 2510 B m
Conductivity @25C	3	N/A	2021/09/11	AB SOP-00005	SM 23 2510 B m
Fluoride	12	N/A	2021/09/12	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (4)	5	2021/09/10	2021/09/10	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (4)	7	2021/09/10	2021/09/11	AB SOP-00037	CCME PHC-CWS m
Hardness	12	N/A	2021/09/23		Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	12	N/A	2021/09/17	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	12	N/A	2021/09/15	BBY WI-00033	Auto Calc
Elements by ICP - Dissolved (6)	7	N/A	2021/09/22	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Dissolved (6)	5	N/A	2021/09/23	AB SOP-00042	EPA 6010d R5 m
Ion Balance	1	N/A	2021/09/23		Auto Calc
Ion Balance	11	N/A	2021/09/29		Auto Calc
Sum of cations, anions	12	N/A	2021/09/23		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	12	N/A	2021/09/15	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (6)	12	N/A	2021/09/12	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	3	2021/09/15	2021/09/16	CAL SOP-00265	EPA 6020 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	12	N/A	2021/09/17	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	9	N/A	2021/09/15	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	12	2021/09/09	2021/09/10	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH <sub>3</sub> ) as N @ 15C	1	2021/10/01	2021/10/05		Auto Calc





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

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**BV LABS JOB #: C166142**

**Received: 2021/09/07, 09:18**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Un-Ionized Ammonia (NH <sub>3</sub> ) as N	11	N/A	2021/10/01		Auto Calc
Ammonia-N (Total)	12	N/A	2021/09/10	AB SOP-00007	SM 23 4500 NH <sub>3</sub> A G m
Nitrate and Nitrite	5	N/A	2021/09/10		Auto Calc
Nitrate and Nitrite	7	N/A	2021/09/11		Auto Calc
NO <sub>2</sub> (N); NO <sub>2</sub> (N) + NO <sub>3</sub> (N) in Water	10	N/A	2021/09/10	AB SOP-00091	SM 23 4500 NO <sub>3</sub> m
NO <sub>2</sub> (N); NO <sub>2</sub> (N) + NO <sub>3</sub> (N) in Water	2	N/A	2021/09/28	AB SOP-00091	SM 23 4500 NO <sub>3</sub> m
Nitrate (as N)	5	2021/09/08	2021/09/10		Auto Calc
Nitrate (as N)	7	2021/09/08	2021/09/11		Auto Calc
Target & Alkylated PAH in Water by GC/MS (7)	12	2021/09/13	2021/09/15	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (8)	12	N/A	2021/09/21		Auto Calc
pH measured @ 15 C (1, 9)	1	N/A	2021/10/05	EENV SOP-00159	SM 23 4500 H+ B m
pH @25°C (9)	9	N/A	2021/09/10	AB SOP-00005	SM 23 4500-H+B m
pH @25°C (9)	3	N/A	2021/09/11	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	11	N/A	2021/10/01	Field Test	Field Test
Orthophosphate by Konelab (low level) (10)	12	N/A	2021/09/10	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	12	2021/09/16	2021/09/17	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	8	2021/09/10	2021/09/10	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Filt. Residue)	4	2021/09/28	2021/09/28	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	1	N/A	2021/09/23		Auto Calc
Total Dissolved Solids (Calculated)	11	N/A	2021/09/29		Auto Calc
Temperature (Field)	11	N/A	2021/10/01		
Total Trihalomethanes Calculation	12	N/A	2021/09/14		Auto Calc
Carbon (Inorganic)	12	N/A	2021/09/13	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	12	2021/09/11	2021/09/13	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (11)	12	N/A	2021/09/12	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (12)	3	2021/09/11	2021/09/12	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (12)	9	2021/09/12	2021/09/14	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	12	2021/09/11	2021/09/11	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	6	2021/09/11	2021/09/11	AB SOP-00061	SM 23 2540 D m
Total Suspended Solids (NFR)	6	2021/09/12	2021/09/12	AB SOP-00061	SM 23 2540 D m
Turbidity	12	N/A	2021/09/08	CAL SOP-00081	SM 23 2130 B m





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-02-01

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**BV LABS JOB #: C166142**

**Received: 2021/09/07, 09:18**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Date		Laboratory Method	Analytical Method
	Quantity	Extracted		
VOCs in Water by HS GC/MS (Std List)	12	N/A	2021/09/10 AB SOP-00056	EPA 5021a/8260d m
Ultra-Low Dissolved Mercury SubC (2)	12	N/A	2021/09/29	
Ultra-Low Total Mercury SubC (2)	12	N/A	2021/09/29	

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Bureau Veritas Edmonton Environmental, 9331 - 48 St. , Edmonton, AB, T6B 2R4

(2) This test was performed by Flett Research Ltd., 440 DeSalaberry Ave. , Winnipeg, MB, R2L 0Y7

(3) DOC present in the sample should be considered as non-purgeable DOC. Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(4) Silica gel clean up employed.

(5) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(6) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(7) Alkylated PAH results are semiquantitative

(8) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

(9) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-02-01

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**CERTIFICATE OF ANALYSIS**

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reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

(10) Orthophosphate > Total Phosphorus Imbalance: When applicable, Orthophosphate, Total Phosphorus and dissolved Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(11) TOC present in the sample should be considered as non-purgeable TOC.

(12) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Morgan Melnychuk  
Customer Solutions Representative  
05 Oct 2021 18:14:29

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Amanda L'Hirondelle, Key Account Specialist  
Email: Amanda.lhirondelle@bureauveritas.com  
Phone# (780)577-7117

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ078			AFJ079		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 1</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	31	N/A	A344004	12	N/A	A344004
Cation Sum	meq/L	35	N/A	A344004	12	N/A	A344004
Hardness (CaCO <sub>3</sub> )	mg/L	88	0.50	A343999	130	0.50	A343999
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	88.0	0.50	A344205	126	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	74.1	0.50	A344210	107	0.50	A344210
Ion Balance (% Difference)	%	5.9	N/A	A344281	0.16	N/A	A344281
Dissolved Nitrate (N)	mg/L	0.056	0.010	A344741	0.026	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.25	0.044	A344761	0.12	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	0.24	0.033	A344761	0.063	0.033	A344761
Calculated Total Dissolved Solids	mg/L	2000	10	A344009	750	10	A344009
Un-Ionized Ammonia	mg/L	0.0060	0.0035	A344896	0.0045	0.0042	A344897
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A347380	<2.0 (1)	2.0	A347380
Chemical Oxygen Demand	mg/L	107	10	A347736	39	10	A347736
<b>Field Parameters</b>							
Field pH	pH	9	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	16.6	N/A	ONSITE	16.8	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	3100	2.0	A347738	1200	2.0	A347738
Dissolved Organic Carbon (C)	mg/L	15	0.50	A349121	8.5	0.50	A349121
pH	pH	9.19	N/A	A347737	8.86	N/A	A347737
Total Organic Carbon (C)	mg/L	17	0.50	A349123	9.2	0.50	A349123
Total Dissolved Solids	mg/L	1900	10	A346812	640	10	A346812
Total Suspended Solids	mg/L	16	1.0	A348508	10	1.0	A348508
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	63	1.0	A347735	16	1.0	A347735
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	370	1.0	A347735	190	1.0	A347735
Bicarbonate (HCO <sub>3</sub> )	mg/L	300	1.0	A347735	190	1.0	A347735
Carbonate (CO <sub>3</sub> )	mg/L	75	1.0	A347735	19	1.0	A347735
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ078			AFJ079		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 1</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	2.3	0.050	A349137	0.77	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347735
Orthophosphate (P)	mg/L	0.0063	0.0010	A347697	0.0024	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	400	5.0	A369153	140	1.0	A369155
Dissolved Sulphate (SO4)	mg/L	590	5.0	A369153	220	5.0	A369155
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	0.025	0.015	A348185	0.016	0.015	A348187
Total Inorganic Carbon (C)	mg/L	89	1.0	A349713	51	1.0	A349689
Dissolved Phosphorus (P)	mg/L	0.011	0.0010	A349056	0.0019	0.0010	A348653
Total Phosphorus (P)	mg/L	0.089	0.0010	A348644	0.032	0.0010	A348644
Dissolved Nitrite (N)	mg/L	0.074	0.010	A347830	0.019	0.010	A347830
Dissolved Nitrate plus Nitrite (N)	mg/L	0.13	0.010	A347830	0.045	0.010	A347830
Total Nitrogen (N)	mg/L	1.9 (1)	0.10	A348568	0.68	0.020	A348568
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	14 (2)	2.0	A346600	9.4 (2)	2.0	A347942
<b>Physical Properties</b>							
Turbidity	NTU	8.3	0.10	A345460	8.5	0.10	A345460
RDL = Reportable Detection Limit							
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.							
(2) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ080			AFJ081		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	5.7	N/A	A344004	4.1	N/A	A344895
Cation Sum	meq/L	6.2	N/A	A344004	4.3	N/A	A344895
Hardness (CaCO <sub>3</sub> )	mg/L	130	0.50	A343999	140	0.50	A343999
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	134	0.50	A344205	140	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	115	0.50	A344210	119	0.50	A344210
Ion Balance (% Difference)	%	3.8	N/A	A344281	2.4	N/A	A344281
Dissolved Nitrate (N)	mg/L	0.022	0.010	A344741	0.018	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.095	0.044	A344761	0.080	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A344761	<0.033	0.033	A344761
Calculated Total Dissolved Solids	mg/L	340	10	A344905	230	10	A344905
Un-Ionized Ammonia	mg/L	<0.0025	0.0025	A344897	<0.0017	0.0017	A344897
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A347380	<2.0 (1)	2.0	A347380
Chemical Oxygen Demand	mg/L	24	10	A347736	15	10	A347736
<b>Field Parameters</b>							
Field pH	pH	8.8	N/A	ONSITE	8.6	N/A	ONSITE
Field Temperature (Fd)	deg. C	16.9	N/A	ONSITE	17.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	590	2.0	A347731	390	2.0	A347748
Dissolved Organic Carbon (C)	mg/L	5.2	0.50	A349121	3.6	0.50	A349121
pH	pH	8.21	N/A	A347730	7.72	N/A	A347746
Total Organic Carbon (C)	mg/L	5.1	0.50	A349123	3.8	0.50	A349123
Total Dissolved Solids	mg/L	340 (2)	10	A367809	270 (2)	10	A367809
Total Suspended Solids	mg/L	8.1	1.0	A348508	6.2	1.0	A348508
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347729	<1.0	1.0	A347743
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	130	1.0	A347729	110	1.0	A347743
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.							
(2) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ080			AFJ081		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
Bicarbonate (HCO <sub>3</sub> )	mg/L	160	1.0	A347729	140	1.0	A347743
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A347729	<1.0	1.0	A347743
Dissolved Fluoride (F)	mg/L	0.33	0.050	A349137	0.17	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347729	<1.0	1.0	A347743
Orthophosphate (P)	mg/L	0.0014	0.0010	A347697	0.0013	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	43	1.0	A348298	19	1.0	A369153
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	91	1.0	A348298	60	1.0	A369153
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A348185	<0.015	0.015	A348187
Total Inorganic Carbon (C)	mg/L	33	1.0	A349689	29	1.0	A349713
Dissolved Phosphorus (P)	mg/L	0.0019	0.0010	A349056	0.0023	0.0010	A348653
Total Phosphorus (P)	mg/L	0.020	0.0010	A348644	0.013	0.0010	A348644
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A347830	<0.010 (1)	0.010	A369021
Dissolved Nitrate plus Nitrite (N)	mg/L	0.022	0.010	A347830	0.018 (1)	0.010	A369021
Total Nitrogen (N)	mg/L	0.35	0.020	A348568	0.29	0.020	A348568
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	7.3 (2)	2.0	A347942	12	2.0	A369980
<b>Physical Properties</b>							
Turbidity	NTU	11	0.10	A345460	7.6	0.10	A345460
RDL = Reportable Detection Limit (1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time. (2) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ082			AFJ083		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.4	N/A	A344895	3.2	N/A	A344895
Cation Sum	meq/L	3.7	N/A	A344895	3.5	N/A	A344895
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A344892	150	0.50	A344892
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	142	0.50	A344205	145	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	123	0.50	A344210	120	0.50	A344210
Ion Balance (% Difference)	%	3.7	N/A	A344281	4.6	N/A	A344281
Dissolved Nitrate (N)	mg/L	0.013	0.010	A344741	<0.010	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.056	0.044	A344761	<0.044	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A344761	<0.033	0.033	A344761
Calculated Total Dissolved Solids	mg/L	190	10	A344905	180	10	A344905
Un-Ionized Ammonia	mg/L	<0.00089	0.00089	A344897	<0.0011	0.0011	A344897
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A347380	3.6 (1)	2.0	A347380
Chemical Oxygen Demand	mg/L	17	10	A347736	12	10	A347736
<b>Field Parameters</b>							
Field pH	pH	8.3	N/A	ONSITE	8.4	N/A	ONSITE
Field Temperature (Fd)	deg. C	17	N/A	ONSITE	17	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	330	2.0	A347738	300	2.0	A347731
Dissolved Organic Carbon (C)	mg/L	3.4	0.50	A349121	3.3	0.50	A349121
pH	pH	7.53	N/A	A347737	7.50	N/A	A347730
Total Organic Carbon (C)	mg/L	3.3	0.50	A349123	3.2	0.50	A349123
Total Dissolved Solids	mg/L	250 (2)	10	A367809	220 (2)	10	A367809
Total Suspended Solids	mg/L	5.9	1.0	A348508	14	1.0	A348508
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	110	1.0	A347735	100	1.0	A347729
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected. (2) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time.							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ082			AFJ083		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
Bicarbonate (HCO <sub>3</sub> )	mg/L	130	1.0	A347735	130	1.0	A347729
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
Dissolved Fluoride (F)	mg/L	0.12	0.050	A349137	0.11	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
Orthophosphate (P)	mg/L	0.0018	0.0010	A347697	<0.0010	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	10	1.0	A369153	6.6	1.0	A369153
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	49	1.0	A369153	46	1.0	A369153
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A348187	<0.015	0.015	A348187
Total Inorganic Carbon (C)	mg/L	27	1.0	A349689	28	1.0	A349689
Dissolved Phosphorus (P)	mg/L	<0.0010	0.0010	A349056	0.0019	0.0010	A348653
Total Phosphorus (P)	mg/L	0.013	0.0010	A348644	0.015	0.0010	A348644
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A347818	<0.010	0.010	A347830
Dissolved Nitrate plus Nitrite (N)	mg/L	0.013	0.010	A347818	<0.010	0.010	A347830
Total Nitrogen (N)	mg/L	0.25	0.020	A348568	0.21	0.020	A348568
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	9.2 (1)	2.0	A346600	8.1 (1)	2.0	A347942
<b>Physical Properties</b>							
Turbidity	NTU	8.9	0.10	A345460	16	0.10	A345460
RDL = Reportable Detection Limit							
(1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ084			AFJ085		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.1	N/A	A344895	3.2	N/A	A344895
Cation Sum	meq/L	3.4	N/A	A344895	3.3	N/A	A344895
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A344892	140	0.50	A344892
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	141	0.50	A344205	140	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	119	0.50	A344210	119	0.50	A344210
Ion Balance (% Difference)	%	3.5	N/A	A344281	2.5	N/A	A344281
Dissolved Nitrate (N)	mg/L	0.010	0.010	A344741	0.012	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.045	0.044	A344761	0.051	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A344761	<0.033	0.033	A344761
Calculated Total Dissolved Solids	mg/L	170	10	A344905	170	10	A344905
Un-Ionized Ammonia	mg/L	<0.0014	0.0014	A344897	<0.00090	0.00090	A344897
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A347380	<2.0 (1)	2.0	A347380
Chemical Oxygen Demand	mg/L	50	10	A347736	13	10	A347736
<b>Field Parameters</b>							
Field pH	pH	8.5	N/A	ONSITE	8.3	N/A	ONSITE
Field Temperature (Fd)	deg. C	17	N/A	ONSITE	17.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	290	2.0	A347738	300	2.0	A347731
Dissolved Organic Carbon (C)	mg/L	3.4	0.50	A349121	3.3	0.50	A349121
pH	pH	7.47	N/A	A347737	7.40	N/A	A347730
Total Organic Carbon (C)	mg/L	3.0	0.50	A349123	3.3	0.50	A349123
Total Dissolved Solids	mg/L	240	10	A346813	240	10	A346813
Total Suspended Solids	mg/L	7.2	1.0	A348983	5.8	1.0	A348983
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	100	1.0	A347735	100	1.0	A347729
Bicarbonate (HCO <sub>3</sub> )	mg/L	130	1.0	A347735	130	1.0	A347729
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ084			AFJ085		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.10	0.050	A349137	0.10	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347729
Orthophosphate (P)	mg/L	0.0026	0.0010	A347697	0.0018	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	5.5	1.0	A369153	5.6	1.0	A369153
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	43	1.0	A369153	43	1.0	A369153
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A348187	<0.015	0.015	A348185
Total Inorganic Carbon (C)	mg/L	27	1.0	A349689	28	1.0	A349689
Dissolved Phosphorus (P)	mg/L	0.0019	0.0010	A349056	0.0011	0.0010	A349056
Total Phosphorus (P)	mg/L	0.049	0.0010	A348644	0.012	0.0010	A348644
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A347818	<0.010	0.010	A347830
Dissolved Nitrate plus Nitrite (N)	mg/L	0.010	0.010	A347818	0.012	0.010	A347830
Total Nitrogen (N)	mg/L	0.30	0.020	A348568	0.22	0.020	A348572
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	11 (1)	2.0	A346600	10 (1)	2.0	A347942
<b>Physical Properties</b>							
Turbidity	NTU	8.4	0.10	A345460	8.5	0.10	A345460
RDL = Reportable Detection Limit (1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ086			AFJ087		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	0.0000	N/A	A344895	4.1	N/A	A344895
Cation Sum	meq/L	0.012	N/A	A344895	4.2	N/A	A344895
Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A344892	140	0.50	A344892
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A344205	138	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A344210	120	0.50	A344210
Ion Balance (% Difference)	%	NC	N/A	A344281	1.5	N/A	A344281
Dissolved Nitrate (N)	mg/L	<0.010	0.010	A344741	0.028	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	<0.044	0.044	A344761	0.12	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A344761	<0.033	0.033	A344761
Calculated Total Dissolved Solids	mg/L	<10	10	A344905	230	10	A344905
Un-Ionized Ammonia	mg/L				<0.0017	0.0017	A344897
Un-Ionized Ammonia @ 15 °C	mg/L	<0.00050	0.00050	A372471			
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A347380	<2.0 (1)	2.0	A347380
Chemical Oxygen Demand	mg/L	<10	10	A347736	13	10	A347736
<b>Field Parameters</b>							
Field pH	pH				8.6	N/A	ONSITE
Field Temperature (Fd)	deg. C				17.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	<2.0	2.0	A347738	390	2.0	A347738
Dissolved Organic Carbon (C)	mg/L	<0.50	0.50	A349121	3.8	0.50	A349121
pH	pH	4.92	N/A	A347737	7.75	N/A	A347737
Total Organic Carbon (C)	mg/L	<0.50	0.50	A349123	3.9	0.50	A349123
Total Dissolved Solids	mg/L	76	10	A346813	320	10	A346813
Total Suspended Solids	mg/L	<1.0	1.0	A348983	6.5	1.0	A348983
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347735
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	110	1.0	A347735
Bicarbonate (HCO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	140	1.0	A347735
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ086			AFJ087		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347735
Dissolved Fluoride (F)	mg/L	<0.050	0.050	A349137	0.17	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347735	<1.0	1.0	A347735
Orthophosphate (P)	mg/L	<0.0010	0.0010	A347697	0.0017	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	<1.0	1.0	A369155	20	1.0	A369153
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	<1.0	1.0	A369155	60	1.0	A369153
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A348185	<0.015	0.015	A348187
Total Inorganic Carbon (C)	mg/L	<1.0	1.0	A349689	30	1.0	A349689
Dissolved Phosphorus (P)	mg/L	0.0013	0.0010	A349056	0.0025	0.0010	A349056
Total Phosphorus (P)	mg/L	<0.0010	0.0010	A348644	0.013	0.0010	A348644
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A347818	<0.010 (1)	0.010	A369021
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	A347818	0.028 (1)	0.010	A369021
Total Nitrogen (N)	mg/L	<0.020	0.020	A348568	0.26	0.020	A348568
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	<2.0 (2)	2.0	A346600	11	2.0	A369980
pH (15 C)	pH	6.12		A376917			
<b>Physical Properties</b>							
Turbidity	NTU	<0.10	0.10	A345460	8.4	0.10	A345460
RDL = Reportable Detection Limit (1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time. (2) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ088			AFJ089		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Parameter</b>							
Subcontract Parameter	N/A	ATTACHED	N/A	A370020	ATTACHED	N/A	A370020
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.2	N/A	A344895	32	N/A	A344895
Cation Sum	meq/L	3.4	N/A	A344895	36	N/A	A344895
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A344892	88	0.50	A344892
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	141	0.50	A344205	88.3	0.50	A344205
Total Hardness (CaCO <sub>3</sub> )	mg/L	124	0.50	A344210	76.5	0.50	A344210
Ion Balance (% Difference)	%	2.8	N/A	A344281	5.3	N/A	A344281
Dissolved Nitrate (N)	mg/L	0.030	0.010	A344741	0.039	0.010	A344741
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.13	0.044	A344761	0.17	0.044	A344761
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A344761	0.20	0.033	A344761
Calculated Total Dissolved Solids	mg/L	170	10	A344905	2100	10	A344905
Un-ionized Ammonia	mg/L	<0.0014	0.0014	A344897	0.0066	0.0034	A344897
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A347467	7.9	2.0	A347467
Chemical Oxygen Demand	mg/L	13	10	A347736	111	10	A347736
<b>Field Parameters</b>							
Field pH	pH	8.5	N/A	ONSITE	9	N/A	ONSITE
Field Temperature (Fd)	deg. C	17	N/A	ONSITE	16.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	290	2.0	A347748	3100	2.0	A347731
Dissolved Organic Carbon (C)	mg/L	3.1	0.50	A349121	16	0.50	A349121
pH	pH	7.39	N/A	A347746	9.21	N/A	A347730
Total Organic Carbon (C)	mg/L	3.4	0.50	A349123	16	0.50	A349123
Total Dissolved Solids	mg/L	300	10	A346813	1900 (1)	25	A346813
Total Suspended Solids	mg/L	6.3	1.0	A348983	17	1.0	A348983
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A347743	67	1.0	A347729
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	110	1.0	A347743	370	1.0	A347729
Bicarbonate (HCO <sub>3</sub> )	mg/L	130	1.0	A347743	290	1.0	A347729
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A347743	80	1.0	A347729
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Detection limit raised based on sample volume used for analysis.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFJ088			AFJ089		
<b>Sampling Date</b>		2021/09/05			2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.10	0.050	A349137	2.2	0.050	A349137
Hydroxide (OH)	mg/L	<1.0	1.0	A347743	<1.0	1.0	A347729
Orthophosphate (P)	mg/L	0.0016	0.0010	A347697	0.0059	0.0010	A347697
Dissolved Chloride (Cl)	mg/L	5.8	1.0	A369153	430	5.0	A369153
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	43	1.0	A369153	590	5.0	A369153
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A348187	0.029	0.015	A348187
Total Inorganic Carbon (C)	mg/L	27	1.0	A349713	89	1.0	A349689
Dissolved Phosphorus (P)	mg/L	0.013	0.0010	A349056	0.014	0.0010	A349056
Total Phosphorus (P)	mg/L	0.011	0.0010	A348644	0.091	0.0010	A348644
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A347818	0.059	0.010	A347830
Dissolved Nitrate plus Nitrite (N)	mg/L	0.030	0.010	A347818	0.098	0.010	A347830
Total Nitrogen (N)	mg/L	0.19	0.020	A348568	1.7	0.020	A348572
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A341888	<2.0	2.0	A341888
<b>Physical Properties</b>							
True Colour	PtCo units	10 (1)	2.0	A347942	21 (1)	2.0	A347942
<b>Physical Properties</b>							
Turbidity	NTU	9.8	0.10	A345460	13	0.10	A345460
RDL = Reportable Detection Limit							
(1) Sample was originally processed within hold time. Data quality required investigation. Re-analysis was completed past recommended hold time							





### PETROLEUM HYDROCARBONS (CCME)

<b>BV Labs ID</b>		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082	AFJ083		
<b>Sampling Date</b>		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
<b>COC Number</b>		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>TABLE 1</b>	<b>TABLE 2</b>	<b>TABLE 3</b>	<b>TABLE 4</b>	<b>TABLE 5</b>	<b>TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Ext. Pet. Hydrocarbon</b>									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346567
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346567
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A346567
<b>Surrogate Recovery (%)</b>									
O-TERPHENYL (sur.)	%	106	110	102	104	103	108		A346567
RDL = Reportable Detection Limit									

<b>BV Labs ID</b>		AFJ084	AFJ085	AFJ086	AFJ087	AFJ088		
<b>Sampling Date</b>		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
<b>COC Number</b>		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>TABLE 7</b>	<b>TABLE 8</b>	<b>BLANK</b>	<b>DUPLICATE</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>

Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346567
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346567
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A346567
Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	102	107	101	106	118		A346567
RDL = Reportable Detection Limit								

<b>BV Labs ID</b>		AFJ089		
<b>Sampling Date</b>		2021/09/05		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Ext. Pet. Hydrocarbon</b>				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A346567
F3 (C16-C34 Hydrocarbons)	mg/L	0.12	0.10	A346567
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	0.20	A346567
<b>Surrogate Recovery (%)</b>				
O-TERPHENYL (sur.)	%	105		A346567
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	RDL	QC Batch
<b>Polycyclic Aromatics</b>								
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A344903
Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Acridine	ug/L	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	A346138
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A346138
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
Fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A346138
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Perylene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
Quinoline	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A346138
Retene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	RDL	QC Batch
C2-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C3-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C3 benzo(a)anthracene/chrysene	ug/L	0.012	0.0091	0.0086	<0.0085	<0.0085	0.0085	A346138
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C1benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
C2benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
<b>Phenols</b>								
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
Cresols	mg/L	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	0.00014	A344888
Phenol	mg/L	0.00030 (1)	0.00020 (1)	<0.00010	<0.00010	<0.00010	0.00010	A353956
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
RDL = Reportable Detection Limit								
(1) Qualifying ion outside of acceptance criteria. Results are tentatively identified and potentially biased high.								





**SEMIVOLATILE ORGANICS BY GC-MS (WATER)**

BV Labs ID		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	RDL	QC Batch
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
<b>Surrogate Recovery (%)</b>								
D10-ANTHRACENE (sur.)	%	110	112	106	106	112		A346138
D8-ACENAPHTHYLENE (sur.)	%	97	92	92	81	92		A346138
D8-NAPHTHALENE (sur.)	%	84	74	85	70	86		A346138
TERPHENYL-D14 (sur.)	%	90	93	87	87	92		A346138
2,4,6-TRIBROMOPHENOL (sur.)	%	121	118	116	121	115		A353956
2,4-DIBROMOPHENOL (sur.)	%	113	112	111	119	112		A353956
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ083	AFJ084	AFJ085	AFJ086	AFJ087		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 6	TABLE 7	TABLE 8	BLANK	DUPLICATE	RDL	QC Batch
<b>Polycyclic Aromatics</b>								
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A344903
Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Acridine	ug/L	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	A346138
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A346138
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
Fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	A346138
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Perylene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
Quinoline	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A346138
Retene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
Biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ083	AFJ084	AFJ085	AFJ086	AFJ087		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 6	TABLE 7	TABLE 8	BLANK	DUPLICATE	RDL	QC Batch
C2-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C3-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	A346138
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	A346138
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0086	0.0085	A346138
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A346138
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A346138
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A346138
<b>Phenols</b>								
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
Cresols	mg/L	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	0.00014	A344888
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00020 (1)	<0.00010	0.00010	A353956
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
RDL = Reportable Detection Limit								
(1) Qualifying ion outside of acceptance criteria. Results are tentatively identified and potentially biased high.								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ083	AFJ084	AFJ085	AFJ086	AFJ087		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 6	TABLE 7	TABLE 8	BLANK	DUPLICATE	RDL	QC Batch
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A353956
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A353956
<b>Surrogate Recovery (%)</b>								
D10-ANTHRACENE (sur.)	%	112	107	110	108	134 (1)		A346138
D8-ACENAPHTHYLENE (sur.)	%	99	93	95	83	116		A346138
D8-NAPHTHALENE (sur.)	%	93	83	87	78	115		A346138
TERPHENYL-D14 (sur.)	%	92	90	91	89	110		A346138
2,4,6-TRIBROMOPHENOL (sur.)	%	112	107	110	108	115		A353956
2,4-DIBROMOPHENOL (sur.)	%	110	104	109	107	114		A353956
RDL = Reportable Detection Limit								
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ088	AFJ089		
Sampling Date		2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01		
	UNITS	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
<b>Polycyclic Aromatics</b>					
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	0.010	A344903
Acenaphthene	ug/L	<0.10	<0.10	0.10	A346138
Acenaphthylene	ug/L	<0.10	<0.10	0.10	A346138
Acridine	ug/L	<0.040	<0.040	0.040	A346138
Anthracene	ug/L	<0.010	<0.010	0.010	A346138
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	0.0085	A346138
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A346138
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A346138
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	0.0085	A346138
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	0.050	A346138
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	0.0075	A346138
Benzo(e)pyrene	ug/L	<0.050	<0.050	0.050	A346138
Chrysene	ug/L	<0.0085	<0.0085	0.0085	A346138
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	0.0075	A346138
Fluoranthene	ug/L	<0.010	<0.010	0.010	A346138
Fluorene	ug/L	<0.050	<0.050	0.050	A346138
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	0.0085	A346138
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A346138
2-Methylnaphthalene	ug/L	<0.10	<0.10	0.10	A346138
Naphthalene	ug/L	<0.10	<0.10	0.10	A346138
Phenanthrene	ug/L	<0.050	<0.050	0.050	A346138
Perylene	ug/L	<0.050	<0.050	0.050	A346138
Pyrene	ug/L	<0.020	<0.020	0.020	A346138
Quinoline	ug/L	<0.20	<0.20	0.20	A346138
Retene	ug/L	<0.050	<0.050	0.050	A346138
C1-Naphthalene	ug/L	<0.10	<0.10	0.10	A346138
C3-Naphthalene	ug/L	<0.10	<0.10	0.10	A346138
C4-Naphthalene	ug/L	<0.10	<0.10	0.10	A346138
C2-Naphthalene	ug/L	<0.10	<0.10	0.10	A346138
Biphenyl	ug/L	<0.020	<0.020	0.020	A346138
C1-biphenyl	ug/L	<0.020	<0.020	0.020	A346138
C2-biphenyl	ug/L	<0.020	<0.020	0.020	A346138
C1-fluorene	ug/L	<0.050	<0.050	0.050	A346138
RDL = Reportable Detection Limit					





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ088	AFJ089		
Sampling Date		2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01		
	UNITS	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
C2-fluorene	ug/L	<0.050	<0.050	0.050	A346138
C3-fluorene	ug/L	<0.050	<0.050	0.050	A346138
Dibenzothiophene	ug/L	<0.020	<0.020	0.020	A346138
C1-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A346138
C2-dibenzothiophene	ug/L	<0.020	0.022	0.020	A346138
C3-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A346138
C4-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A346138
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A346138
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A346138
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A346138
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A346138
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A346138
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A346138
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A346138
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A346138
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A346138
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0091	0.0085	A346138
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.014	0.0085	A346138
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A346138
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	0.0075	A346138
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	0.0075	A346138
C1-Acenaphthene	ug/L	<0.10	<0.10	0.10	A346138
1-Methylnaphthalene	ug/L	<0.10	<0.10	0.10	A346138
<b>Phenols</b>					
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
Cresols	mg/L	<0.00014	<0.00014	0.00014	A344888
Phenol	mg/L	<0.00010	0.00040 (1)	0.00010	A353956
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
RDL = Reportable Detection Limit					
(1) Qualifying ion outside of acceptance criteria. Results are tentatively identified and potentially biased high.					





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ088	AFJ089		
Sampling Date		2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01		
	UNITS	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	0.0010	A353956
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2-chlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A353956
2-nitrophenol	mg/L	<0.0010	<0.0010	0.0010	A353956
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A353956
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	0.0010	A353956
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A353956
4-nitrophenol	mg/L	<0.0010	<0.0010	0.0010	A353956
Pentachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A353956
<b>Surrogate Recovery (%)</b>					
D10-ANTHRACENE (sur.)	%	113	111		A346138
D8-ACENAPHTHYLENE (sur.)	%	100	94		A346138
D8-NAPHTHALENE (sur.)	%	91	82		A346138
TERPHENYL-D14 (sur.)	%	93	87		A346138
2,4,6-TRIBROMOPHENOL (sur.)	%	115	112		A353956
2,4-DIBROMOPHENOL (sur.)	%	113	107		A353956
RDL = Reportable Detection Limit					





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ078			AFJ079			AFJ080		
Sampling Date		2021/09/05			2021/09/05			2021/09/05		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	QC Batch	TABLE 3	RDL	QC Batch
<b>Elements</b>										
Dissolved Calcium (Ca)	mg/L	16	0.30	A357434	31	0.30	A357434	35	0.30	A357434
Dissolved Iron (Fe)	mg/L	0.31	0.060	A357434	0.33	0.060	A357434	0.29	0.060	A357434
Dissolved Magnesium (Mg)	mg/L	11	0.20	A357434	12	0.20	A357434	11	0.20	A357434
Dissolved Manganese (Mn)	mg/L	0.027	0.0040	A369068	0.025	0.0040	A357434	0.025	0.0040	A357434
Dissolved Potassium (K)	mg/L	12	0.30	A357434	4.8	0.30	A357434	2.4	0.30	A357434
Dissolved Sodium (Na)	mg/L	760	2.5	A357434	230	0.50	A357434	78	0.50	A357434
<b>Dissolved Metals by ICPMS</b>										
Dissolved Aluminum (Al)	ug/L	94.3	0.50	A346253	40.1	0.50	A346253	18.5	0.50	A346253
Dissolved Antimony (Sb)	ug/L	0.788	0.020	A346253	0.283	0.020	A346253	0.121	0.020	A346253
Dissolved Arsenic (As)	ug/L	10.5	0.020	A346253	3.29	0.020	A346253	1.23	0.020	A346253
Dissolved Barium (Ba)	ug/L	52.5	0.020	A346253	47.0	0.020	A346253	44.4	0.020	A346253
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A346253	<0.010	0.010	A346253	<0.010	0.010	A346253
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Boron (B)	ug/L	2340	10	A371225	731	10	A346253	249	10	A346253
Dissolved Cadmium (Cd)	ug/L	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	A346253	<0.10	0.10	A346253	<0.10	0.10	A346253
Dissolved Cobalt (Co)	ug/L	0.141	0.0050	A346253	0.0837	0.0050	A346253	0.0630	0.0050	A346253
Dissolved Copper (Cu)	ug/L	0.284	0.050	A346253	0.433	0.050	A346253	0.431	0.050	A346253
Dissolved Iron (Fe)	ug/L	20.9	1.0	A346253	15.1	1.0	A346253	11.8	1.0	A346253
Dissolved Lead (Pb)	ug/L	0.0564	0.0050	A346253	0.0165	0.0050	A346253	0.0081	0.0050	A346253
Dissolved Lithium (Li)	ug/L	98.8	0.50	A346253	33.9	0.50	A346253	14.2	0.50	A346253
Dissolved Manganese (Mn)	ug/L	2.80	0.050	A346253	0.967	0.050	A346253	0.602	0.050	A346253
Dissolved Molybdenum (Mo)	ug/L	543	0.050	A346253	168	0.050	A346253	52.1	0.050	A346253
Dissolved Nickel (Ni)	ug/L	3.68	0.020	A346253	1.61	0.020	A346253	1.01	0.020	A346253
Dissolved Selenium (Se)	ug/L	2.95	0.040	A346253	0.999	0.040	A346253	0.404	0.040	A346253
Dissolved Silicon (Si)	ug/L	1800	50	A346253	1300	50	A346253	1150	50	A346253
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Strontium (Sr)	ug/L	463	0.050	A346253	297	0.050	A346253	246	0.050	A346253
Dissolved Thallium (Tl)	ug/L	0.0080	0.0020	A346253	0.0054	0.0020	A346253	0.0061	0.0020	A346253
Dissolved Tin (Sn)	ug/L	0.75	0.20	A346253	0.76	0.20	A346253	<0.20	0.20	A346253
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A346253	<0.50	0.50	A346253	<0.50	0.50	A346253
Dissolved Uranium (U)	ug/L	6.18	0.0020	A346253	2.18	0.0020	A346253	0.914	0.0020	A346253
RDL = Reportable Detection Limit										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ078			AFJ079			AFJ080		
Sampling Date		2021/09/05			2021/09/05			2021/09/05		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	QC Batch	TABLE 3	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	1480 (1)	1.0	A346253	472	0.20	A346253	136	0.20	A346253
Dissolved Zinc (Zn)	ug/L	4.17	0.10	A346253	2.47	0.10	A346253	0.72	0.10	A346253
Dissolved Zirconium (Zr)	ug/L	0.74	0.10	A346253	0.22	0.10	A346253	<0.10	0.10	A346253
Dissolved Calcium (Ca)	mg/L	13.3	0.050	A344369	26.0	0.050	A344369	29.8	0.050	A344369
Dissolved Magnesium (Mg)	mg/L	8.36	0.050	A344369	8.31	0.050	A344369	8.12	0.050	A344369
Dissolved Potassium (K)	mg/L	10.5	0.050	A344369	4.14	0.050	A344369	1.84	0.050	A344369
Dissolved Sodium (Na)	mg/L	556	0.25	A344369	180	0.050	A344369	60.7	0.050	A344369
Dissolved Sulphur (S)	mg/L	125	3.0	A344369	45.8	3.0	A344369	17.5	3.0	A344369
<b>Total Metals by ICPMS</b>										
Total Aluminum (Al)	ug/L	191	0.50	A346238	199	3.0	A352282	167	0.50	A346238
Total Antimony (Sb)	ug/L	0.842	0.020	A346238	0.329	0.020	A352282	0.130	0.020	A346238
Total Arsenic (As)	ug/L	10.1	0.020	A346238	3.86	0.020	A352282	1.24	0.020	A346238
Total Barium (Ba)	ug/L	58.1	0.020	A346238	55.4	0.050	A352282	46.5	0.020	A346238
Total Beryllium (Be)	ug/L	<0.010	0.010	A346238	0.012	0.010	A352282	0.010	0.010	A346238
Total Bismuth (Bi)	ug/L	0.0075	0.0050	A346238	<0.010	0.010	A352282	<0.0050	0.0050	A346238
Total Boron (B)	ug/L	307 (1)	50	A346238	669	10	A352282	240	10	A346238
Total Cadmium (Cd)	ug/L	<0.0050	0.0050	A346238	<0.0050	0.0050	A352282	<0.0050	0.0050	A346238
Total Chromium (Cr)	ug/L	0.23	0.10	A346238	0.47	0.10	A352282	0.25	0.10	A346238
Total Cobalt (Co)	ug/L	0.266	0.0050	A346238	0.221	0.010	A352282	0.242	0.0050	A346238
Total Copper (Cu)	ug/L	0.877	0.050	A346238	0.69	0.10	A352282	0.865	0.050	A346238
Total Iron (Fe)	ug/L	208	1.0	A346238	344	5.0	A352282	298	1.0	A346238
Total Lead (Pb)	ug/L	0.283	0.0050	A346238	0.215	0.020	A352282	0.156	0.0050	A346238
Total Lithium (Li)	ug/L	109	0.50	A346238	36.1	0.50	A352282	15.0	0.50	A346238
Total Manganese (Mn)	ug/L	21.2	0.050	A346238	21.1	0.10	A352282	19.1	0.050	A346238
Total Molybdenum (Mo)	ug/L	548	0.050	A346238	226	0.050	A352282	52.5	0.050	A346238
Total Nickel (Ni)	ug/L	3.94	0.020	A346238	2.14	0.10	A352282	1.13	0.020	A346238
Total Phosphorus (P)	ug/L				45.0	5.0	A352282			
Total Selenium (Se)	ug/L	2.88	0.040	A346238	1.11	0.040	A352282	0.441	0.040	A346238
Total Silicon (Si)	ug/L	2140	50	A346238	1610	50	A352282	1380	50	A346238
Total Silver (Ag)	ug/L	<0.0050	0.0050	A346238	<0.010	0.010	A352282	<0.0050	0.0050	A346238
Total Strontium (Sr)	ug/L	489	0.050	A346238	356	0.050	A352282	250	0.050	A346238
Total Thallium (Tl)	ug/L	0.0066	0.0020	A346238	0.0050	0.0020	A352282	0.0067	0.0020	A346238
Total Tin (Sn)	ug/L	0.82	0.20	A346238	1.34	0.20	A352282	<0.20	0.20	A346238
RDL = Reportable Detection Limit										
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ078			AFJ079			AFJ080		
Sampling Date		2021/09/05			2021/09/05			2021/09/05		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	QC Batch	TABLE 3	RDL	QC Batch
Total Titanium (Ti)	ug/L	2.33	0.50	A346238	2.7	2.0	A352282	2.91	0.50	A346238
Total Uranium (U)	ug/L	6.34	0.0020	A346238	2.53	0.0050	A352282	0.941	0.0020	A346238
Total Vanadium (V)	ug/L	2320 (1)	1.0	A346238	619 (1)	1.0	A352282	156	0.20	A346238
Total Zinc (Zn)	ug/L	18.4	0.10	A346238	9.9	1.0	A352282	3.74	0.10	A346238
Total Zirconium (Zr)	ug/L	0.80	0.10	A346238	0.42	0.10	A352282	0.20	0.10	A346238
Total Calcium (Ca)	mg/L	15.0	0.050	A344372	26.9	0.25	A344372	31.5	0.050	A344372
Total Magnesium (Mg)	mg/L	8.93	0.050	A344372	9.69	0.25	A344372	8.80	0.050	A344372
Total Potassium (K)	mg/L	10.6	0.050	A344372	4.26	0.25	A344372	1.89	0.050	A344372
Total Sodium (Na)	mg/L	639	0.25	A344372	202	0.25	A344372	64.8	0.050	A344372
Total Sulphur (S)	mg/L	162	3.0	A344372	63.8	3.0	A344372	16.7	3.0	A344372
RDL = Reportable Detection Limit										
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ081		AFJ082		AFJ083		
Sampling Date		2021/09/05		2021/09/05		2021/09/05		
COC Number		644187-02-01		644187-02-01		644187-02-01		
	UNITS	TABLE 4	QC Batch	TABLE 5	QC Batch	TABLE 6	RDL	QC Batch
<b>Elements</b>								
Dissolved Calcium (Ca)	mg/L	37	A357434	38	A357434	39	0.30	A357434
Dissolved Iron (Fe)	mg/L	0.25	A357434	0.26	A357434	0.64	0.060	A369068
Dissolved Magnesium (Mg)	mg/L	12	A357434	12	A357434	12	0.20	A357434
Dissolved Manganese (Mn)	mg/L	0.024	A357434	0.024	A357434	0.041	0.0040	A369068
Dissolved Potassium (K)	mg/L	1.6	A357434	1.5	A357434	1.4	0.30	A357434
Dissolved Sodium (Na)	mg/L	33	A357434	19	A357434	13	0.50	A357434
<b>Dissolved Metals by ICPMS</b>								
Dissolved Aluminum (Al)	ug/L	47.8	A371225	12.0	A346253	11.3	0.50	A346253
Dissolved Antimony (Sb)	ug/L	0.066	A346253	0.055	A346253	0.043	0.020	A346253
Dissolved Arsenic (As)	ug/L	0.587	A346253	0.378	A346253	0.288	0.020	A346253
Dissolved Barium (Ba)	ug/L	42.6	A346253	42.2	A346253	42.4	0.020	A346253
Dissolved Beryllium (Be)	ug/L	<0.010	A346253	<0.010	A346253	<0.010	0.010	A346253
Dissolved Bismuth (Bi)	ug/L	<0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Boron (B)	ug/L	106	A346253	57	A346253	154	10	A371225
Dissolved Cadmium (Cd)	ug/L	<0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Chromium (Cr)	ug/L	<0.10	A346253	<0.10	A346253	<0.10	0.10	A346253
Dissolved Cobalt (Co)	ug/L	0.0764	A346253	0.0528	A346253	0.0530	0.0050	A346253
Dissolved Copper (Cu)	ug/L	0.504	A346253	0.454	A346253	0.436	0.050	A346253
Dissolved Iron (Fe)	ug/L	107	A371225	10.9	A346253	9.8	1.0	A346253
Dissolved Lead (Pb)	ug/L	0.0663	A371225	<0.0050	A346253	0.0058	0.0050	A346253
Dissolved Lithium (Li)	ug/L	8.29	A346253	6.32	A346253	5.79	0.50	A346253
Dissolved Manganese (Mn)	ug/L	6.53	A371225	0.361	A346253	0.354	0.050	A346253
Dissolved Molybdenum (Mo)	ug/L	16.7	A346253	6.28	A346253	2.08	0.050	A346253
Dissolved Nickel (Ni)	ug/L	0.847	A346253	0.738	A346253	0.719	0.020	A346253
Dissolved Selenium (Se)	ug/L	0.225	A346253	0.151	A346253	0.129	0.040	A346253
Dissolved Silicon (Si)	ug/L	965	A346253	929	A346253	981	50	A346253
Dissolved Silver (Ag)	ug/L	<0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Strontium (Sr)	ug/L	231	A346253	230	A346253	225	0.050	A346253
Dissolved Thallium (Tl)	ug/L	0.0058	A346253	0.0051	A346253	0.0053	0.0020	A346253
Dissolved Tin (Sn)	ug/L	<0.20	A346253	<0.20	A346253	<0.20	0.20	A346253
Dissolved Titanium (Ti)	ug/L	<0.50	A346253	<0.50	A346253	<0.50	0.50	A346253
Dissolved Uranium (U)	ug/L	0.532	A346253	0.434	A346253	0.376	0.0020	A346253
Dissolved Vanadium (V)	ug/L	43.8	A346253	15.1	A346253	2.86	0.20	A346253
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ081		AFJ082		AFJ083		
Sampling Date		2021/09/05		2021/09/05		2021/09/05		
COC Number		644187-02-01		644187-02-01		644187-02-01		
	UNITS	TABLE 4	QC Batch	TABLE 5	QC Batch	TABLE 6	RDL	QC Batch
Dissolved Zinc (Zn)	ug/L	4.00	A371225	0.87	A346253	0.83	0.10	A346253
Dissolved Zirconium (Zr)	ug/L	<0.10	A346253	<0.10	A346253	<0.10	0.10	A346253
Dissolved Calcium (Ca)	mg/L	31.6	A344369	32.1	A344369	31.9	0.050	A344369
Dissolved Magnesium (Mg)	mg/L	8.15	A344369	8.38	A344369	8.34	0.050	A344369
Dissolved Potassium (K)	mg/L	1.25	A344369	1.08	A344369	1.01	0.050	A344369
Dissolved Sodium (Na)	mg/L	25.2	A344369	14.8	A344369	10.2	0.050	A344369
Dissolved Sulphur (S)	mg/L	9.2	A344369	7.5	A344369	6.7	3.0	A344369
<b>Total Metals by ICPMS</b>								
Total Aluminum (Al)	ug/L	123	A346238	106	A346238	95.7	0.50	A346238
Total Antimony (Sb)	ug/L	0.073	A346238	0.056	A346238	0.043	0.020	A346238
Total Arsenic (As)	ug/L	0.604	A346238	0.423	A346238	0.338	0.020	A346238
Total Barium (Ba)	ug/L	44.9	A346238	45.8	A346238	44.6	0.020	A346238
Total Beryllium (Be)	ug/L	0.010	A346238	<0.010	A346238	0.010	0.010	A346238
Total Bismuth (Bi)	ug/L	<0.0050	A346238	<0.0050	A346238	<0.0050	0.0050	A346238
Total Boron (B)	ug/L	97	A346238	51	A346238	31	10	A346238
Total Cadmium (Cd)	ug/L	<0.0050	A346238	<0.0050	A346238	0.0057	0.0050	A346238
Total Chromium (Cr)	ug/L	0.22	A346238	0.20	A346238	0.20	0.10	A346238
Total Cobalt (Co)	ug/L	0.220	A346238	0.245	A346238	0.249	0.0050	A346238
Total Copper (Cu)	ug/L	0.847	A346238	0.993	A346238	0.850	0.050	A346238
Total Iron (Fe)	ug/L	295	A346238	277	A346238	273	1.0	A346238
Total Lead (Pb)	ug/L	0.144	A346238	0.131	A346238	0.143	0.0050	A346238
Total Lithium (Li)	ug/L	8.50	A346238	6.83	A346238	5.85	0.50	A346238
Total Manganese (Mn)	ug/L	20.0	A346238	18.0	A346238	19.0	0.050	A346238
Total Molybdenum (Mo)	ug/L	16.9	A346238	6.33	A346238	1.86	0.050	A346238
Total Nickel (Ni)	ug/L	0.983	A346238	0.861	A346238	0.858	0.020	A346238
Total Selenium (Se)	ug/L	0.236	A346238	0.171	A346238	0.143	0.040	A346238
Total Silicon (Si)	ug/L	1260	A346238	1240	A346238	1210	50	A346238
Total Silver (Ag)	ug/L	<0.0050	A346238	<0.0050	A346238	<0.0050	0.0050	A346238
Total Strontium (Sr)	ug/L	233	A346238	233	A346238	225	0.050	A346238
Total Thallium (Tl)	ug/L	0.0068	A346238	0.0066	A346238	0.0060	0.0020	A346238
Total Tin (Sn)	ug/L	<0.20	A346238	<0.20	A346238	<0.20	0.20	A346238
Total Titanium (Ti)	ug/L	2.03	A346238	1.73	A346238	1.37	0.50	A346238
Total Uranium (U)	ug/L	0.549	A346238	0.447	A346238	0.379	0.0020	A346238
Total Vanadium (V)	ug/L	48.8	A346238	17.2	A346238	3.70	0.20	A346238
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>BV Labs ID</b>		AFJ081		AFJ082		AFJ083		
<b>Sampling Date</b>		2021/09/05		2021/09/05		2021/09/05		
<b>COC Number</b>		644187-02-01		644187-02-01		644187-02-01		
	<b>UNITS</b>	<b>TABLE 4</b>	<b>QC Batch</b>	<b>TABLE 5</b>	<b>QC Batch</b>	<b>TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
Total Zinc (Zn)	ug/L	7.22	A371236	2.10	A346238	2.18	0.10	A346238
Total Zirconium (Zr)	ug/L	0.13	A346238	0.15	A346238	<0.10	0.10	A346238
Total Calcium (Ca)	mg/L	33.1	A344372	34.4	A344372	33.5	0.050	A344372
Total Magnesium (Mg)	mg/L	8.78	A344372	8.88	A344372	8.77	0.050	A344372
Total Potassium (K)	mg/L	1.28	A344372	1.11	A344372	1.00	0.050	A344372
Total Sodium (Na)	mg/L	26.9	A344372	15.6	A344372	10.4	0.050	A344372
Total Sulphur (S)	mg/L	9.1	A344372	6.8	A344372	6.2	3.0	A344372
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ084			AFJ085		AFJ086		
Sampling Date		2021/09/05			2021/09/05		2021/09/05		
COC Number		644187-02-01			644187-02-01		644187-02-01		
	UNITS	TABLE 7	RDL	QC Batch	TABLE 8	QC Batch	BLANK	RDL	QC Batch
<b>Elements</b>									
Dissolved Calcium (Ca)	mg/L	38	0.30	A357434	37	A357434	<0.30	0.30	A357434
Dissolved Iron (Fe)	mg/L	0.29	0.060	A357434	0.27	A357434	<0.060	0.060	A357434
Dissolved Magnesium (Mg)	mg/L	11	0.20	A357434	11	A357434	<0.20	0.20	A357434
Dissolved Manganese (Mn)	mg/L	0.027	0.0040	A357434	0.024	A357434	<0.0040	0.0040	A357434
Dissolved Potassium (K)	mg/L	1.3	0.30	A357434	1.2	A357434	<0.30	0.30	A357434
Dissolved Sodium (Na)	mg/L	11	0.50	A357434	11	A357434	<0.50	0.50	A357434
<b>Dissolved Metals by ICPMS</b>									
Dissolved Aluminum (Al)	ug/L	15.0	0.50	A346253	12.1	A346253	<0.50	0.50	A346253
Dissolved Antimony (Sb)	ug/L	0.045	0.020	A346253	0.051	A346253	<0.020	0.020	A346253
Dissolved Arsenic (As)	ug/L	0.288	0.020	A346253	0.291	A346253	0.020	0.020	A346253
Dissolved Barium (Ba)	ug/L	43.4	0.020	A346253	41.4	A346253	0.115	0.020	A346253
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A346253	<0.010	A346253	<0.010	0.010	A346253
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Boron (B)	ug/L	41	10	A346253	36	A346253	11	10	A346253
Dissolved Cadmium (Cd)	ug/L	0.0052	0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	A346253	<0.10	A346253	<0.10	0.10	A346253
Dissolved Cobalt (Co)	ug/L	0.0619	0.0050	A346253	0.0553	A346253	<0.0050	0.0050	A346253
Dissolved Copper (Cu)	ug/L	0.499	0.050	A346253	0.511	A346253	<0.050	0.050	A346253
Dissolved Iron (Fe)	ug/L	23.3	1.0	A346253	14.6	A346253	<1.0	1.0	A346253
Dissolved Lead (Pb)	ug/L	0.0148	0.0050	A346253	0.0137	A346253	<0.0050	0.0050	A346253
Dissolved Lithium (Li)	ug/L	5.23	0.50	A346253	5.04	A346253	<0.50	0.50	A346253
Dissolved Manganese (Mn)	ug/L	1.43	0.050	A346253	0.621	A346253	<0.050	0.050	A346253
Dissolved Molybdenum (Mo)	ug/L	0.781	0.050	A346253	0.725	A346253	<0.050	0.050	A346253
Dissolved Nickel (Ni)	ug/L	0.746	0.020	A346253	0.731	A346253	<0.020	0.020	A346253
Dissolved Selenium (Se)	ug/L	0.120	0.040	A346253	0.111	A346253	<0.040	0.040	A346253
Dissolved Silicon (Si)	ug/L	954	50	A346253	916	A346253	<50	50	A346253
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A346253	<0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Strontium (Sr)	ug/L	230	0.050	A346253	225	A346253	<0.050	0.050	A346253
Dissolved Thallium (Tl)	ug/L	0.0052	0.0020	A346253	0.0045	A346253	<0.0020	0.0020	A346253
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A346253	<0.20	A346253	<0.20	0.20	A346253
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A346253	<0.50	A346253	<0.50	0.50	A346253
Dissolved Uranium (U)	ug/L	0.366	0.0020	A346253	0.358	A346253	<0.0020	0.0020	A346253
Dissolved Vanadium (V)	ug/L	0.26	0.20	A346253	0.24	A346253	<0.20	0.20	A346253
RDL = Reportable Detection Limit									





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ084			AFJ085		AFJ086		
Sampling Date		2021/09/05			2021/09/05		2021/09/05		
COC Number		644187-02-01			644187-02-01		644187-02-01		
	UNITS	TABLE 7	RDL	QC Batch	TABLE 8	QC Batch	BLANK	RDL	QC Batch
Dissolved Zinc (Zn)	ug/L	0.91	0.10	A346253	8.48	A371225	0.54	0.10	A346253
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A346253	<0.10	A346253	<0.10	0.10	A346253
Dissolved Calcium (Ca)	mg/L	32.1	0.050	A344369	31.3	A344369	<0.050	0.050	A344369
Dissolved Magnesium (Mg)	mg/L	8.31	0.050	A344369	8.18	A344369	<0.050	0.050	A344369
Dissolved Potassium (K)	mg/L	0.994	0.050	A344369	0.989	A344369	<0.050	0.050	A344369
Dissolved Sodium (Na)	mg/L	8.88	0.050	A344369	8.86	A344369	0.093	0.050	A344369
Dissolved Sulphur (S)	mg/L	6.5	3.0	A344369	6.3	A344369	<3.0	3.0	A344369
<b>Total Metals by ICPMS</b>									
Total Aluminum (Al)	ug/L	187	3.0	A352282	85.0	A346238	3.55	0.50	A371236
Total Antimony (Sb)	ug/L	0.060	0.020	A352282	0.040	A346238	<0.020	0.020	A346238
Total Arsenic (As)	ug/L	0.438	0.020	A352282	0.298	A346238	<0.020	0.020	A346238
Total Barium (Ba)	ug/L	50.1	0.050	A352282	43.3	A346238	<0.020	0.020	A346238
Total Beryllium (Be)	ug/L	0.013	0.010	A352282	<0.010	A346238	<0.010	0.010	A346238
Total Bismuth (Bi)	ug/L	<0.010	0.010	A352282	<0.0050	A346238	<0.0050	0.0050	A346238
Total Boron (B)	ug/L	122	10	A352282	29	A346238	10	10	A346238
Total Cadmium (Cd)	ug/L	0.0144	0.0050	A352282	0.0063	A346238	<0.0050	0.0050	A346238
Total Chromium (Cr)	ug/L	0.44	0.10	A352282	0.17	A346238	<0.10	0.10	A346238
Total Cobalt (Co)	ug/L	0.215	0.010	A352282	0.211	A346238	<0.0050	0.0050	A346238
Total Copper (Cu)	ug/L	1.16	0.10	A352282	0.873	A346238	<0.050	0.050	A346238
Total Iron (Fe)	ug/L	397	5.0	A352282	267	A346238	<1.0	1.0	A346238
Total Lead (Pb)	ug/L	0.211	0.020	A352282	0.127	A346238	<0.0050	0.0050	A346238
Total Lithium (Li)	ug/L	5.46	0.50	A352282	5.56	A346238	<0.50	0.50	A346238
Total Manganese (Mn)	ug/L	22.9	0.10	A352282	17.5	A346238	<0.050	0.050	A346238
Total Molybdenum (Mo)	ug/L	1.04	0.050	A352282	0.680	A346238	<0.050	0.050	A346238
Total Nickel (Ni)	ug/L	1.18	0.10	A352282	0.772	A346238	<0.020	0.020	A346238
Total Phosphorus (P)	ug/L	25.7	5.0	A352282					
Total Selenium (Se)	ug/L	0.141	0.040	A352282	0.138	A346238	<0.040	0.040	A346238
Total Silicon (Si)	ug/L	1340	50	A352282	1170	A346238	<50	50	A346238
Total Silver (Ag)	ug/L	<0.010	0.010	A352282	<0.0050	A346238	<0.0050	0.0050	A346238
Total Strontium (Sr)	ug/L	254	0.050	A352282	219	A346238	<0.050	0.050	A346238
Total Thallium (Tl)	ug/L	0.0044	0.0020	A352282	0.0053	A346238	<0.0020	0.0020	A346238
Total Tin (Sn)	ug/L	<0.20	0.20	A352282	<0.20	A346238	<0.20	0.20	A346238
Total Titanium (Ti)	ug/L	2.3	2.0	A352282	1.92	A346238	<0.50	0.50	A346238
Total Uranium (U)	ug/L	0.434	0.0050	A352282	0.365	A346238	<0.0020	0.0020	A346238
RDL = Reportable Detection Limit									





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>BV Labs ID</b>		AFJ084			AFJ085		AFJ086		
<b>Sampling Date</b>		2021/09/05			2021/09/05		2021/09/05		
<b>COC Number</b>		644187-02-01			644187-02-01		644187-02-01		
	<b>UNITS</b>	<b>TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TABLE 8</b>	<b>QC Batch</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
Total Vanadium (V)	ug/L	0.81	0.20	A352282	0.37	A346238	<0.20	0.20	A346238
Total Zinc (Zn)	ug/L	5.4	1.0	A352282	2.20	A346238	10.8	0.10	A371236
Total Zirconium (Zr)	ug/L	0.18	0.10	A352282	<0.10	A346238	<0.10	0.10	A346238
Total Calcium (Ca)	mg/L	31.9	0.25	A344372	33.4	A344372	<0.050	0.050	A344372
Total Magnesium (Mg)	mg/L	9.65	0.25	A344372	8.61	A344372	<0.050	0.050	A344372
Total Potassium (K)	mg/L	1.15	0.25	A344372	0.970	A344372	<0.050	0.050	A344372
Total Sodium (Na)	mg/L	10.4	0.25	A344372	9.27	A344372	<0.050	0.050	A344372
Total Sulphur (S)	mg/L	10.8	3.0	A344372	5.8	A344372	<3.0	3.0	A344372
RDL = Reportable Detection Limit									





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ087		AFJ088			AFJ089		
Sampling Date		2021/09/05		2021/09/05			2021/09/05		
COC Number		644187-02-01		644187-02-01			644187-02-01		
	UNITS	DUPLICATE	QC Batch	RIVER WATER TANK	RDL	QC Batch	TREATED OSPW TANK	RDL	QC Batch
<b>Elements</b>									
Dissolved Calcium (Ca)	mg/L	37	A357434	38	0.30	A357434	16	0.30	A357434
Dissolved Iron (Fe)	mg/L	0.27	A357434	0.30	0.060	A357434	0.33	0.060	A357434
Dissolved Magnesium (Mg)	mg/L	11	A357434	12	0.20	A357434	12	0.20	A357434
Dissolved Manganese (Mn)	mg/L	0.023	A357434	0.025	0.0040	A357434	0.029	0.0040	A357434
Dissolved Potassium (K)	mg/L	1.6	A357434	1.3	0.30	A357434	12	0.30	A357434
Dissolved Sodium (Na)	mg/L	33	A357434	11	0.50	A357434	770	2.5	A357434
<b>Dissolved Metals by ICPMS</b>									
Dissolved Aluminum (Al)	ug/L	23.1	A371225	14.1	0.50	A346253	120	0.50	A346253
Dissolved Antimony (Sb)	ug/L	0.067	A346253	0.045	0.020	A346253	0.824	0.020	A346253
Dissolved Arsenic (As)	ug/L	0.582	A346253	0.292	0.020	A346253	10.4	0.020	A346253
Dissolved Barium (Ba)	ug/L	43.5	A346253	44.0	0.020	A346253	54.8	0.020	A346253
Dissolved Beryllium (Be)	ug/L	<0.010	A346253	<0.010	0.010	A346253	<0.010	0.010	A346253
Dissolved Bismuth (Bi)	ug/L	<0.0050	A346253	<0.0050	0.0050	A346253	0.0103	0.0050	A346253
Dissolved Boron (B)	ug/L	95	A346253	34	10	A346253	2160	10	A346253
Dissolved Cadmium (Cd)	ug/L	<0.0050	A346253	0.0054	0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Chromium (Cr)	ug/L	<0.10	A346253	<0.10	0.10	A346253	0.10	0.10	A346253
Dissolved Cobalt (Co)	ug/L	0.0609	A346253	0.0620	0.0050	A346253	0.150	0.0050	A346253
Dissolved Copper (Cu)	ug/L	0.458	A346253	0.448	0.050	A346253	0.262	0.050	A346253
Dissolved Iron (Fe)	ug/L	26.7	A371225	12.4	1.0	A346253	29.7	1.0	A346253
Dissolved Lead (Pb)	ug/L	0.0171	A371225	0.0147	0.0050	A346253	0.0477	0.0050	A346253
Dissolved Lithium (Li)	ug/L	8.23	A346253	5.34	0.50	A346253	103	0.50	A346253
Dissolved Manganese (Mn)	ug/L	2.13	A371225	0.581	0.050	A346253	3.38	0.050	A346253
Dissolved Molybdenum (Mo)	ug/L	17.2	A346253	0.760	0.050	A346253	545	0.050	A346253
Dissolved Nickel (Ni)	ug/L	0.837	A346253	0.768	0.020	A346253	3.76	0.020	A346253
Dissolved Selenium (Se)	ug/L	0.207	A346253	0.126	0.040	A346253	2.75	0.040	A346253
Dissolved Silicon (Si)	ug/L	940	A346253	1060	50	A346253	1760	50	A346253
Dissolved Silver (Ag)	ug/L	<0.0050	A346253	<0.0050	0.0050	A346253	<0.0050	0.0050	A346253
Dissolved Strontium (Sr)	ug/L	235	A346253	235	0.050	A346253	488	0.050	A346253
Dissolved Thallium (Tl)	ug/L	0.0054	A346253	0.0041	0.0020	A346253	0.0046	0.0020	A346253
Dissolved Tin (Sn)	ug/L	<0.20	A346253	<0.20	0.20	A346253	4.56	0.20	A346253
Dissolved Titanium (Ti)	ug/L	<0.50	A346253	<0.50	0.50	A346253	<0.50	0.50	A346253
Dissolved Uranium (U)	ug/L	0.550	A346253	0.371	0.0020	A346253	6.16	0.0020	A346253
Dissolved Vanadium (V)	ug/L	44.8	A346253	0.25	0.20	A346253	1520	0.20	A346253
RDL = Reportable Detection Limit									





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ087		AFJ088			AFJ089		
Sampling Date		2021/09/05		2021/09/05			2021/09/05		
COC Number		644187-02-01		644187-02-01			644187-02-01		
	UNITS	DUPLICATE	QC Batch	RIVER WATER TANK	RDL	QC Batch	TREATED OSPW TANK	RDL	QC Batch
Dissolved Zinc (Zn)	ug/L	2.76	A371225	5.65	0.10	A346253	10.8	0.10	A346253
Dissolved Zirconium (Zr)	ug/L	<0.10	A346253	<0.10	0.10	A346253	0.75	0.10	A346253
Dissolved Calcium (Ca)	mg/L	31.5	A344369	32.1	0.050	A344369	13.8	0.050	A344369
Dissolved Magnesium (Mg)	mg/L	8.37	A344369	8.58	0.050	A344369	8.60	0.050	A344369
Dissolved Potassium (K)	mg/L	1.28	A344369	1.02	0.050	A344369	10.4	0.050	A344369
Dissolved Sodium (Na)	mg/L	25.9	A344369	9.23	0.050	A344369	564	0.050	A344369
Dissolved Sulphur (S)	mg/L	9.7	A344369	7.0	3.0	A344369	119	3.0	A344369
<b>Total Metals by ICPMS</b>									
Total Aluminum (Al)	ug/L	127	A346238	95.9	0.50	A346238	233	3.0	A352282
Total Antimony (Sb)	ug/L	0.070	A346238	0.047	0.020	A346238	0.927	0.020	A352282
Total Arsenic (As)	ug/L	0.605	A346238	0.336	0.020	A346238	12.0	0.020	A352282
Total Barium (Ba)	ug/L	45.2	A346238	45.6	0.020	A346238	66.8	0.050	A352282
Total Beryllium (Be)	ug/L	<0.010	A346238	<0.010	0.010	A346238	<0.010	0.010	A352282
Total Bismuth (Bi)	ug/L	<0.0050	A346238	<0.0050	0.0050	A346238	0.013	0.010	A352282
Total Boron (B)	ug/L	94	A346238	28	10	A346238	1890	10	A352282
Total Cadmium (Cd)	ug/L	<0.0050	A346238	0.0080	0.0050	A346238	<0.0050	0.0050	A352282
Total Chromium (Cr)	ug/L	0.23	A346238	0.19	0.10	A346238	0.48	0.10	A352282
Total Cobalt (Co)	ug/L	0.236	A346238	0.278	0.0050	A346238	0.259	0.010	A352282
Total Copper (Cu)	ug/L	0.960	A346238	1.12	0.050	A346238	0.42	0.10	A352282
Total Iron (Fe)	ug/L	293	A346238	286	1.0	A346238	377	5.0	A352282
Total Lead (Pb)	ug/L	0.135	A346238	0.150	0.0050	A346238	0.300	0.020	A352282
Total Lithium (Li)	ug/L	8.58	A346238	5.74	0.50	A346238	111	0.50	A352282
Total Manganese (Mn)	ug/L	17.9	A346238	18.8	0.050	A346238	24.4	0.10	A352282
Total Molybdenum (Mo)	ug/L	17.1	A346238	0.733	0.050	A346238	778	0.050	A352282
Total Nickel (Ni)	ug/L	0.935	A346238	0.888	0.020	A346238	4.17	0.10	A352282
Total Phosphorus (P)	ug/L						103	5.0	A352282
Total Selenium (Se)	ug/L	0.230	A346238	0.138	0.040	A346238	3.09	0.040	A352282
Total Silicon (Si)	ug/L	1250	A346238	1210	50	A346238	2370	50	A352282
Total Silver (Ag)	ug/L	<0.0050	A346238	<0.0050	0.0050	A346238	<0.010	0.010	A352282
Total Strontium (Sr)	ug/L	236	A346238	229	0.050	A346238	609	0.050	A352282
Total Thallium (Tl)	ug/L	0.0060	A346238	0.0064	0.0020	A346238	0.0037	0.0020	A352282
Total Tin (Sn)	ug/L	<0.20	A346238	<0.20	0.20	A346238	4.83	0.20	A352282
Total Titanium (Ti)	ug/L	2.19	A346238	1.35	0.50	A346238	2.4	2.0	A352282
Total Uranium (U)	ug/L	0.561	A346238	0.379	0.0020	A346238	7.30	0.0050	A352282
RDL = Reportable Detection Limit									





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFJ087		AFJ088			AFJ089		
Sampling Date		2021/09/05		2021/09/05			2021/09/05		
COC Number		644187-02-01		644187-02-01			644187-02-01		
	UNITS	DUPLICATE	QC Batch	RIVER WATER TANK	RDL	QC Batch	TREATED OSPW TANK	RDL	QC Batch
Total Vanadium (V)	ug/L	49.0	A346238	0.41	0.20	A346238	2020 (1)	1.0	A352282
Total Zinc (Zn)	ug/L	5.81	A371236	7.55	0.10	A346238	28.2	1.0	A352282
Total Zirconium (Zr)	ug/L	0.12	A346238	<0.10	0.10	A346238	1.20	0.10	A352282
Total Calcium (Ca)	mg/L	33.5	A344372	34.9	0.050	A344372	14.8	0.25	A344372
Total Magnesium (Mg)	mg/L	8.77	A344372	8.88	0.050	A344372	9.56	0.25	A344372
Total Potassium (K)	mg/L	1.28	A344372	1.03	0.050	A344372	11.5	0.25	A344372
Total Sodium (Na)	mg/L	26.9	A344372	9.49	0.050	A344372	651	1.3	A344372
Total Sulphur (S)	mg/L	8.8	A344372	5.7	3.0	A344372	191	3.0	A344372

RDL = Reportable Detection Limit

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





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082	AFJ083		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6	RDL	QC Batch
<b>Volatiles</b>									
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	1.3	A344906
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	A345961
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	<0.89	<0.89	0.89	A344229
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	<100	100	A344229
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
F1 (C6-C10)	ug/L	<100	<100	<100	<100	<100	<100	100	A345961
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A345964
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
RDL = Reportable Detection Limit									





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ078	AFJ079	AFJ080	AFJ081	AFJ082	AFJ083		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6	RDL	QC Batch
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
<b>Surrogate Recovery (%)</b>									
1,4-Difluorobenzene (sur.)	%	83	96	98	99	99	98		A345961
4-Bromofluorobenzene (sur.)	%	82	95	96	95	98	97		A345961
D4-1,2-Dichloroethane (sur.)	%	80	92	95	94	93	93		A345961
1,4-Difluorobenzene (sur.)	%	101	101	100	101	102	101		A345964
4-Bromofluorobenzene (sur.)	%	87	89	89	89	89	88		A345964
D4-1,2-Dichloroethane (sur.)	%	100	104	112	110	99	105		A345964
RDL = Reportable Detection Limit									





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ084	AFJ085	AFJ086	AFJ087	AFJ088		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 7	TABLE 8	BLANK	DUPLICATE	RIVER WATER TANK	RDL	QC Batch
<b>Volatiles</b>								
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	<1.3	1.3	A344906
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	A345961
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A345961
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	<0.89	0.89	A344229
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	100	A344229
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
F1 (C6-C10)	ug/L	<100	<100	<100	<100	<100	100	A345961
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A345964
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFJ084	AFJ085	AFJ086	AFJ087	AFJ088		
Sampling Date		2021/09/05	2021/09/05	2021/09/05	2021/09/05	2021/09/05		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 7	TABLE 8	BLANK	DUPLICATE	RIVER WATER TANK	RDL	QC Batch
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A345964
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A345964
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A345964
<b>Surrogate Recovery (%)</b>								
1,4-Difluorobenzene (sur.)	%	102	100	101	101	100		A345961
4-Bromofluorobenzene (sur.)	%	96	100	95	96	96		A345961
D4-1,2-Dichloroethane (sur.)	%	95	95	95	95	96		A345961
1,4-Difluorobenzene (sur.)	%	102	101	101	102	102		A345964
4-Bromofluorobenzene (sur.)	%	89	88	89	89	89		A345964
D4-1,2-Dichloroethane (sur.)	%	101	95	103	100	97		A345964
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

<b>BV Labs ID</b>		AFJ089		
<b>Sampling Date</b>		2021/09/05		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Volatiles</b>				
Total Trihalomethanes	ug/L	<1.3	1.3	A344906
Benzene	ug/L	<0.40	0.40	A345961
Bromodichloromethane	ug/L	<0.50	0.50	A345964
Toluene	ug/L	<0.40	0.40	A345961
Bromoform	ug/L	<0.50	0.50	A345964
Ethylbenzene	ug/L	<0.40	0.40	A345961
Bromomethane	ug/L	<2.0	2.0	A345964
m & p-Xylene	ug/L	<0.80	0.80	A345961
Carbon tetrachloride	ug/L	<0.50	0.50	A345964
o-Xylene	ug/L	<0.40	0.40	A345961
Chlorobenzene	ug/L	<0.50	0.50	A345964
Dibromochloromethane	ug/L	<1.0	1.0	A345964
Xylenes (Total)	ug/L	<0.89	0.89	A344229
Chloroethane	ug/L	<1.0	1.0	A345964
F1 (C6-C10) - BTEX	ug/L	<100	100	A344229
Chloroform	ug/L	<0.50	0.50	A345964
Chloromethane	ug/L	<2.0	2.0	A345964
F1 (C6-C10)	ug/L	<100	100	A345961
1,2-dibromoethane	ug/L	<0.20	0.20	A345964
1,2-dichlorobenzene	ug/L	<0.50	0.50	A345964
1,3-dichlorobenzene	ug/L	<0.50	0.50	A345964
1,4-dichlorobenzene	ug/L	<0.50	0.50	A345964
1,1-dichloroethane	ug/L	<0.50	0.50	A345964
1,2-dichloroethane	ug/L	<0.50	0.50	A345964
1,1-dichloroethene	ug/L	<0.50	0.50	A345964
cis-1,2-dichloroethene	ug/L	<0.50	0.50	A345964
trans-1,2-dichloroethene	ug/L	<0.50	0.50	A345964
Dichloromethane	ug/L	<2.0	2.0	A345964
1,2-dichloropropane	ug/L	<0.50	0.50	A345964
cis-1,3-dichloropropene	ug/L	<0.50	0.50	A345964
trans-1,3-dichloropropene	ug/L	<0.50	0.50	A345964
Methyl methacrylate	ug/L	<0.50	0.50	A345964
Methyl-tert-butylether (MTBE)	ug/L	<0.50	0.50	A345964
RDL = Reportable Detection Limit				





### VOLATILE ORGANICS BY GC-MS (WATER)

<b>BV Labs ID</b>		AFJ089		
<b>Sampling Date</b>		2021/09/05		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Styrene	ug/L	<0.50	0.50	A345964
1,1,1,2-tetrachloroethane	ug/L	<1.0	1.0	A345964
1,1,2,2-tetrachloroethane	ug/L	<2.0	2.0	A345964
Tetrachloroethene	ug/L	<0.50	0.50	A345964
1,2,3-trichlorobenzene	ug/L	<1.0	1.0	A345964
1,2,4-trichlorobenzene	ug/L	<1.0	1.0	A345964
1,3,5-trichlorobenzene	ug/L	<0.50	0.50	A345964
1,1,1-trichloroethane	ug/L	<0.50	0.50	A345964
1,1,2-trichloroethane	ug/L	<0.50	0.50	A345964
Trichloroethene	ug/L	<0.50	0.50	A345964
Trichlorofluoromethane	ug/L	<0.50	0.50	A345964
1,2,4-trimethylbenzene	ug/L	<0.50	0.50	A345964
1,3,5-trimethylbenzene	ug/L	<0.50	0.50	A345964
Vinyl chloride	ug/L	<0.50	0.50	A345964
<b>Surrogate Recovery (%)</b>				
1,4-Difluorobenzene (sur.)	%	100		A345961
4-Bromofluorobenzene (sur.)	%	97		A345961
D4-1,2-Dichloroethane (sur.)	%	94		A345961
1,4-Difluorobenzene (sur.)	%	102		A345964
4-Bromofluorobenzene (sur.)	%	88		A345964
D4-1,2-Dichloroethane (sur.)	%	97		A345964
RDL = Reportable Detection Limit				





## GENERAL COMMENTS

Sample AFJ078 [TABLE 1] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AFJ079 [TABLE 2] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AFJ080 [TABLE 3] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Total Dissolved Solids (Filt. Residue).

Sample AFJ081 [TABLE 4] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water. Sample was analyzed past method specified hold time for Total Dissolved Solids (Filt. Residue).

Sample AFJ082 [TABLE 5] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Total Dissolved Solids (Filt. Residue).

Sample AFJ083 [TABLE 6] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Total Dissolved Solids (Filt. Residue).

Sample AFJ084 [TABLE 7] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AFJ085 [TABLE 8] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AFJ086 [BLANK] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Total Dissolved Solids (Filt. Residue).

Sample AFJ087 [DUPLICATE] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water.

Sample AFJ088 [RIVER WATER TANK] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AFJ089 [TREATED OSPW TANK] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

Sample AFJ078, Elements by ICP - Dissolved: Test repeated.  
Sample AFJ078, Elements by ICPMS Low Level (dissolved): Test repeated.  
Sample AFJ081, Elements by ICPMS Low Level (dissolved): Test repeated.  
Sample AFJ081, Elements by ICPMS Low Level (total): Test repeated.  
Sample AFJ083, Elements by ICP - Dissolved: Test repeated.  
Sample AFJ083, Elements by ICPMS Low Level (dissolved): Test repeated.  
Sample AFJ085, Elements by ICPMS Low Level (dissolved): Test repeated.  
Sample AFJ086, Elements by ICPMS Low Level (total): Test repeated.  
Sample AFJ087, Elements by ICPMS Low Level (dissolved): Test repeated.  
Sample AFJ087, Elements by ICPMS Low Level (total): Test repeated.

**Results relate only to the items tested.**





### QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A341888	AAX		Matrix Spike	Naphthenic Acids	2021/09/10		91	%	70 - 130
A341888	AAX		Spiked Blank	Naphthenic Acids	2021/09/10		82	%	70 - 130
A341888	AAX		Method Blank	Naphthenic Acids	2021/09/10	<2.0		mg/L	
A341888	AAX		RPD	Naphthenic Acids	2021/09/10	NC		%	30
A345460	AP1		Spiked Blank	Turbidity	2021/09/08		103	%	80 - 120
A345460	AP1		Method Blank	Turbidity	2021/09/08	<0.10		NTU	
A345460	AP1		RPD [AFJ078-01]	Turbidity	2021/09/08	3.3		%	20
A345961	PKL		Matrix Spike	1,4-Difluorobenzene (sur.)	2021/09/10		95	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		96	%	50 - 140
				Benzene	2021/09/10		87	%	50 - 140
				Toluene	2021/09/10		89	%	50 - 140
				Ethylbenzene	2021/09/10		94	%	50 - 140
				m & p-Xylene	2021/09/10		92	%	50 - 140
				o-Xylene	2021/09/10		96	%	50 - 140
				F1 (C6-C10)	2021/09/10		100	%	60 - 140
A345961	PKL		Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/10		96	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		97	%	50 - 140
				Benzene	2021/09/10		90	%	60 - 130
				Toluene	2021/09/10		93	%	60 - 130
				Ethylbenzene	2021/09/10		98	%	60 - 130
				m & p-Xylene	2021/09/10		96	%	60 - 130
				o-Xylene	2021/09/10		100	%	60 - 130
				F1 (C6-C10)	2021/09/10		98	%	60 - 140
A345961	PKL		Method Blank	1,4-Difluorobenzene (sur.)	2021/09/10		99	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		96	%	50 - 140
				Benzene	2021/09/10	<0.40		ug/L	
				Toluene	2021/09/10	<0.40		ug/L	
				Ethylbenzene	2021/09/10	<0.40		ug/L	
				m & p-Xylene	2021/09/10	<0.80		ug/L	
				o-Xylene	2021/09/10	<0.40		ug/L	
				F1 (C6-C10)	2021/09/10	<100		ug/L	
A345961	PKL		RPD	Benzene	2021/09/10	NC		%	30
				Toluene	2021/09/10	NC		%	30
				Ethylbenzene	2021/09/10	NC		%	30
				m & p-Xylene	2021/09/10	NC		%	30
				o-Xylene	2021/09/10	NC		%	30
				F1 (C6-C10)	2021/09/10	NC		%	30
A345964	YPA		Matrix Spike [AFJ079-18]	1,4-Difluorobenzene (sur.)	2021/09/10		102	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		92	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		97	%	50 - 140
				Bromodichloromethane	2021/09/10		103	%	50 - 140
				Bromoform	2021/09/10		138	%	50 - 140
				Bromomethane	2021/09/10		103	%	50 - 140
				Carbon tetrachloride	2021/09/10		101	%	50 - 140
				Chlorobenzene	2021/09/10		111	%	50 - 140
				Dibromochloromethane	2021/09/10		129	%	50 - 140
				Chloroethane	2021/09/10		80	%	50 - 140
				Chloroform	2021/09/10		96	%	50 - 140
				Chloromethane	2021/09/10		72	%	50 - 140
				1,2-dibromoethane	2021/09/10		119	%	50 - 140
				1,2-dichlorobenzene	2021/09/10		103	%	50 - 140
				1,3-dichlorobenzene	2021/09/10		99	%	50 - 140





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				1,4-dichlorobenzene	2021/09/10		96	%	50 - 140
				1,1-dichloroethane	2021/09/10		92	%	50 - 140
				1,2-dichloroethane	2021/09/10		108	%	50 - 140
				1,1-dichloroethene	2021/09/10		100	%	50 - 140
				cis-1,2-dichloroethene	2021/09/10		103	%	50 - 140
				trans-1,2-dichloroethene	2021/09/10		95	%	50 - 140
				Dichloromethane	2021/09/10		100	%	50 - 140
				1,2-dichloropropane	2021/09/10		94	%	50 - 140
				cis-1,3-dichloropropene	2021/09/10		115	%	50 - 140
				trans-1,3-dichloropropene	2021/09/10		122	%	50 - 140
				Methyl methacrylate	2021/09/10		114	%	50 - 140
				Methyl-tert-butylether (MTBE)	2021/09/10		97	%	50 - 140
				Styrene	2021/09/10		108	%	50 - 140
				1,1,1,2-tetrachloroethane	2021/09/10		113	%	50 - 140
				1,1,2,2-tetrachloroethane	2021/09/10		126	%	50 - 140
				Tetrachloroethene	2021/09/10		106	%	50 - 140
				1,2,3-trichlorobenzene	2021/09/10		113	%	50 - 140
				1,2,4-trichlorobenzene	2021/09/10		109	%	50 - 140
				1,3,5-trichlorobenzene	2021/09/10		99	%	50 - 140
				1,1,1-trichloroethane	2021/09/10		103	%	50 - 140
				1,1,2-trichloroethane	2021/09/10		114	%	50 - 140
				Trichloroethene	2021/09/10		106	%	50 - 140
				Trichlorofluoromethane	2021/09/10		99	%	50 - 140
				1,2,4-trimethylbenzene	2021/09/10		90	%	50 - 140
				1,3,5-trimethylbenzene	2021/09/10		89	%	50 - 140
				Vinyl chloride	2021/09/10		98	%	50 - 140
	A345964	YPA	Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/10		103	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		92	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		91	%	50 - 140
				Bromodichloromethane	2021/09/10		100	%	60 - 130
				Bromoform	2021/09/10		132 (1)	%	60 - 130
				Bromomethane	2021/09/10		106	%	60 - 130
				Carbon tetrachloride	2021/09/10		101	%	60 - 130
				Chlorobenzene	2021/09/10		113	%	60 - 130
				Dibromochloromethane	2021/09/10		127	%	60 - 130
				Chloroethane	2021/09/10		80	%	60 - 130
				Chloroform	2021/09/10		95	%	60 - 130
				Chloromethane	2021/09/10		73	%	60 - 130
				1,2-dibromoethane	2021/09/10		116	%	60 - 130
				1,2-dichlorobenzene	2021/09/10		102	%	60 - 130
				1,3-dichlorobenzene	2021/09/10		98	%	60 - 130
				1,4-dichlorobenzene	2021/09/10		96	%	60 - 130
				1,1-dichloroethane	2021/09/10		91	%	60 - 130
				1,2-dichloroethane	2021/09/10		102	%	60 - 130
				1,1-dichloroethene	2021/09/10		101	%	60 - 130
				cis-1,2-dichloroethene	2021/09/10		102	%	60 - 130
				trans-1,2-dichloroethene	2021/09/10		95	%	60 - 130
				Dichloromethane	2021/09/10		97	%	60 - 130
				1,2-dichloropropane	2021/09/10		93	%	60 - 130
				cis-1,3-dichloropropene	2021/09/10		115	%	60 - 130
				trans-1,3-dichloropropene	2021/09/10		106	%	60 - 130
				Methyl methacrylate	2021/09/10		106	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/09/10		94	%	60 - 130
				Styrene	2021/09/10		111	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/09/10		114	%	60 - 130





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A345964	YPA	Method Blank		1,1,2,2-tetrachloroethane	2021/09/10		123	%	60 - 130
				Tetrachloroethene	2021/09/10		111	%	60 - 130
				1,2,3-trichlorobenzene	2021/09/10		108	%	60 - 130
				1,2,4-trichlorobenzene	2021/09/10		104	%	60 - 130
				1,3,5-trichlorobenzene	2021/09/10		95	%	60 - 130
				1,1,1-trichloroethane	2021/09/10		103	%	60 - 130
				1,1,2-trichloroethane	2021/09/10		107	%	60 - 130
				Trichloroethene	2021/09/10		106	%	60 - 130
				Trichlorofluoromethane	2021/09/10		101	%	60 - 130
				1,2,4-trimethylbenzene	2021/09/10		91	%	60 - 130
				1,3,5-trimethylbenzene	2021/09/10		91	%	60 - 130
				Vinyl chloride	2021/09/10		100	%	60 - 130
				1,4-Difluorobenzene (sur.)	2021/09/10		101	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/10		88	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/10		112	%	50 - 140
				Bromodichloromethane	2021/09/10	<0.50		ug/L	
				Bromoform	2021/09/10	<0.50		ug/L	
				Bromomethane	2021/09/10	<2.0		ug/L	
				Carbon tetrachloride	2021/09/10	<0.50		ug/L	
				Chlorobenzene	2021/09/10	<0.50		ug/L	
				Dibromochloromethane	2021/09/10	<1.0		ug/L	
				Chloroethane	2021/09/10	<1.0		ug/L	
				Chloroform	2021/09/10	<0.50		ug/L	
				Chloromethane	2021/09/10	<2.0		ug/L	
				1,2-dibromoethane	2021/09/10	<0.20		ug/L	
				1,2-dichlorobenzene	2021/09/10	<0.50		ug/L	
				1,3-dichlorobenzene	2021/09/10	<0.50		ug/L	
				1,4-dichlorobenzene	2021/09/10	<0.50		ug/L	
				1,1-dichloroethane	2021/09/10	<0.50		ug/L	
				1,2-dichloroethane	2021/09/10	<0.50		ug/L	
				1,1-dichloroethene	2021/09/10	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/09/10	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/09/10	<0.50		ug/L	
				Dichloromethane	2021/09/10	<2.0		ug/L	
				1,2-dichloropropane	2021/09/10	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/09/10	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/09/10	<0.50		ug/L	
				Methyl methacrylate	2021/09/10	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/09/10	<0.50		ug/L	
				Styrene	2021/09/10	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/09/10	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/09/10	<2.0		ug/L	
				Tetrachloroethene	2021/09/10	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/09/10	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/09/10	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/09/10	<0.50		ug/L	
				1,1,1-trichloroethane	2021/09/10	<0.50		ug/L	
				1,1,2-trichloroethane	2021/09/10	<0.50		ug/L	
				Trichloroethene	2021/09/10	<0.50		ug/L	
				Trichlorofluoromethane	2021/09/10	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/09/10	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/09/10	<0.50		ug/L	
				Vinyl chloride	2021/09/10	<0.50		ug/L	
A345964	YPA	RPD [AFJ078-18]		Bromodichloromethane	2021/09/10	NC		%	30
				Bromoform	2021/09/10	NC		%	30





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Bromomethane	2021/09/10	NC		%	30
				Carbon tetrachloride	2021/09/10	NC		%	30
				Chlorobenzene	2021/09/10	NC		%	30
				Dibromochloromethane	2021/09/10	NC		%	30
				Chloroethane	2021/09/10	NC		%	30
				Chloroform	2021/09/10	NC		%	30
				Chloromethane	2021/09/10	NC		%	30
				1,2-dibromoethane	2021/09/10	NC		%	30
				1,2-dichlorobenzene	2021/09/10	NC		%	30
				1,3-dichlorobenzene	2021/09/10	NC		%	30
				1,4-dichlorobenzene	2021/09/10	NC		%	30
				1,1-dichloroethane	2021/09/10	NC		%	30
				1,2-dichloroethane	2021/09/10	NC		%	30
				1,1-dichloroethene	2021/09/10	NC		%	30
				cis-1,2-dichloroethene	2021/09/10	NC		%	30
				trans-1,2-dichloroethene	2021/09/10	NC		%	30
				Dichloromethane	2021/09/10	NC		%	30
				1,2-dichloropropane	2021/09/10	NC		%	30
				cis-1,3-dichloropropene	2021/09/10	NC		%	30
				trans-1,3-dichloropropene	2021/09/10	NC		%	30
				Methyl methacrylate	2021/09/10	NC		%	30
				Methyl-tert-butylether (MTBE)	2021/09/10	NC		%	30
				Styrene	2021/09/10	NC		%	30
				1,1,1,2-tetrachloroethane	2021/09/10	NC		%	30
				1,1,2,2-tetrachloroethane	2021/09/10	NC		%	30
				Tetrachloroethene	2021/09/10	NC		%	30
				1,2,3-trichlorobenzene	2021/09/10	NC		%	30
				1,2,4-trichlorobenzene	2021/09/10	NC		%	30
				1,3,5-trichlorobenzene	2021/09/10	NC		%	30
				1,1,1-trichloroethane	2021/09/10	NC		%	30
				1,1,2-trichloroethane	2021/09/10	NC		%	30
				Trichloroethene	2021/09/10	NC		%	30
				Trichlorofluoromethane	2021/09/10	NC		%	30
				1,2,4-trimethylbenzene	2021/09/10	NC		%	30
				1,3,5-trimethylbenzene	2021/09/10	NC		%	30
				Vinyl chloride	2021/09/10	NC		%	30
A346138	DM		Matrix Spike [AFJ078-16]	D10-ANTHRACENE (sur.)	2021/09/15		116	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/15		128	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/15		105	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/15		98	%	50 - 130
				Acenaphthene	2021/09/15		129	%	50 - 130
				Acenaphthylene	2021/09/15		129	%	50 - 130
				Acridine	2021/09/15		84	%	50 - 130
				Anthracene	2021/09/15		82	%	50 - 130
				Benzo(a)anthracene	2021/09/15		125	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/15		122	%	50 - 130
				Benzo(k)fluoranthene	2021/09/15		124	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/15		118	%	50 - 130
				Benzo(c)phenanthrene	2021/09/15		127	%	50 - 130
				Benzo(a)pyrene	2021/09/15		115	%	50 - 130
				Benzo(e)pyrene	2021/09/15		121	%	50 - 130
				Chrysene	2021/09/15		121	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/15		122	%	50 - 130
				Fluoranthene	2021/09/15		108	%	50 - 130
				Fluorene	2021/09/15		136 (1)	%	50 - 130





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346138	DM	Spiked Blank		Indeno(1,2,3-cd)pyrene	2021/09/15		121	%	50 - 130
				2-Methylnaphthalene	2021/09/15		115	%	50 - 130
				Naphthalene	2021/09/15		115	%	50 - 130
				Phenanthrene	2021/09/15		101	%	50 - 130
				Perylene	2021/09/15		118	%	50 - 130
				Pyrene	2021/09/15		106	%	50 - 130
				Quinoline	2021/09/15		110	%	50 - 130
				C1-Naphthalene	2021/09/15		111	%	50 - 130
				C3-Naphthalene	2021/09/15		129	%	50 - 130
				C2-Naphthalene	2021/09/15		119	%	50 - 130
				C1-biphenyl	2021/09/15		113	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/15		121	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/15		108	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/15		101	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/15		52	%	30 - 130
				1-Methylnaphthalene	2021/09/15		112	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/09/15		110	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/15		83	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/15		68	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/15		93	%	50 - 130
				Acenaphthene	2021/09/15		82	%	50 - 130
				Acenaphthylene	2021/09/15		83	%	50 - 130
				Acridine	2021/09/15		83	%	50 - 130
				Anthracene	2021/09/15		82	%	50 - 130
				Benzo(a)anthracene	2021/09/15		101	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/15		100	%	50 - 130
				Benzo(k)fluoranthene	2021/09/15		103	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/15		98	%	50 - 130
				Benzo(c)phenanthrene	2021/09/15		97	%	50 - 130
				Benzo(a)pyrene	2021/09/15		96	%	50 - 130
				Benzo(e)pyrene	2021/09/15		100	%	50 - 130
				Chrysene	2021/09/15		99	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/15		101	%	50 - 130
				Fluoranthene	2021/09/15		105	%	50 - 130
				Fluorene	2021/09/15		86	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/15		102	%	50 - 130
				2-Methylnaphthalene	2021/09/15		76	%	50 - 130
				Naphthalene	2021/09/15		72	%	50 - 130
				Phenanthrene	2021/09/15		93	%	50 - 130
				Perylene	2021/09/15		102	%	50 - 130
				Pyrene	2021/09/15		103	%	50 - 130
				Quinoline	2021/09/15		107	%	50 - 130
				C1-Naphthalene	2021/09/15		70	%	50 - 130
				C3-Naphthalene	2021/09/15		77	%	50 - 130
				C2-Naphthalene	2021/09/15		72	%	50 - 130
				C1-biphenyl	2021/09/15		64	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/15		119	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/15		108	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/15		104	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/15		22 (1)	%	30 - 130
A346138	DM	Method Blank		1-Methylnaphthalene	2021/09/15		70	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/09/15		113	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/15		91	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/15		76	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/15		94	%	50 - 130





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Acenaphthene	2021/09/15	<0.10		ug/L	
				Acenaphthylene	2021/09/15	<0.10		ug/L	
				Acridine	2021/09/15	<0.040		ug/L	
				Anthracene	2021/09/15	<0.010		ug/L	
				Benzo(a)anthracene	2021/09/15	<0.0085		ug/L	
				Benzo(b&j)fluoranthene	2021/09/15	<0.0085		ug/L	
				Benzo(k)fluoranthene	2021/09/15	<0.0085		ug/L	
				Benzo(g,h,i)perylene	2021/09/15	<0.0085		ug/L	
				Benzo(c)phenanthrene	2021/09/15	<0.050		ug/L	
				Benzo(a)pyrene	2021/09/15	<0.0075		ug/L	
				Benzo(e)pyrene	2021/09/15	<0.050		ug/L	
				Chrysene	2021/09/15	<0.0085		ug/L	
				Dibenz(a,h)anthracene	2021/09/15	<0.0075		ug/L	
				Fluoranthene	2021/09/15	<0.010		ug/L	
				Fluorene	2021/09/15	<0.050		ug/L	
				Indeno(1,2,3-cd)pyrene	2021/09/15	<0.0085		ug/L	
				Indeno(1,2,3-cd)fluoranthene	2021/09/15	<0.0085		ug/L	
				2-Methylnaphthalene	2021/09/15	<0.10		ug/L	
				Naphthalene	2021/09/15	<0.10		ug/L	
				Phenanthrene	2021/09/15	<0.050		ug/L	
				Perylene	2021/09/15	<0.050		ug/L	
				Pyrene	2021/09/15	<0.020		ug/L	
				Quinoline	2021/09/15	<0.20		ug/L	
				Retene	2021/09/15	<0.050		ug/L	
				C1-Naphthalene	2021/09/15	<0.10		ug/L	
				C3-Naphthalene	2021/09/15	<0.10		ug/L	
				C4-Naphthalene	2021/09/15	<0.10		ug/L	
				C2-Naphthalene	2021/09/15	<0.10		ug/L	
				Biphenyl	2021/09/15	<0.020		ug/L	
				C1-biphenyl	2021/09/15	<0.020		ug/L	
				C2-biphenyl	2021/09/15	<0.020		ug/L	
				C1-fluorene	2021/09/15	<0.050		ug/L	
				C2-fluorene	2021/09/15	<0.050		ug/L	
				C3-fluorene	2021/09/15	<0.050		ug/L	
				Dibenzothiophene	2021/09/15	<0.020		ug/L	
				C1-dibenzothiophene	2021/09/15	<0.020		ug/L	
				C2-dibenzothiophene	2021/09/15	<0.020		ug/L	
				C3-dibenzothiophene	2021/09/15	<0.020		ug/L	
				C4-dibenzothiophene	2021/09/15	<0.020		ug/L	
				C1 phenanthrene/anthracene	2021/09/15	<0.050		ug/L	
				C2 phenanthrene/anthracene	2021/09/15	<0.050		ug/L	
				C3 phenanthrene/anthracene	2021/09/15	<0.050		ug/L	
				C4 phenanthrene/anthracene	2021/09/15	<0.050		ug/L	
				C1 fluoranthene/pyrene	2021/09/15	<0.020		ug/L	
				C2 fluoranthene/pyrene	2021/09/15	<0.020		ug/L	
				C3 fluoranthene/pyrene	2021/09/15	<0.020		ug/L	
				C4 fluoranthene/pyrene	2021/09/15	<0.020		ug/L	
				C1 benzo(a)anthracene/chrysene	2021/09/15	<0.0085		ug/L	
				C2 benzo(a)anthracene/chrysene	2021/09/15	<0.0085		ug/L	
				C3 benzo(a)anthracene/chrysene	2021/09/15	<0.0085		ug/L	
				C4 benzo(a)anthracene/chrysene	2021/09/15	<0.0085		ug/L	
				C1benzobjkfluoranthene/benzoapyrene	2021/09/15	<0.0075		ug/L	
				C2benzobjkfluoranthene/benzoapyrene	2021/09/15	<0.0075		ug/L	
				C1-Acenaphthene	2021/09/15	<0.10		ug/L	
				1-Methylnaphthalene	2021/09/15	<0.10		ug/L	





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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346138	DM	RPD [AFJ089-16]	Acenaphthene	2021/09/15	NC		%	30
			Acenaphthylene	2021/09/15	NC		%	30
			Acridine	2021/09/15	NC		%	30
			Anthracene	2021/09/15	NC		%	30
			Benzo(a)anthracene	2021/09/15	NC		%	30
			Benzo(b&j)fluoranthene	2021/09/15	NC		%	30
			Benzo(k)fluoranthene	2021/09/15	NC		%	30
			Benzo(g,h,i)perylene	2021/09/15	NC		%	30
			Benzo(c)phenanthrene	2021/09/15	NC		%	30
			Benzo(a)pyrene	2021/09/15	NC		%	30
			Benzo(e)pyrene	2021/09/15	NC		%	30
			Chrysene	2021/09/15	NC		%	30
			Dibenz(a,h)anthracene	2021/09/15	NC		%	30
			Fluoranthene	2021/09/15	NC		%	30
			Fluorene	2021/09/15	NC		%	30
			Indeno(1,2,3-cd)pyrene	2021/09/15	NC		%	30
			Indeno(1,2,3-cd)fluoranthene	2021/09/15	NC		%	30
			2-Methylnaphthalene	2021/09/15	NC		%	30
			Naphthalene	2021/09/15	NC		%	30
			Phenanthrene	2021/09/15	NC		%	30
			Perylene	2021/09/15	NC		%	30
			Pyrene	2021/09/15	NC		%	30
			Quinoline	2021/09/15	NC		%	30
			Retene	2021/09/15	NC		%	30
			C1-Naphthalene	2021/09/15	NC		%	30
			C3-Naphthalene	2021/09/15	NC		%	30
			C4-Naphthalene	2021/09/15	NC		%	30
			C2-Naphthalene	2021/09/15	NC		%	30
			Biphenyl	2021/09/15	NC		%	30
			C1-biphenyl	2021/09/15	NC		%	30
			C2-biphenyl	2021/09/15	NC		%	30
			C1-fluorene	2021/09/15	NC		%	30
			C2-fluorene	2021/09/15	NC		%	30
			C3-fluorene	2021/09/15	NC		%	30
			Dibenzothiophene	2021/09/15	NC		%	30
			C1-dibenzothiophene	2021/09/15	NC		%	30
			C2-dibenzothiophene	2021/09/15	3.1		%	30
			C3-dibenzothiophene	2021/09/15	NC		%	30
			C4-dibenzothiophene	2021/09/15	NC		%	30
			C1 phenanthrene/anthracene	2021/09/15	NC		%	30
			C2 phenanthrene/anthracene	2021/09/15	NC		%	30
			C3 phenanthrene/anthracene	2021/09/15	NC		%	30
			C4 phenanthrene/anthracene	2021/09/15	NC		%	30
			C1 fluoranthene/pyrene	2021/09/15	NC		%	30
			C2 fluoranthene/pyrene	2021/09/15	NC		%	30
			C3 fluoranthene/pyrene	2021/09/15	NC		%	30
			C4 fluoranthene/pyrene	2021/09/15	NC		%	30
			C1 benzo(a)anthracene/chrysene	2021/09/15	NC		%	30
			C2 benzo(a)anthracene/chrysene	2021/09/15	5.6		%	30
			C3 benzo(a)anthracene/chrysene	2021/09/15	6.0		%	30
			C4 benzo(a)anthracene/chrysene	2021/09/15	NC		%	30
			C1benzobjkfluoranthene/benzoapyrene	2021/09/15	NC		%	30
			C2benzobjkfluoranthene/benzoapyrene	2021/09/15	NC		%	30
			C1-Acenaphthene	2021/09/15	NC		%	30
			1-Methylnaphthalene	2021/09/15	NC		%	30





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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346238	PC5	Matrix Spike	Total Aluminum (Al)	2021/09/11		121 (1)	%	80 - 120
			Total Antimony (Sb)	2021/09/11		87	%	80 - 120
			Total Arsenic (As)	2021/09/11		87	%	80 - 120
			Total Barium (Ba)	2021/09/11		NC	%	80 - 120
			Total Beryllium (Be)	2021/09/11		94	%	80 - 120
			Total Bismuth (Bi)	2021/09/11		87	%	80 - 120
			Total Boron (B)	2021/09/11		96	%	80 - 120
			Total Cadmium (Cd)	2021/09/11		84	%	80 - 120
			Total Chromium (Cr)	2021/09/11		87	%	80 - 120
			Total Cobalt (Co)	2021/09/11		86	%	80 - 120
			Total Copper (Cu)	2021/09/11		82	%	80 - 120
			Total Iron (Fe)	2021/09/11		103	%	80 - 120
			Total Lead (Pb)	2021/09/11		90	%	80 - 120
			Total Lithium (Li)	2021/09/11		NC	%	80 - 120
			Total Manganese (Mn)	2021/09/11		83	%	80 - 120
			Total Molybdenum (Mo)	2021/09/11		NC	%	80 - 120
			Total Nickel (Ni)	2021/09/11		84	%	80 - 120
			Total Selenium (Se)	2021/09/11		82	%	80 - 120
			Total Silicon (Si)	2021/09/11		79 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/11		77 (1)	%	80 - 120
			Total Strontium (Sr)	2021/09/11		NC	%	80 - 120
			Total Thallium (Tl)	2021/09/11		90	%	80 - 120
			Total Tin (Sn)	2021/09/11		97	%	80 - 120
			Total Titanium (Ti)	2021/09/11		88	%	80 - 120
			Total Uranium (U)	2021/09/11		98	%	80 - 120
			Total Vanadium (V)	2021/09/11		89	%	80 - 120
			Total Zinc (Zn)	2021/09/11		89	%	80 - 120
			Total Zirconium (Zr)	2021/09/11		95	%	80 - 120
A346238	PC5	Spiked Blank	Total Aluminum (Al)	2021/09/11		106	%	80 - 120
			Total Antimony (Sb)	2021/09/11		91	%	80 - 120
			Total Arsenic (As)	2021/09/11		89	%	80 - 120
			Total Barium (Ba)	2021/09/11		95	%	80 - 120
			Total Beryllium (Be)	2021/09/11		103	%	80 - 120
			Total Bismuth (Bi)	2021/09/11		90	%	80 - 120
			Total Boron (B)	2021/09/11		125 (1)	%	80 - 120
			Total Cadmium (Cd)	2021/09/11		81	%	80 - 120
			Total Chromium (Cr)	2021/09/11		83	%	80 - 120
			Total Cobalt (Co)	2021/09/11		89	%	80 - 120
			Total Copper (Cu)	2021/09/11		85	%	80 - 120
			Total Iron (Fe)	2021/09/11		103	%	80 - 120
			Total Lead (Pb)	2021/09/11		93	%	80 - 120
			Total Lithium (Li)	2021/09/11		100	%	80 - 120
			Total Manganese (Mn)	2021/09/11		93	%	80 - 120
			Total Molybdenum (Mo)	2021/09/11		81	%	80 - 120
			Total Nickel (Ni)	2021/09/11		89	%	80 - 120
			Total Selenium (Se)	2021/09/11		93	%	80 - 120
			Total Silicon (Si)	2021/09/11		76 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/11		77 (1)	%	80 - 120
			Total Strontium (Sr)	2021/09/11		93	%	80 - 120
			Total Thallium (Tl)	2021/09/11		99	%	80 - 120
			Total Tin (Sn)	2021/09/11		99	%	80 - 120
			Total Titanium (Ti)	2021/09/11		85	%	80 - 120
			Total Uranium (U)	2021/09/11		98	%	80 - 120
			Total Vanadium (V)	2021/09/11		82	%	80 - 120
			Total Zinc (Zn)	2021/09/11		97	%	80 - 120





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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346238	PC5	Method Blank	Total Zirconium (Zr)	2021/09/11		89	%	80 - 120
			Total Aluminum (Al)	2021/09/12	<0.50		ug/L	
			Total Antimony (Sb)	2021/09/12	<0.020		ug/L	
			Total Arsenic (As)	2021/09/12	<0.020		ug/L	
			Total Barium (Ba)	2021/09/12	<0.020		ug/L	
			Total Beryllium (Be)	2021/09/12	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/12	<0.0050		ug/L	
			Total Boron (B)	2021/09/12	<10		ug/L	
			Total Cadmium (Cd)	2021/09/12	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/12	<0.10		ug/L	
			Total Cobalt (Co)	2021/09/12	<0.0050		ug/L	
			Total Copper (Cu)	2021/09/12	<0.050		ug/L	
			Total Iron (Fe)	2021/09/12	<1.0		ug/L	
			Total Lead (Pb)	2021/09/12	<0.0050		ug/L	
			Total Lithium (Li)	2021/09/12	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/12	<0.050		ug/L	
			Total Molybdenum (Mo)	2021/09/12	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/12	<0.020		ug/L	
			Total Selenium (Se)	2021/09/12	<0.040		ug/L	
			Total Silicon (Si)	2021/09/12	<50		ug/L	
			Total Silver (Ag)	2021/09/12	<0.0050		ug/L	
			Total Strontium (Sr)	2021/09/12	<0.050		ug/L	
			Total Thallium (Tl)	2021/09/12	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/12	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/12	<0.50		ug/L	
			Total Uranium (U)	2021/09/12	<0.0020		ug/L	
			Total Vanadium (V)	2021/09/12	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/12	<0.10		ug/L	
A346238	PC5	RPD	Total Zirconium (Zr)	2021/09/12	<0.10		ug/L	
			Total Aluminum (Al)	2021/09/15	12		%	20
			Total Antimony (Sb)	2021/09/15	1.3		%	20
			Total Arsenic (As)	2021/09/15	1.6		%	20
			Total Barium (Ba)	2021/09/15	0.84		%	20
			Total Beryllium (Be)	2021/09/15	4.0		%	20
			Total Bismuth (Bi)	2021/09/15	NC		%	20
			Total Boron (B)	2021/09/15	0.048 (2)		%	20
			Total Cadmium (Cd)	2021/09/15	NC		%	20
			Total Chromium (Cr)	2021/09/15	11		%	20
			Total Cobalt (Co)	2021/09/15	0.39		%	20
			Total Copper (Cu)	2021/09/15	9.3		%	20
			Total Iron (Fe)	2021/09/15	1.5		%	20
			Total Lead (Pb)	2021/09/15	0.043		%	20
			Total Lithium (Li)	2021/09/15	2.4		%	20
			Total Manganese (Mn)	2021/09/15	0.62		%	20
			Total Molybdenum (Mo)	2021/09/15	0.93		%	20
			Total Nickel (Ni)	2021/09/15	0.93		%	20
			Total Selenium (Se)	2021/09/15	8.6		%	20
			Total Silicon (Si)	2021/09/15	1.7		%	20
			Total Silver (Ag)	2021/09/15	NC		%	20
			Total Strontium (Sr)	2021/09/15	0.74		%	20
			Total Thallium (Tl)	2021/09/15	NC		%	20
			Total Tin (Sn)	2021/09/15	NC		%	20
			Total Titanium (Ti)	2021/09/15	16		%	20
			Total Uranium (U)	2021/09/15	1.1		%	20
			Total Vanadium (V)	2021/09/15	1.8		%	20





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346253	PC5	Matrix Spike	Total Zinc (Zn)	2021/09/15	11		%	20
			Total Zirconium (Zr)	2021/09/15	3.0		%	20
			Dissolved Aluminum (Al)	2021/09/11		111	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/11		86	%	80 - 120
			Dissolved Arsenic (As)	2021/09/11		93	%	80 - 120
			Dissolved Barium (Ba)	2021/09/11		NC	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/11		101	%	80 - 120
			Dissolved Bismuth (Bi)	2021/09/11		88	%	80 - 120
			Dissolved Boron (B)	2021/09/11		128 (1)	%	80 - 120
			Dissolved Cadmium (Cd)	2021/09/11		87	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/11		87	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/11		82	%	80 - 120
			Dissolved Copper (Cu)	2021/09/11		83	%	80 - 120
			Dissolved Iron (Fe)	2021/09/11		94	%	80 - 120
			Dissolved Lead (Pb)	2021/09/11		93	%	80 - 120
			Dissolved Lithium (Li)	2021/09/11		NC	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/11		84	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/11		NC	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/11		91	%	80 - 120
			Dissolved Selenium (Se)	2021/09/11		83	%	80 - 120
			Dissolved Silicon (Si)	2021/09/11		81	%	80 - 120
			Dissolved Silver (Ag)	2021/09/11		80	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/11		NC	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/11		92	%	80 - 120
			Dissolved Tin (Sn)	2021/09/11		97	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/11		85	%	80 - 120
			Dissolved Uranium (U)	2021/09/11		99	%	80 - 120
			Dissolved Vanadium (V)	2021/09/11		80	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/11		80	%	80 - 120
			Dissolved Zirconium (Zr)	2021/09/11		90	%	80 - 120
A346253	PC5	Spiked Blank	Dissolved Aluminum (Al)	2021/09/11		110	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/11		89	%	80 - 120
			Dissolved Arsenic (As)	2021/09/11		92	%	80 - 120
			Dissolved Barium (Ba)	2021/09/11		98	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/11		104	%	80 - 120
			Dissolved Bismuth (Bi)	2021/09/11		90	%	80 - 120
			Dissolved Boron (B)	2021/09/11		121 (1)	%	80 - 120
			Dissolved Cadmium (Cd)	2021/09/11		85	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/11		82	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/11		84	%	80 - 120
			Dissolved Copper (Cu)	2021/09/11		85	%	80 - 120
			Dissolved Iron (Fe)	2021/09/11		100	%	80 - 120
			Dissolved Lead (Pb)	2021/09/11		93	%	80 - 120
			Dissolved Lithium (Li)	2021/09/11		110	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/11		92	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/11		86	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/11		94	%	80 - 120
			Dissolved Selenium (Se)	2021/09/11		89	%	80 - 120
			Dissolved Silicon (Si)	2021/09/11		75 (1)	%	80 - 120
			Dissolved Silver (Ag)	2021/09/11		77 (1)	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/11		98	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/11		98	%	80 - 120
			Dissolved Tin (Sn)	2021/09/11		97	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/11		87	%	80 - 120
			Dissolved Uranium (U)	2021/09/11		98	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346253	PC5	Method Blank		Dissolved Vanadium (V)	2021/09/11		83	%	80 - 120
				Dissolved Zinc (Zn)	2021/09/11		95	%	80 - 120
				Dissolved Zirconium (Zr)	2021/09/11		95	%	80 - 120
				Dissolved Aluminum (Al)	2021/09/12	<0.50		ug/L	
				Dissolved Antimony (Sb)	2021/09/12	<0.020		ug/L	
				Dissolved Arsenic (As)	2021/09/12	<0.020		ug/L	
				Dissolved Barium (Ba)	2021/09/12	<0.020		ug/L	
				Dissolved Beryllium (Be)	2021/09/12	<0.010		ug/L	
				Dissolved Bismuth (Bi)	2021/09/12	<0.0050		ug/L	
				Dissolved Boron (B)	2021/09/12	<10		ug/L	
				Dissolved Cadmium (Cd)	2021/09/12	<0.0050		ug/L	
				Dissolved Chromium (Cr)	2021/09/12	<0.10		ug/L	
				Dissolved Cobalt (Co)	2021/09/12	<0.0050		ug/L	
				Dissolved Copper (Cu)	2021/09/12	<0.050		ug/L	
				Dissolved Iron (Fe)	2021/09/12	<1.0		ug/L	
				Dissolved Lead (Pb)	2021/09/12	<0.0050		ug/L	
				Dissolved Lithium (Li)	2021/09/12	<0.50		ug/L	
				Dissolved Manganese (Mn)	2021/09/12	<0.050		ug/L	
				Dissolved Molybdenum (Mo)	2021/09/12	<0.050		ug/L	
				Dissolved Nickel (Ni)	2021/09/12	<0.020		ug/L	
				Dissolved Selenium (Se)	2021/09/12	<0.040		ug/L	
				Dissolved Silicon (Si)	2021/09/12	<50		ug/L	
				Dissolved Silver (Ag)	2021/09/12	<0.0050		ug/L	
				Dissolved Strontium (Sr)	2021/09/12	<0.050		ug/L	
				Dissolved Thallium (Tl)	2021/09/12	<0.0020		ug/L	
				Dissolved Tin (Sn)	2021/09/12	<0.20		ug/L	
				Dissolved Titanium (Ti)	2021/09/12	<0.50		ug/L	
				Dissolved Uranium (U)	2021/09/12	<0.0020		ug/L	
				Dissolved Vanadium (V)	2021/09/12	<0.20		ug/L	
				Dissolved Zinc (Zn)	2021/09/12	<0.10		ug/L	
				Dissolved Zirconium (Zr)	2021/09/12	<0.10		ug/L	
A346253	PC5	RPD		Dissolved Aluminum (Al)	2021/09/12	10		%	20
				Dissolved Antimony (Sb)	2021/09/12	1.2		%	20
				Dissolved Arsenic (As)	2021/09/12	0.13		%	20
				Dissolved Barium (Ba)	2021/09/12	1.0		%	20
				Dissolved Beryllium (Be)	2021/09/12	17		%	20
				Dissolved Bismuth (Bi)	2021/09/12	NC		%	20
				Dissolved Boron (B)	2021/09/12	1.3 (2)		%	20
				Dissolved Cadmium (Cd)	2021/09/12	NC		%	20
				Dissolved Chromium (Cr)	2021/09/12	NC		%	20
				Dissolved Cobalt (Co)	2021/09/12	0.51		%	20
				Dissolved Copper (Cu)	2021/09/12	5.4		%	20
				Dissolved Iron (Fe)	2021/09/12	10		%	20
				Dissolved Lead (Pb)	2021/09/12	4.4		%	20
				Dissolved Lithium (Li)	2021/09/12	0.087		%	20
				Dissolved Manganese (Mn)	2021/09/12	16		%	20
				Dissolved Molybdenum (Mo)	2021/09/12	1.2		%	20
				Dissolved Nickel (Ni)	2021/09/12	5.0		%	20
				Dissolved Selenium (Se)	2021/09/12	2.7		%	20
				Dissolved Silicon (Si)	2021/09/12	2.3		%	20
				Dissolved Silver (Ag)	2021/09/12	NC		%	20
				Dissolved Strontium (Sr)	2021/09/12	1.0		%	20
				Dissolved Thallium (Tl)	2021/09/12	NC		%	20
				Dissolved Tin (Sn)	2021/09/12	NC		%	20
				Dissolved Titanium (Ti)	2021/09/12	NC		%	20





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A346567	AAX	Matrix Spike	Dissolved Uranium (U)	2021/09/12	1.3		%	20
			Dissolved Vanadium (V)	2021/09/12	0.31		%	20
			Dissolved Zinc (Zn)	2021/09/12	40 (1)		%	20
			Dissolved Zirconium (Zr)	2021/09/12	6.4		%	20
			O-TERPHENYL (sur.)	2021/09/10		106	%	60 - 140
A346567	AAX	Spiked Blank	F2 (C10-C16 Hydrocarbons)	2021/09/10		113	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/09/10		116	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/10		113	%	60 - 140
			O-TERPHENYL (sur.)	2021/09/10		102	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/10		99	%	60 - 140
A346567	AAX	Method Blank	F3 (C16-C34 Hydrocarbons)	2021/09/10		100	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/10		100	%	60 - 140
			O-TERPHENYL (sur.)	2021/09/10		102	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/10	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2021/09/10	<0.10		mg/L	
A346567	AAX	RPD	F4 (C34-C50 Hydrocarbons)	2021/09/10	<0.20		mg/L	
			F2 (C10-C16 Hydrocarbons)	2021/09/10	26		%	30
			F3 (C16-C34 Hydrocarbons)	2021/09/10	33 (1)		%	30
			F4 (C34-C50 Hydrocarbons)	2021/09/10	NC		%	30
A346600	FM0	Matrix Spike	True Colour	2021/09/11		90	%	80 - 120
A346600	FM0	Spiked Blank	True Colour	2021/09/11		97	%	80 - 120
A346600	FM0	Method Blank	True Colour	2021/09/11	<2.0		PtCo units	
A346600	FM0	RPD	True Colour	2021/09/11	6.7		%	20
A346812	HE1	Matrix Spike	Total Dissolved Solids	2021/09/10		94	%	80 - 120
A346812	HE1	Spiked Blank	Total Dissolved Solids	2021/09/10		104	%	80 - 120
A346812	HE1	Method Blank	Total Dissolved Solids	2021/09/10	<10		mg/L	
A346812	HE1	RPD	Total Dissolved Solids	2021/09/10	2.8		%	20
A346813	KGA	Matrix Spike	Total Dissolved Solids	2021/09/10		110	%	80 - 120
A346813	KGA	Spiked Blank	Total Dissolved Solids	2021/09/12		97	%	80 - 120
A346813	KGA	Method Blank	Total Dissolved Solids	2021/09/10	<10		mg/L	
A346813	KGA	RPD	Total Dissolved Solids	2021/09/10	0.87		%	20
A347380	PK8	Spiked Blank	Biochemical Oxygen Demand	2021/09/15		89	%	85 - 115
A347380	PK8	Method Blank	Biochemical Oxygen Demand	2021/09/15	<2.0		mg/L	
A347380	PK8	RPD	Biochemical Oxygen Demand	2021/09/15	47 (1)		%	20
A347467	PK8	Spiked Blank	Biochemical Oxygen Demand	2021/09/15		87	%	85 - 115
A347467	PK8	Method Blank	Biochemical Oxygen Demand	2021/09/15	<2.0		mg/L	
A347467	PK8	RPD [AFJ089-02]	Biochemical Oxygen Demand	2021/09/15	16		%	20
A347697	FM0	Matrix Spike [AFJ080-03]	Orthophosphate (P)	2021/09/10		117	%	80 - 120
A347697	FM0	Spiked Blank	Orthophosphate (P)	2021/09/10		101	%	80 - 120
A347697	FM0	Method Blank	Orthophosphate (P)	2021/09/10	0.0020, RDL=0.0010 (3)		mg/L	
A347697	FM0	RPD [AFJ080-03]	Orthophosphate (P)	2021/09/10	0.72		%	20
A347729	IKO	Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/10		97	%	80 - 120
A347729	IKO	Method Blank	Alkalinity (PP as CaCO3)	2021/09/10	<1.0		mg/L	
A347729	IKO	RPD	Alkalinity (Total as CaCO3)	2021/09/10	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/10	<1.0		mg/L	
			Carbonate (CO3)	2021/09/10	<1.0		mg/L	
			Hydroxide (OH)	2021/09/10	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/09/10	NC		%	20
			Alkalinity (Total as CaCO3)	2021/09/10	0.35		%	20
			Bicarbonate (HCO3)	2021/09/10	0.35		%	20
			Carbonate (CO3)	2021/09/10	NC		%	20
			Hydroxide (OH)	2021/09/10	NC		%	20
A347730	IKO	Spiked Blank	pH	2021/09/10		100	%	97 - 103
A347730	IKO	RPD	pH	2021/09/10	0.17		%	N/A





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A347731	IKO	Spiked Blank	Conductivity	2021/09/10		102	%	90 - 110
A347731	IKO	Method Blank	Conductivity	2021/09/10	<2.0		uS/cm	
A347731	IKO	RPD	Conductivity	2021/09/10	0.13		%	10
A347735	IKO	Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/10		97	%	80 - 120
A347735	IKO	Method Blank	Alkalinity (PP as CaCO3)	2021/09/10	<1.0		mg/L	
			Alkalinity (Total as CaCO3)	2021/09/10	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/10	<1.0		mg/L	
			Carbonate (CO3)	2021/09/10	<1.0		mg/L	
			Hydroxide (OH)	2021/09/10	<1.0		mg/L	
A347735	IKO	RPD	Alkalinity (PP as CaCO3)	2021/09/10	NC		%	20
			Alkalinity (Total as CaCO3)	2021/09/10	0.20		%	20
			Bicarbonate (HCO3)	2021/09/10	0.20		%	20
			Carbonate (CO3)	2021/09/10	NC		%	20
			Hydroxide (OH)	2021/09/10	NC		%	20
A347736	KSO	Matrix Spike [AFJ085-06]	Chemical Oxygen Demand	2021/09/10		106	%	80 - 120
A347736	KSO	Spiked Blank	Chemical Oxygen Demand	2021/09/10		102	%	80 - 120
A347736	KSO	Method Blank	Chemical Oxygen Demand	2021/09/10	<10		mg/L	
A347736	KSO	RPD [AFJ085-06]	Chemical Oxygen Demand	2021/09/10	14		%	20
A347737	IKO	Spiked Blank	pH	2021/09/10		100	%	97 - 103
A347737	IKO	RPD	pH	2021/09/10	0.90		%	N/A
A347738	IKO	Spiked Blank	Conductivity	2021/09/10		102	%	90 - 110
A347738	IKO	Method Blank	Conductivity	2021/09/10	<2.0		uS/cm	
A347738	IKO	RPD	Conductivity	2021/09/10	0.56		%	10
A347743	IKO	Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/11		96	%	80 - 120
A347743	IKO	Method Blank	Alkalinity (PP as CaCO3)	2021/09/11	<1.0		mg/L	
			Alkalinity (Total as CaCO3)	2021/09/11	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/11	<1.0		mg/L	
			Carbonate (CO3)	2021/09/11	<1.0		mg/L	
			Hydroxide (OH)	2021/09/11	<1.0		mg/L	
A347743	IKO	RPD	Alkalinity (PP as CaCO3)	2021/09/11	NC		%	20
			Alkalinity (Total as CaCO3)	2021/09/11	1.2		%	20
			Bicarbonate (HCO3)	2021/09/11	1.2		%	20
			Carbonate (CO3)	2021/09/11	NC		%	20
			Hydroxide (OH)	2021/09/11	NC		%	20
A347746	IKO	Spiked Blank	pH	2021/09/11		100	%	97 - 103
A347746	IKO	RPD	pH	2021/09/11	1.8		%	N/A
A347748	IKO	Spiked Blank	Conductivity	2021/09/11		102	%	90 - 110
A347748	IKO	Method Blank	Conductivity	2021/09/11	<2.0		uS/cm	
A347748	IKO	RPD	Conductivity	2021/09/11	0.57		%	10
A347818	JFH	Matrix Spike	Dissolved Nitrite (N)	2021/09/10		104	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/10		103	%	80 - 120
A347818	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/10		104	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/10		105	%	80 - 120
A347818	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/10	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/10	<0.010		mg/L	
A347818	JFH	RPD	Dissolved Nitrite (N)	2021/09/10	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/10	NC (4)		%	20
A347830	JFH	Matrix Spike	Dissolved Nitrite (N)	2021/09/10		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/10		111	%	80 - 120
A347830	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/10		104	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/10		105	%	80 - 120
A347830	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/10	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/10	<0.010		mg/L	
A347830	JFH	RPD	Dissolved Nitrite (N)	2021/09/10	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/10	0.81		%	20





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A347942	KWE	Matrix Spike	True Colour	2021/09/10		63 (1)	%	80 - 120
A347942	KWE	Spiked Blank	True Colour	2021/09/10		98	%	80 - 120
A347942	KWE	Method Blank	True Colour	2021/09/10	<2.0		PtCo units	
A347942	KWE	RPD	True Colour	2021/09/10	0.47		%	20
A348185	JFH	Matrix Spike	Total Ammonia (N)	2021/09/10		97	%	80 - 120
A348185	JFH	Spiked Blank	Total Ammonia (N)	2021/09/10		97	%	80 - 120
A348185	JFH	Method Blank	Total Ammonia (N)	2021/09/10	<0.015		mg/L	
A348185	JFH	RPD	Total Ammonia (N)	2021/09/10	NC		%	20
A348187	JFH	Matrix Spike	Total Ammonia (N)	2021/09/10		99	%	80 - 120
A348187	JFH	Spiked Blank	Total Ammonia (N)	2021/09/10		95	%	80 - 120
A348187	JFH	Method Blank	Total Ammonia (N)	2021/09/10	<0.015		mg/L	
A348187	JFH	RPD	Total Ammonia (N)	2021/09/10	NC		%	20
A348298	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/09/10		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/10		NC	%	80 - 120
A348298	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/09/10		102	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/10		100	%	80 - 120
A348298	BFE	Method Blank	Dissolved Chloride (Cl)	2021/09/10	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/10	<1.0		mg/L	
A348298	BFE	RPD	Dissolved Chloride (Cl)	2021/09/10	2.0		%	20
A348508	QNG	Matrix Spike	Total Suspended Solids	2021/09/11		89	%	80 - 120
A348508	QNG	Spiked Blank	Total Suspended Solids	2021/09/11		97	%	80 - 120
A348508	QNG	Method Blank	Total Suspended Solids	2021/09/11	<1.0		mg/L	
A348508	QNG	RPD	Total Suspended Solids	2021/09/11	13		%	20
A348568	STI	Matrix Spike	Total Nitrogen (N)	2021/09/13		96	%	80 - 120
A348568	STI	QC Standard	Total Nitrogen (N)	2021/09/13		86	%	80 - 120
A348568	STI	Spiked Blank	Total Nitrogen (N)	2021/09/13		95	%	80 - 120
A348568	STI	Method Blank	Total Nitrogen (N)	2021/09/13	<0.020		mg/L	
A348568	STI	RPD	Total Nitrogen (N)	2021/09/13	NC		%	20
A348572	STI	Matrix Spike	Total Nitrogen (N)	2021/09/13		100	%	80 - 120
A348572	STI	QC Standard	Total Nitrogen (N)	2021/09/13		86	%	80 - 120
A348572	STI	Spiked Blank	Total Nitrogen (N)	2021/09/13		95	%	80 - 120
A348572	STI	Method Blank	Total Nitrogen (N)	2021/09/13	<0.020		mg/L	
A348572	STI	RPD	Total Nitrogen (N)	2021/09/13	4.9		%	20
A348644	FM0	Matrix Spike [AFJ081-06]	Total Phosphorus (P)	2021/09/11		100	%	80 - 120
A348644	FM0	QC Standard	Total Phosphorus (P)	2021/09/11		89	%	80 - 120
A348644	FM0	Spiked Blank	Total Phosphorus (P)	2021/09/11		93	%	80 - 120
A348644	FM0	Method Blank	Total Phosphorus (P)	2021/09/11	<0.0010		mg/L	
A348644	FM0	RPD [AFJ081-06]	Total Phosphorus (P)	2021/09/11	6.0		%	20
A348653	STI	Matrix Spike [AFJ083-07]	Dissolved Phosphorus (P)	2021/09/12		89	%	80 - 120
A348653	STI	QC Standard	Dissolved Phosphorus (P)	2021/09/12		86	%	80 - 120
A348653	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/09/12		85	%	80 - 120
A348653	STI	Method Blank	Dissolved Phosphorus (P)	2021/09/12	<0.0010		mg/L	
A348653	STI	RPD [AFJ083-07]	Dissolved Phosphorus (P)	2021/09/12	NC		%	20
A348983	KGA	Matrix Spike [AFJ085-01]	Total Suspended Solids	2021/09/12		97	%	80 - 120
A348983	KGA	Spiked Blank	Total Suspended Solids	2021/09/12		87	%	80 - 120
A348983	KGA	Method Blank	Total Suspended Solids	2021/09/12	<1.0		mg/L	
A348983	KGA	RPD [AFJ084-01]	Total Suspended Solids	2021/09/12	2.8		%	20
A349056	FM0	Matrix Spike [AFJ078-07]	Dissolved Phosphorus (P)	2021/09/14		103	%	80 - 120
A349056	FM0	QC Standard	Dissolved Phosphorus (P)	2021/09/14		91	%	80 - 120
A349056	FM0	Spiked Blank	Dissolved Phosphorus (P)	2021/09/14		96	%	80 - 120
A349056	FM0	Method Blank	Dissolved Phosphorus (P)	2021/09/14	<0.0010		mg/L	
A349056	FM0	RPD [AFJ078-07]	Dissolved Phosphorus (P)	2021/09/14	6.7		%	20
A349121	ZWU	Matrix Spike [AFJ081-07]	Dissolved Organic Carbon (C)	2021/09/12		100	%	80 - 120
A349121	ZWU	Spiked Blank	Dissolved Organic Carbon (C)	2021/09/12		96	%	80 - 120
A349121	ZWU	Method Blank	Dissolved Organic Carbon (C)	2021/09/12	<0.50		mg/L	





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Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A349121	ZWU	RPD [AFJ081-07]		Dissolved Organic Carbon (C)	2021/09/12	0.48		%	20
A349123	ZWU	Matrix Spike [AFJ084-06]		Total Organic Carbon (C)	2021/09/12		101	%	80 - 120
A349123	ZWU	Spiked Blank		Total Organic Carbon (C)	2021/09/12		97	%	80 - 120
A349123	ZWU	Method Blank		Total Organic Carbon (C)	2021/09/12	<0.50		mg/L	
A349123	ZWU	RPD [AFJ084-06]		Total Organic Carbon (C)	2021/09/12	2.1		%	20
A349137	KGR	Matrix Spike [AFJ079-03]		Dissolved Fluoride (F)	2021/09/12		97	%	80 - 120
A349137	KGR	Spiked Blank		Dissolved Fluoride (F)	2021/09/12		92	%	80 - 120
A349137	KGR	Method Blank		Dissolved Fluoride (F)	2021/09/12	<0.050		mg/L	
A349137	KGR	RPD [AFJ079-03]		Dissolved Fluoride (F)	2021/09/12	0.98		%	20
A349689	TMU	Matrix Spike		Total Inorganic Carbon (C)	2021/09/13		528 (1)	%	80 - 120
A349689	TMU	Spiked Blank		Total Inorganic Carbon (C)	2021/09/13		107	%	80 - 120
A349689	TMU	Method Blank		Total Inorganic Carbon (C)	2021/09/13	<1.0		mg/L	
A349689	TMU	RPD		Total Inorganic Carbon (C)	2021/09/13	NC		%	20
A349713	TMU	Matrix Spike [AFJ088-03]		Total Inorganic Carbon (C)	2021/09/13		94	%	80 - 120
A349713	TMU	Spiked Blank		Total Inorganic Carbon (C)	2021/09/13		112	%	80 - 120
A349713	TMU	Method Blank		Total Inorganic Carbon (C)	2021/09/13	<1.0		mg/L	
A349713	TMU	RPD [AFJ088-03]		Total Inorganic Carbon (C)	2021/09/13	0.090		%	20
A352282	ANE	Matrix Spike		Total Aluminum (Al)	2021/09/16		NC	%	80 - 120
				Total Antimony (Sb)	2021/09/16		104	%	80 - 120
				Total Arsenic (As)	2021/09/16		98	%	80 - 120
				Total Barium (Ba)	2021/09/16		NC	%	80 - 120
				Total Beryllium (Be)	2021/09/16		95	%	80 - 120
				Total Bismuth (Bi)	2021/09/16		101	%	80 - 120
				Total Boron (B)	2021/09/16		NC	%	80 - 120
				Total Cadmium (Cd)	2021/09/16		100	%	80 - 120
				Total Chromium (Cr)	2021/09/16		104	%	80 - 120
				Total Cobalt (Co)	2021/09/16		98	%	80 - 120
				Total Copper (Cu)	2021/09/16		98	%	80 - 120
				Total Iron (Fe)	2021/09/16		NC	%	80 - 120
				Total Lead (Pb)	2021/09/16		101	%	80 - 120
				Total Lithium (Li)	2021/09/16		NC	%	80 - 120
				Total Manganese (Mn)	2021/09/16		102	%	80 - 120
				Total Molybdenum (Mo)	2021/09/16		NC	%	80 - 120
				Total Nickel (Ni)	2021/09/16		99	%	80 - 120
				Total Phosphorus (P)	2021/09/16		105	%	80 - 120
				Total Selenium (Se)	2021/09/16		89	%	80 - 120
				Total Silicon (Si)	2021/09/16		95	%	80 - 120
				Total Silver (Ag)	2021/09/16		100	%	80 - 120
				Total Strontium (Sr)	2021/09/16		NC	%	80 - 120
				Total Thallium (Tl)	2021/09/16		73 (1)	%	80 - 120
				Total Tin (Sn)	2021/09/16		102	%	80 - 120
				Total Titanium (Ti)	2021/09/16		126 (1)	%	80 - 120
				Total Uranium (U)	2021/09/16		100	%	80 - 120
				Total Vanadium (V)	2021/09/16		109	%	80 - 120
				Total Zinc (Zn)	2021/09/16		119	%	80 - 120
				Total Zirconium (Zr)	2021/09/16		NC	%	80 - 120
A352282	ANE	Spiked Blank		Total Aluminum (Al)	2021/09/15		111	%	80 - 120
				Total Antimony (Sb)	2021/09/15		98	%	80 - 120
				Total Arsenic (As)	2021/09/15		104	%	80 - 120
				Total Barium (Ba)	2021/09/15		103	%	80 - 120
				Total Beryllium (Be)	2021/09/15		103	%	80 - 120
				Total Bismuth (Bi)	2021/09/15		104	%	80 - 120
				Total Boron (B)	2021/09/15		115	%	80 - 120
				Total Cadmium (Cd)	2021/09/15		102	%	80 - 120
				Total Chromium (Cr)	2021/09/15		108	%	80 - 120





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Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A352282	ANE	Method Blank	Total Cobalt (Co)	2021/09/15		105	%	80 - 120
			Total Copper (Cu)	2021/09/15		104	%	80 - 120
			Total Iron (Fe)	2021/09/15		106	%	80 - 120
			Total Lead (Pb)	2021/09/15		103	%	80 - 120
			Total Lithium (Li)	2021/09/15		98	%	80 - 120
			Total Manganese (Mn)	2021/09/15		106	%	80 - 120
			Total Molybdenum (Mo)	2021/09/15		108	%	80 - 120
			Total Nickel (Ni)	2021/09/15		105	%	80 - 120
			Total Phosphorus (P)	2021/09/15		107	%	80 - 120
			Total Selenium (Se)	2021/09/15		92	%	80 - 120
			Total Silicon (Si)	2021/09/15		71 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/15		100	%	80 - 120
			Total Strontium (Sr)	2021/09/15		111	%	80 - 120
			Total Thallium (Tl)	2021/09/15		101	%	80 - 120
			Total Tin (Sn)	2021/09/15		104	%	80 - 120
			Total Titanium (Ti)	2021/09/15		106	%	80 - 120
			Total Uranium (U)	2021/09/15		102	%	80 - 120
			Total Vanadium (V)	2021/09/15		107	%	80 - 120
			Total Zinc (Zn)	2021/09/15		107	%	80 - 120
			Total Zirconium (Zr)	2021/09/15		104	%	80 - 120
			Total Aluminum (Al)	2021/09/16	5.2, RDL=3.0 (5)		ug/L	
			Total Antimony (Sb)	2021/09/16	<0.020		ug/L	
			Total Arsenic (As)	2021/09/16	<0.020		ug/L	
			Total Barium (Ba)	2021/09/16	0.365, RDL=0.050 (6)		ug/L	
			Total Beryllium (Be)	2021/09/16	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/16	<0.010		ug/L	
			Total Boron (B)	2021/09/16	<10		ug/L	
			Total Cadmium (Cd)	2021/09/16	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/16	<0.10		ug/L	
			Total Cobalt (Co)	2021/09/16	<0.010		ug/L	
			Total Copper (Cu)	2021/09/16	<0.10		ug/L	
			Total Iron (Fe)	2021/09/16	<5.0		ug/L	
			Total Lead (Pb)	2021/09/16	0.020, RDL=0.020 (7)		ug/L	
			Total Lithium (Li)	2021/09/16	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/16	<0.10		ug/L	
			Total Molybdenum (Mo)	2021/09/16	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/16	<0.10		ug/L	
			Total Phosphorus (P)	2021/09/16	6.2, RDL=5.0 (8)		ug/L	
			Total Selenium (Se)	2021/09/16	<0.040		ug/L	
			Total Silicon (Si)	2021/09/16	<50		ug/L	
			Total Silver (Ag)	2021/09/16	<0.010		ug/L	
			Total Strontium (Sr)	2021/09/16	0.095, RDL=0.050 (9)		ug/L	
			Total Thallium (Tl)	2021/09/16	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/16	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/16	<2.0		ug/L	
			Total Uranium (U)	2021/09/16	<0.0050		ug/L	
			Total Vanadium (V)	2021/09/16	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/16	1.6, RDL=1.0 (10)		ug/L	
			Total Zirconium (Zr)	2021/09/16	<0.10		ug/L	





BV Labs Job #: C166142  
Report Date: 2021/10/05

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A352282	ANE	RPD	Total Aluminum (Al)	2021/09/15	62 (1)		%	20
			Total Antimony (Sb)	2021/09/15	18		%	20
			Total Arsenic (As)	2021/09/15	17		%	20
			Total Barium (Ba)	2021/09/15	5.4		%	20
			Total Beryllium (Be)	2021/09/15	NC		%	20
			Total Bismuth (Bi)	2021/09/15	10		%	20
			Total Boron (B)	2021/09/15	13		%	20
			Total Cadmium (Cd)	2021/09/15	NC		%	20
			Total Chromium (Cr)	2021/09/15	49 (1)		%	20
			Total Cobalt (Co)	2021/09/15	34 (1)		%	20
			Total Copper (Cu)	2021/09/15	19		%	20
			Total Iron (Fe)	2021/09/15	51 (1)		%	20
			Total Lead (Pb)	2021/09/15	25 (1)		%	20
			Total Lithium (Li)	2021/09/15	10		%	20
			Total Manganese (Mn)	2021/09/15	19		%	20
			Total Molybdenum (Mo)	2021/09/15	12		%	20
			Total Nickel (Ni)	2021/09/15	22 (1)		%	20
			Total Phosphorus (P)	2021/09/15	7.2		%	20
			Total Selenium (Se)	2021/09/15	NC		%	20
			Total Silicon (Si)	2021/09/15	41 (1)		%	20
			Total Silver (Ag)	2021/09/15	NC		%	20
			Total Strontium (Sr)	2021/09/15	9.0		%	20
			Total Thallium (Tl)	2021/09/15	18		%	20
			Total Tin (Sn)	2021/09/15	NC		%	20
			Total Titanium (Ti)	2021/09/15	74 (1)		%	20
			Total Uranium (U)	2021/09/15	6.4		%	20
			Total Vanadium (V)	2021/09/15	43 (1)		%	20
			Total Zinc (Zn)	2021/09/15	16		%	20
			Total Zirconium (Zr)	2021/09/15	14		%	20
A353956	SJ1	Spiked Blank	2,3,4-trichlorophenol	2021/09/17		96	%	50 - 140
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/17		108	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/17		105	%	50 - 140
			Phenol	2021/09/17		56	%	30 - 130
			3 & 4-chlorophenol	2021/09/17		94	%	50 - 140
			2,3,5,6-tetrachlorophenol	2021/09/17		96	%	50 - 140
			2,3,4,6-tetrachlorophenol	2021/09/17		104	%	50 - 140
			2,4,5-trichlorophenol	2021/09/17		100	%	50 - 140
			2,4,6-trichlorophenol	2021/09/17		104	%	50 - 140
			2,3,5-trichlorophenol	2021/09/17		96	%	50 - 140
			2,4-dichlorophenol	2021/09/17		100	%	50 - 140
			2,4-dimethylphenol	2021/09/17		96	%	50 - 140
			2,4-dinitrophenol	2021/09/17		72	%	30 - 130
			2,6-dichlorophenol	2021/09/17		104	%	50 - 140
			2-chlorophenol	2021/09/17		100	%	50 - 140
			2-methylphenol	2021/09/17		88	%	50 - 140
			2-nitrophenol	2021/09/17		92	%	50 - 140
			3 & 4-methylphenol	2021/09/17		88	%	50 - 140
			4,6-dinitro-2-methylphenol	2021/09/17		80	%	30 - 130
			4-chloro-3-methylphenol	2021/09/17		96	%	50 - 140
A353956	SJ1	Method Blank	4-nitrophenol	2021/09/17		56	%	50 - 140
			Pentachlorophenol	2021/09/17		80	%	50 - 140
			2,3,4-trichlorophenol	2021/09/17	<0.00010		mg/L	
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/17		112	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/17		111	%	50 - 140
			Phenol	2021/09/17	<0.00010		mg/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A357434	JAB	Matrix Spike	3 & 4-chlorophenol	2021/09/17	<0.00010		mg/L	
			2,3,5,6-tetrachlorophenol	2021/09/17	<0.00010		mg/L	
			2,3,4,6-tetrachlorophenol	2021/09/17	<0.00010		mg/L	
			2,4,5-trichlorophenol	2021/09/17	<0.00010		mg/L	
			2,4,6-trichlorophenol	2021/09/17	<0.00010		mg/L	
			2,3,5-trichlorophenol	2021/09/17	<0.00010		mg/L	
			2,4-dichlorophenol	2021/09/17	<0.00010		mg/L	
			2,4-dimethylphenol	2021/09/17	<0.00010		mg/L	
			2,4-dinitrophenol	2021/09/17	<0.0010		mg/L	
			2,6-dichlorophenol	2021/09/17	<0.00010		mg/L	
			2-chlorophenol	2021/09/17	<0.00010		mg/L	
			2-methylphenol	2021/09/17	<0.00010		mg/L	
			2-nitrophenol	2021/09/17	<0.0010		mg/L	
			3 & 4-methylphenol	2021/09/17	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/09/17	<0.0010		mg/L	
			4-chloro-3-methylphenol	2021/09/17	<0.00010		mg/L	
			4-nitrophenol	2021/09/17	<0.0010		mg/L	
			Pentachlorophenol	2021/09/17	<0.00010		mg/L	
			Dissolved Calcium (Ca)	2021/09/22		NC	%	80 - 120
			Dissolved Iron (Fe)	2021/09/22		96	%	80 - 120
A357434	JAB	Spiked Blank	Dissolved Magnesium (Mg)	2021/09/22		NC	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/22		95	%	80 - 120
			Dissolved Potassium (K)	2021/09/22		95	%	80 - 120
			Dissolved Sodium (Na)	2021/09/22		NC	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/22		96	%	80 - 120
			Dissolved Iron (Fe)	2021/09/22		101	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/22		103	%	80 - 120
A357434	JAB	Method Blank	Dissolved Manganese (Mn)	2021/09/22		98	%	80 - 120
			Dissolved Potassium (K)	2021/09/22		98	%	80 - 120
			Dissolved Sodium (Na)	2021/09/22		93	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/22	<0.30		mg/L	
			Dissolved Iron (Fe)	2021/09/22	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2021/09/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/22	<0.0040		mg/L	
A357434	JAB	RPD	Dissolved Potassium (K)	2021/09/22	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/22	<0.50		mg/L	
			Dissolved Calcium (Ca)	2021/09/23	0.51		%	20
			Dissolved Iron (Fe)	2021/09/23	NC		%	20
			Dissolved Magnesium (Mg)	2021/09/23	0.27		%	20
			Dissolved Manganese (Mn)	2021/09/23	1.4		%	20
			Dissolved Potassium (K)	2021/09/23	0.78		%	20
A367809	MTG	Matrix Spike [AFJ081-01]	Dissolved Sodium (Na)	2021/09/23	0.040		%	20
			Total Dissolved Solids	2021/09/28		108	%	80 - 120
A367809	MTG	Spiked Blank	Total Dissolved Solids	2021/09/28		104	%	80 - 120
A367809	MTG	Method Blank	Total Dissolved Solids	2021/09/28	<10		mg/L	
A367809	MTG	RPD [AFJ080-01]	Total Dissolved Solids	2021/09/28	7.8		%	20
A369021	ACR	Matrix Spike	Dissolved Nitrite (N)	2021/09/28		84	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		98	%	80 - 120
			Dissolved Nitrite (N)	2021/09/28		100	%	80 - 120
A369021	ACR	Spiked Blank	Dissolved Nitrate plus Nitrite (N)	2021/09/28		105	%	80 - 120
			Dissolved Nitrite (N)	2021/09/28	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	<0.010		mg/L	
A369021	ACR	Method Blank	Dissolved Nitrite (N)	2021/09/28	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	NC		%	20
A369068	MAP	Matrix Spike	Dissolved Iron (Fe)	2021/09/29		97	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A369068	MAP	Spiked Blank	Dissolved Manganese (Mn)	2021/09/29		98	%	80 - 120
			Dissolved Iron (Fe)	2021/09/29		105	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/29		105	%	80 - 120
A369068	MAP	Method Blank	Dissolved Iron (Fe)	2021/09/29	<0.060		mg/L	
			Dissolved Manganese (Mn)	2021/09/29	<0.0040		mg/L	
A369153	NR	Matrix Spike	Dissolved Chloride (Cl)	2021/09/28		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		NC	%	80 - 120
A369153	NR	Spiked Blank	Dissolved Chloride (Cl)	2021/09/28		105	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		101	%	80 - 120
A369153	NR	Method Blank	Dissolved Chloride (Cl)	2021/09/28	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/28	<1.0		mg/L	
A369153	NR	RPD	Dissolved Chloride (Cl)	2021/09/28	2.3		%	20
			Dissolved Sulphate (SO4)	2021/09/28	0.32		%	20
A369155	NR	Matrix Spike	Dissolved Chloride (Cl)	2021/09/28		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		NC	%	80 - 120
A369155	NR	Spiked Blank	Dissolved Chloride (Cl)	2021/09/28		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		100	%	80 - 120
A369155	NR	Method Blank	Dissolved Chloride (Cl)	2021/09/28	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/28	<1.0		mg/L	
A369155	NR	RPD	Dissolved Chloride (Cl)	2021/09/28	0.50		%	20
			Dissolved Sulphate (SO4)	2021/09/28	0.52		%	20
A369980	STI	Matrix Spike	True Colour	2021/09/29		63 (1)	%	80 - 120
A369980	STI	Spiked Blank	True Colour	2021/09/29		105	%	80 - 120
A369980	STI	Method Blank	True Colour	2021/09/29	<2.0		PtCo units	
A369980	STI	RPD	True Colour	2021/09/29	0.85		%	20
A371225	ANE	Spiked Blank	Dissolved Aluminum (Al)	2021/10/01		106	%	80 - 120
			Dissolved Boron (B)	2021/10/01		118	%	80 - 120
			Dissolved Iron (Fe)	2021/10/01		108	%	80 - 120
			Dissolved Lead (Pb)	2021/10/01		104	%	80 - 120
			Dissolved Manganese (Mn)	2021/10/01		111	%	80 - 120
			Dissolved Zinc (Zn)	2021/10/01		125 (1)	%	80 - 120
A371225	ANE	Method Blank	Dissolved Aluminum (Al)	2021/09/30	<0.50		ug/L	
			Dissolved Boron (B)	2021/09/30	<10		ug/L	
			Dissolved Iron (Fe)	2021/09/30	<1.0		ug/L	
			Dissolved Lead (Pb)	2021/09/30	<0.0050		ug/L	
			Dissolved Manganese (Mn)	2021/09/30	<0.050		ug/L	
			Dissolved Zinc (Zn)	2021/09/30	0.17, RDL=0.10 (11)		ug/L	
A371236	ANE	Spiked Blank	Total Aluminum (Al)	2021/10/01		102	%	80 - 120
			Total Zinc (Zn)	2021/10/01		124 (1)	%	80 - 120
A371236	ANE	Method Blank	Total Aluminum (Al)	2021/09/30	<0.50		ug/L	
			Total Zinc (Zn)	2021/09/30	<0.10		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
A376917	DBA	Spiked Blank	pH (15 C)	2021/10/05		98	%	97 - 103
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <math>\leq 2 \times</math> RDL).</p> <p>(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.</p> <p>(2) Detection limits raised due to dilution to bring analyte within the calibrated range.</p> <p>(3) Method Blank <math>&lt; 2 \times</math> RDL.</p> <p>(4) Detection limits raised due to matrix interference.</p> <p>(5) AI MB <math>&lt; 2 \times</math> RDL</p> <p>(6) Method blank above criteria. Data inspected. All data <math>&lt; 2 \times</math> RDL or greater than 10x Method Blank.</p> <p>(7) Pb MB <math>&lt; 2 \times</math> RDL</p> <p>(8) P MB <math>&lt; 2 \times</math> RDL</p> <p>(9) Sr MB <math>&lt; 2 \times</math> RDL</p> <p>(10) Zn MB <math>&lt; 2 \times</math> RDL</p> <p>(11) Method Blank <math>&lt; 2 \times</math> RDL</p>								





### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Gita Pokhrel, Laboratory Supervisor

Maria Magdalena Florescu, Ph.D., P.Chem., QP, Inorganics Manager

Patrick Mursell, Project Solutions Representative

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics


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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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4000 19st N.E. Calgary, Alberta Canada T2E 6P8 Tel: (403) 291-3077 Toll-free: 800-563-6266 Fax: (403) 291-9458 www.bvlabs.com

CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name: #11052 HATFIELD CONSULTANTS		Company Name: Zach Mueller		Quotation #: C10909		BV Labs Job #:	
Attention: Zach Mueller		Attention: Zach Mueller		P.O. #:		Bottle Order #:	
Address: Suite A, 300 MacKenzie Blvd		Address: Suite A, 300 MacKenzie Blvd		Project: Syncrude mesocosm experiment		COC #:	
Tel: (250) 893-4939		Tel: (250) 893-4939		Project Name:		Project Manager:	
Email: zmueller@hatfieldgroup.com		Email: zmueller@hatfieldgroup.com		Site #:		Amanda L'Hirondelle	
Fax:		Fax:		Sampled By:		C644187-02-01	

Regulatory Criteria:

☐ ATI

☐ CCME

☐ Other

Special Instructions

6 COGLERS TOTAL

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y/N)	ENV - 2021 Syncrude Mesocosm	Analysis Requested
1	Table 1	SEP 5		W	Y	X	
2	Table 2				Y	X	
3	Table 3					X	
4	Table 4					X	
5	Table 5					X	
6	Table 6					X	
7	Table 7					X	
8	Table 8					X	
9	BLANK					X	
10	DUPLICATE					X	

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:  
(will be applied if Rush TAT is not specified).  
Standard TAT = 5-7 Working days for most tests.  
Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details

Job Specific Rush TAT (if applies to entire submission)  
Date Required: \_\_\_\_\_

Rush Confirmation Number: \_\_\_\_\_ (call lab for #)

07-Sep-21 09:18

Amanda L'Hirondelle

C166142

KMV INS-0172

\* RELINQUISHED BY: (Signature/Print)

MORGAN EDWARDS

Date: (YY/MM/DD)

21/09/07

Time

0900

RECEIVED BY: (Signature/Print)

Reem Phillips, Reem

Date: (YY/MM/DD)

2021/09/05

Time

07:00

# Jars used and not submitted

Time Sensitive

☐

Temperature (°C) on Receipt

See ACIR

Custody Seal Intact on Cooler?

☐ Yes ☐ No

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT [WWW.BVLABS.COM/TERMS-AND-CONDITIONS](http://WWW.BVLABS.COM/TERMS-AND-CONDITIONS).

\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* ALL SAMPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT, FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.

SEP 07 2021

@ 9:18am

Temp: 7 7 8 ice-ups CS-NO





Bureau Veritas Laboratories  
4000 19th N.E. Calgary, Alberta Canada T2E 6P8 Tel: (403) 291-3077 Toll-free: 800-563-6266 Fax: (403) 291-5468 www.bvlabs.com

# CHAIN OF CUSTODY RECORD

Page 2 of 2

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#11052 HATFIELD CONSULTANTS	Company Name:	Zach Mueller	Quotation #:	C10909	BV Labs Job #:	Bottle Order #:
Attention:	Zach Mueller	Attention:	Zach Mueller	P.O. #:			
Address:	Suite A, 300 MacKenzie Blvd	Address:	Suite A, 300 MacKenzie Blvd	Project:	Syncrude mesocosm experiment		
	FORT MCMURRAY AB T9H 4C4		FORT MCMURRAY AB T9H 4C4	Project Name:		COC #:	Project Manager:
Tel:	(250) 893-4939	Tel:	(250) 893-4939	Site #:			
Email:	zmueller@hatfieldgroup.com	Email:	zmueller@hatfieldgroup.com	Sampled By:			

Regulatory Criteria:		Special Instructions		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)										Turnaround Time (TAT) Required:				
<input type="checkbox"/> ATI <input type="checkbox"/> CCME <input type="checkbox"/> Other		6 COULERS TOTAL												Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details Job Specific Rush TAT (if applies to entire submission) Date Required: Rush Confirmation Number:				
SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS																		
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y/N)	ENV - 2021 Syncrude Mesocosm											# of Bottles	Comments
1	RIVER WATER TANK	SEP 5		W	Y	X											27	DISSOLVED BTL FIELD FILTERED
2	TREATED CSW TANK	↓		W	Y	X											41	↓
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# Jars used and not submitted	Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?							
MARGARET EDWARDS		21/09/21	0900	Reem Phillippos, Reem		2021/09/08	0700		<input type="checkbox"/>	see ACIR	<input type="checkbox"/> Yes <input type="checkbox"/> No							
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.												White: BV Labs Yellow: Client						
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.																		
** ALL SAMPLES ARE HELD FOR 90 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER																		

07-Sep-21 09:18  
Amanda L'Hirondelle  
C166142  
KMV INS-0172

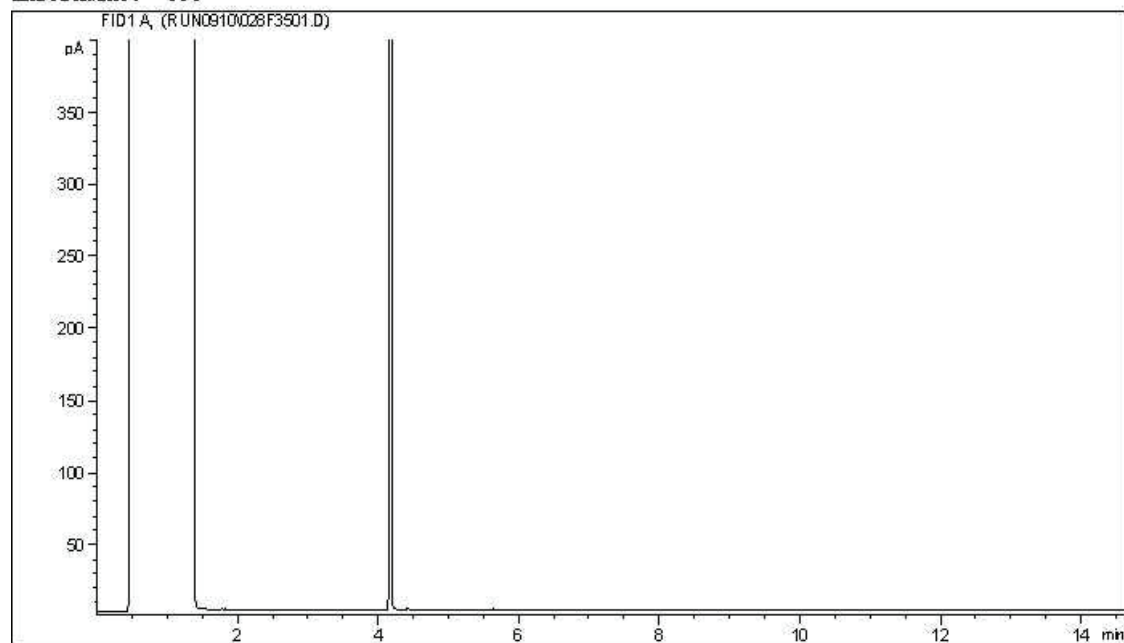
Received in Fort McMurray  
By: [Signature]

SEP 17 2021  
@ 9:18 am  
Temp: 7 7 8 ice yes CS-NO

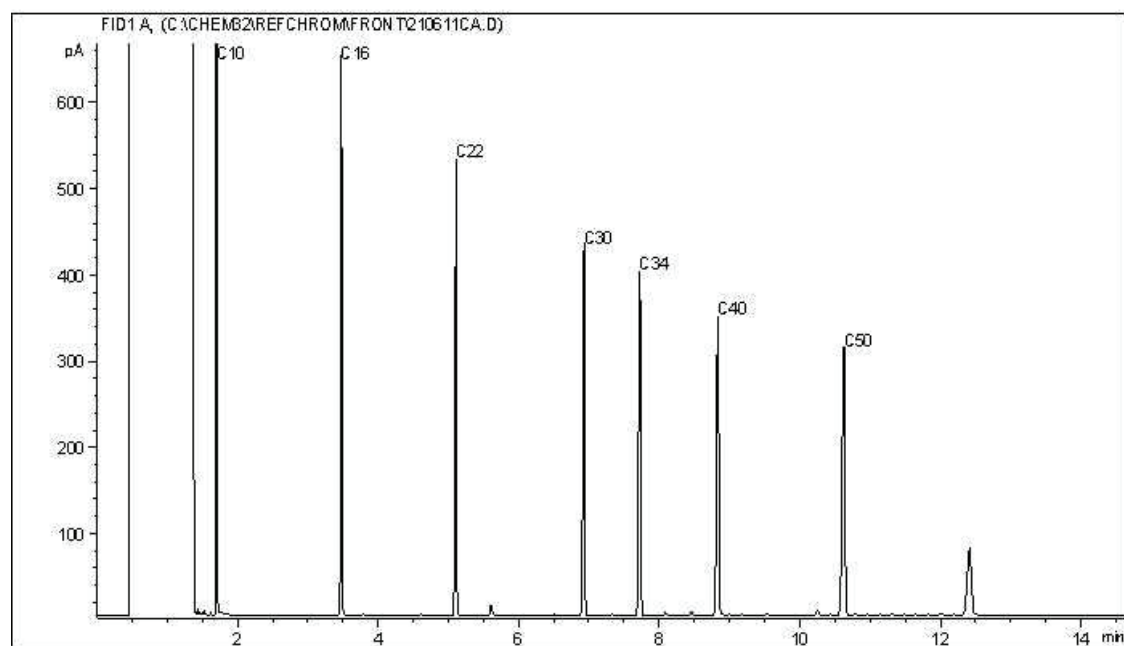


**CCME Hydrocarbons (F2-F4 in water) Chromatogram**

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



**TYPICAL PRODUCT CARBON NUMBER RANGES**

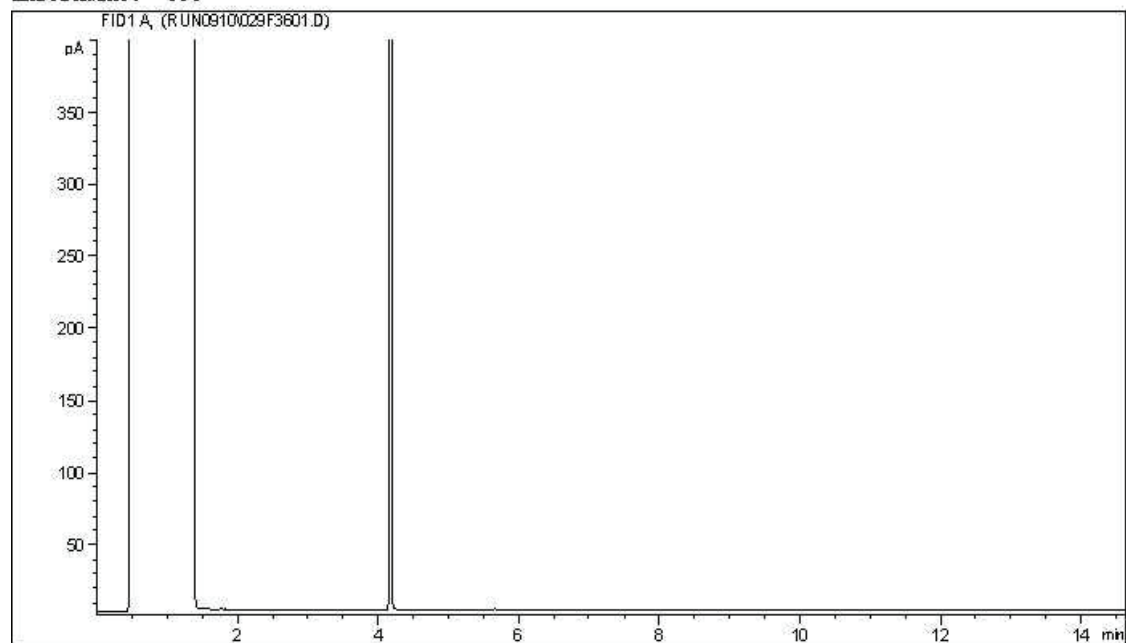
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

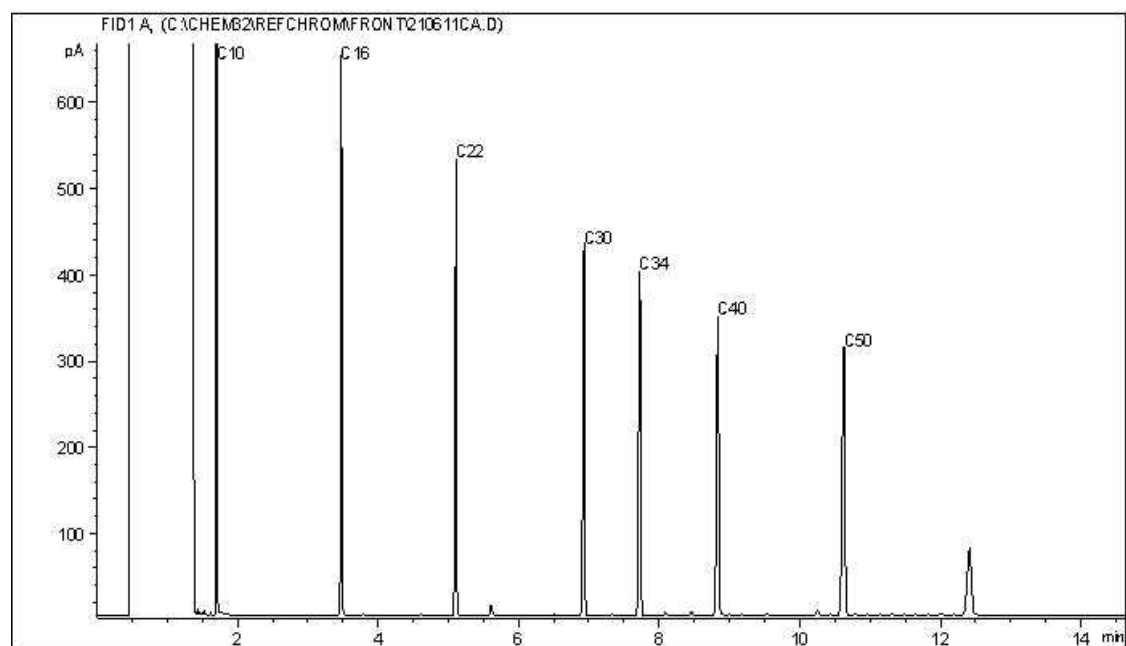


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



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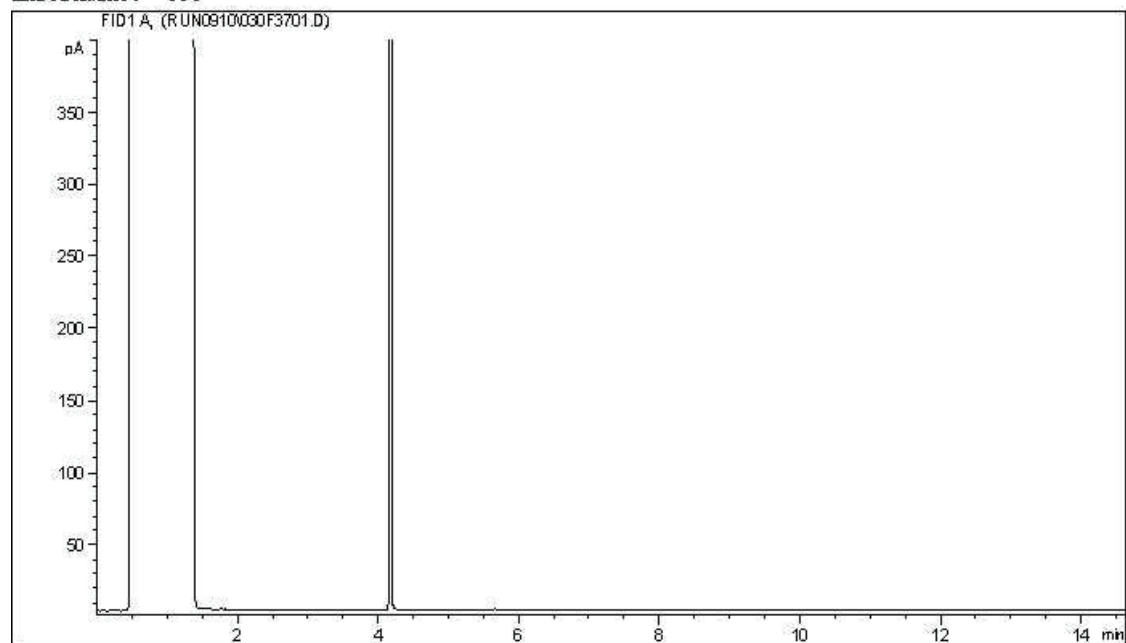
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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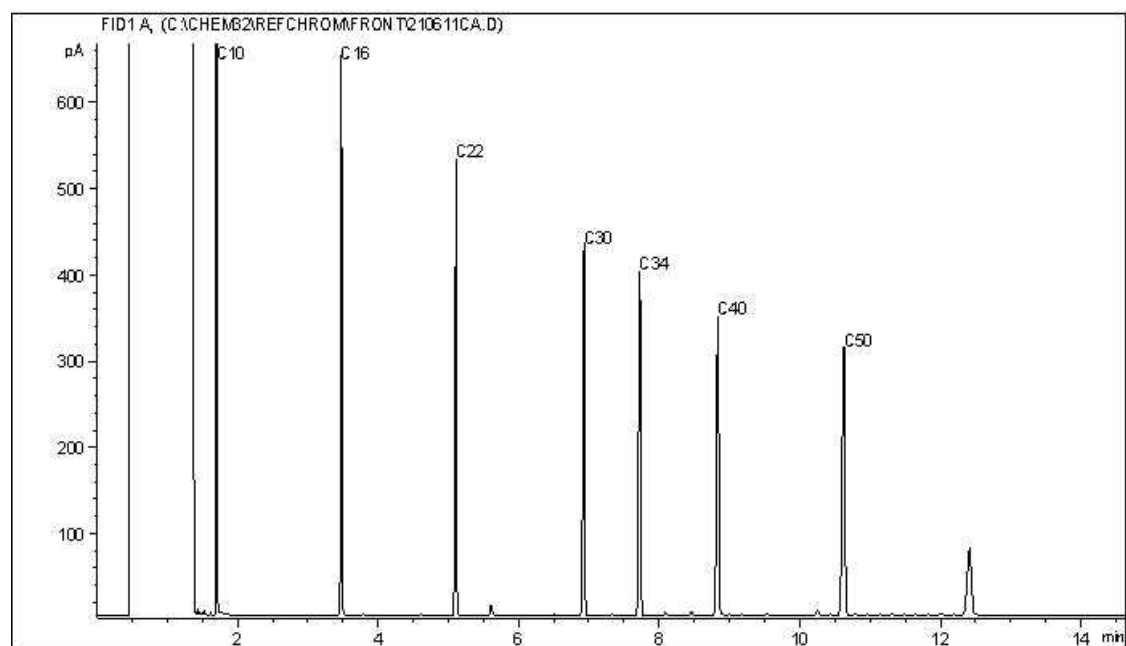


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Carbon Range Distribution - Reference Chromatogram



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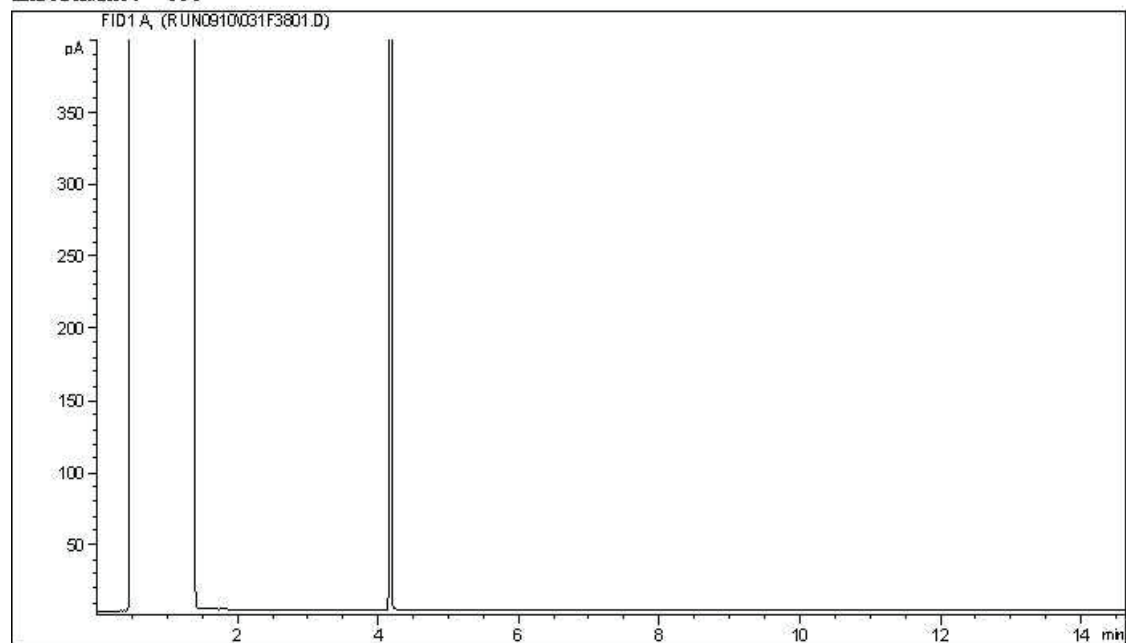
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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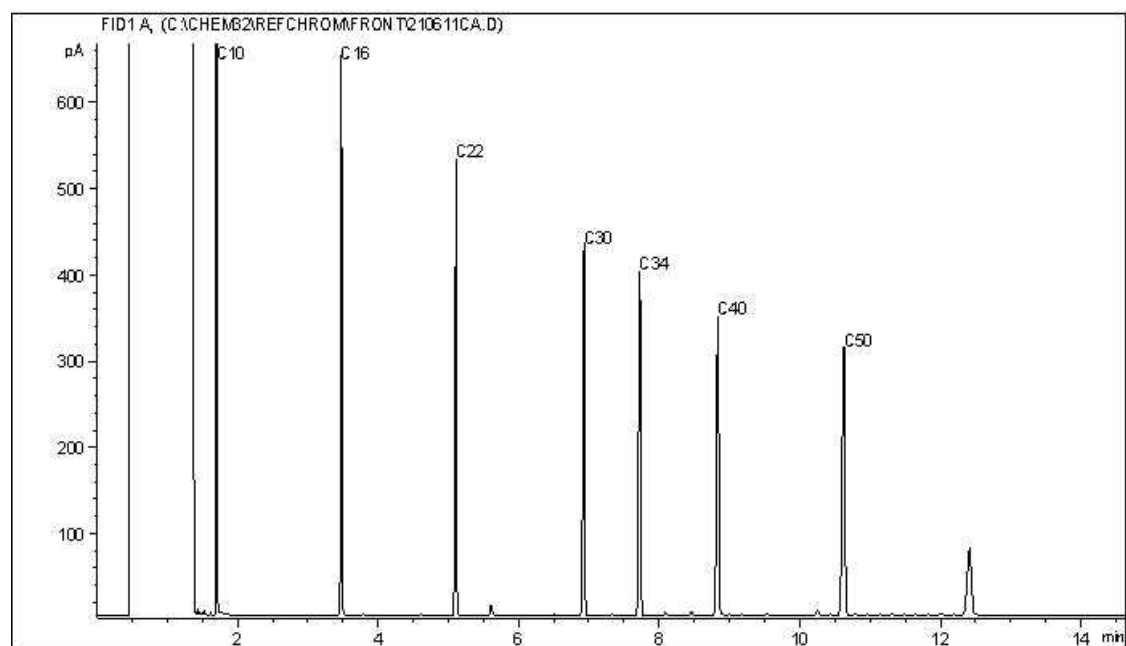


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Carbon Range Distribution - Reference Chromatogram



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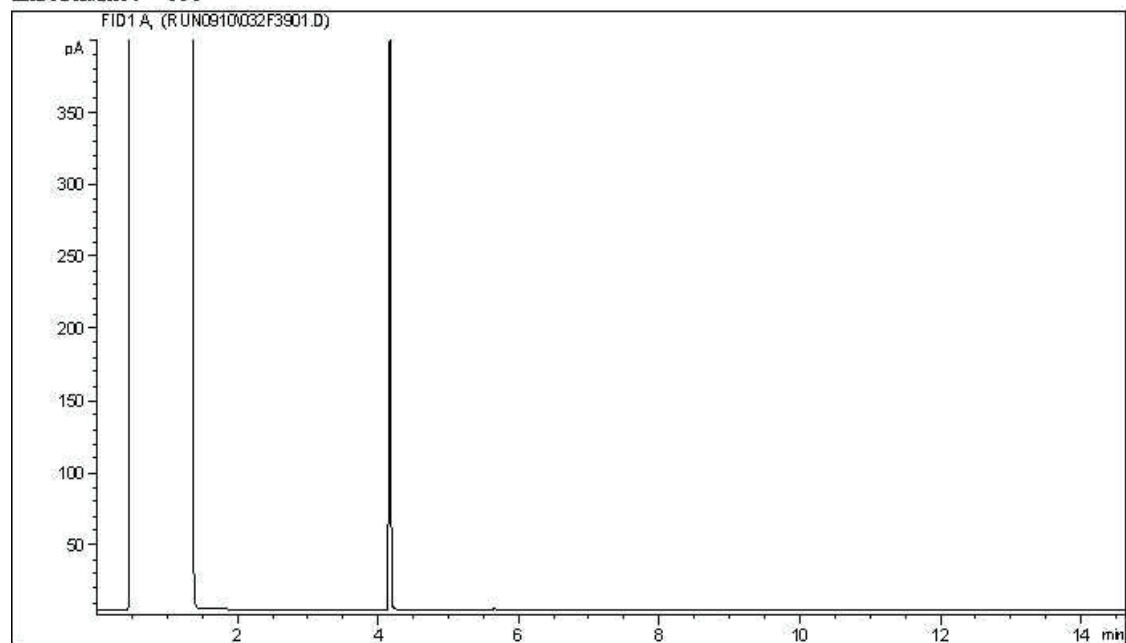
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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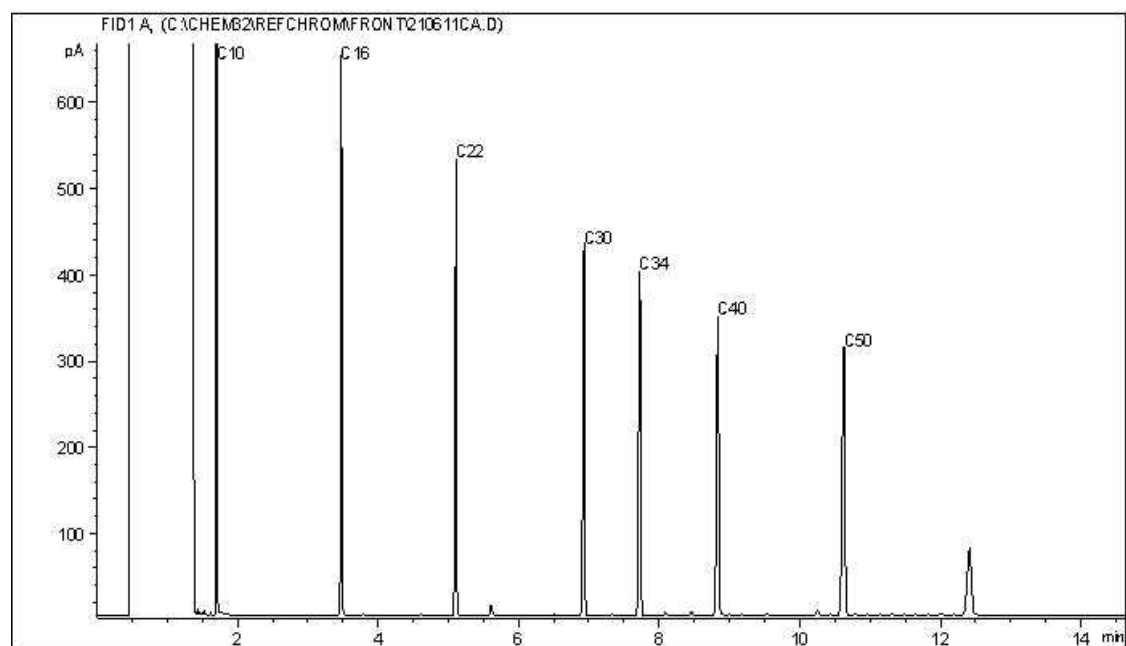


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Carbon Range Distribution - Reference Chromatogram



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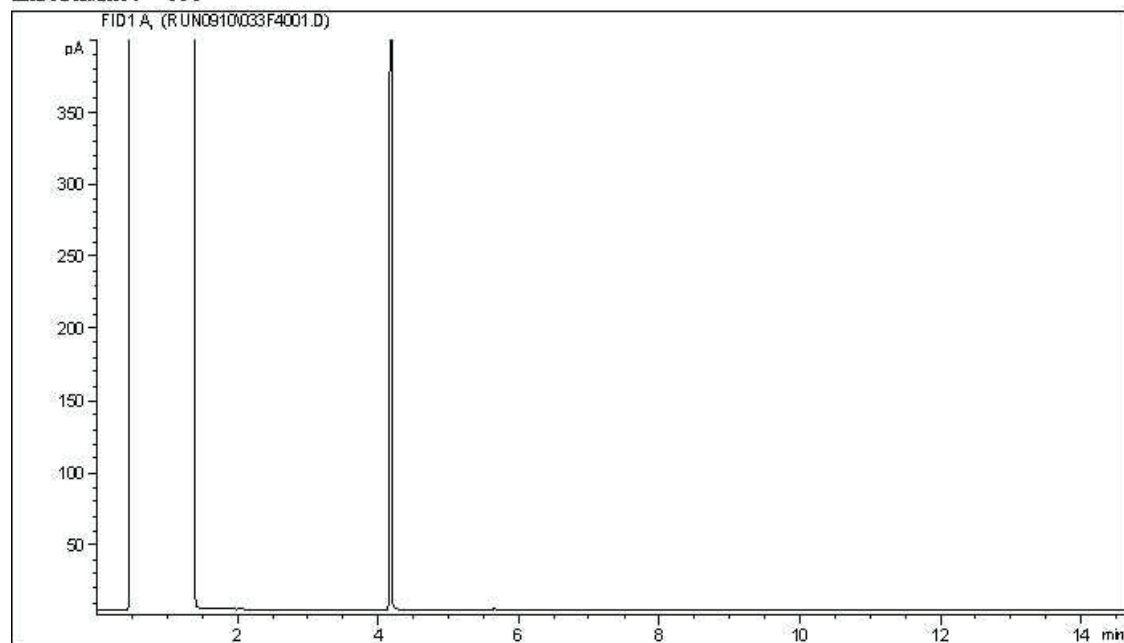
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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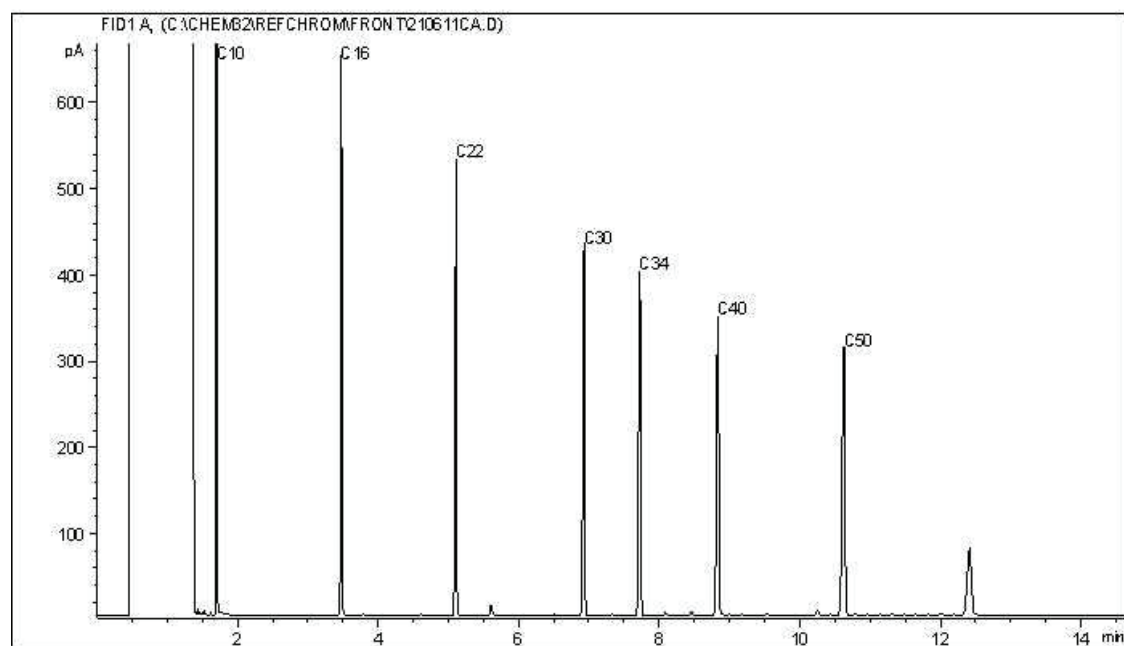


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Carbon Range Distribution - Reference Chromatogram



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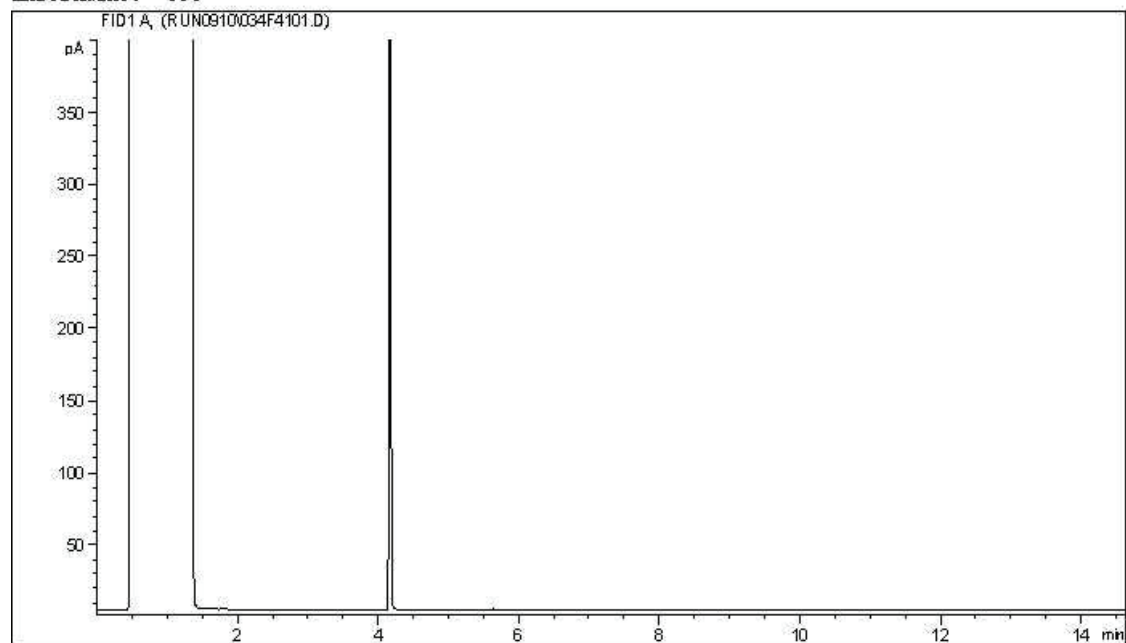
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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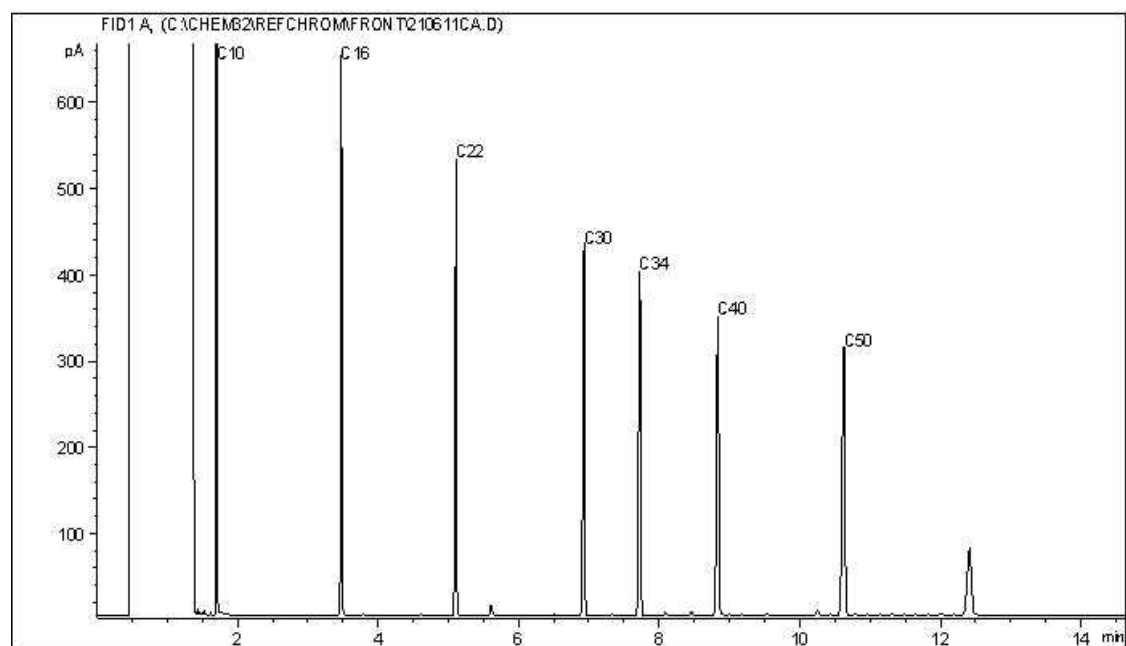


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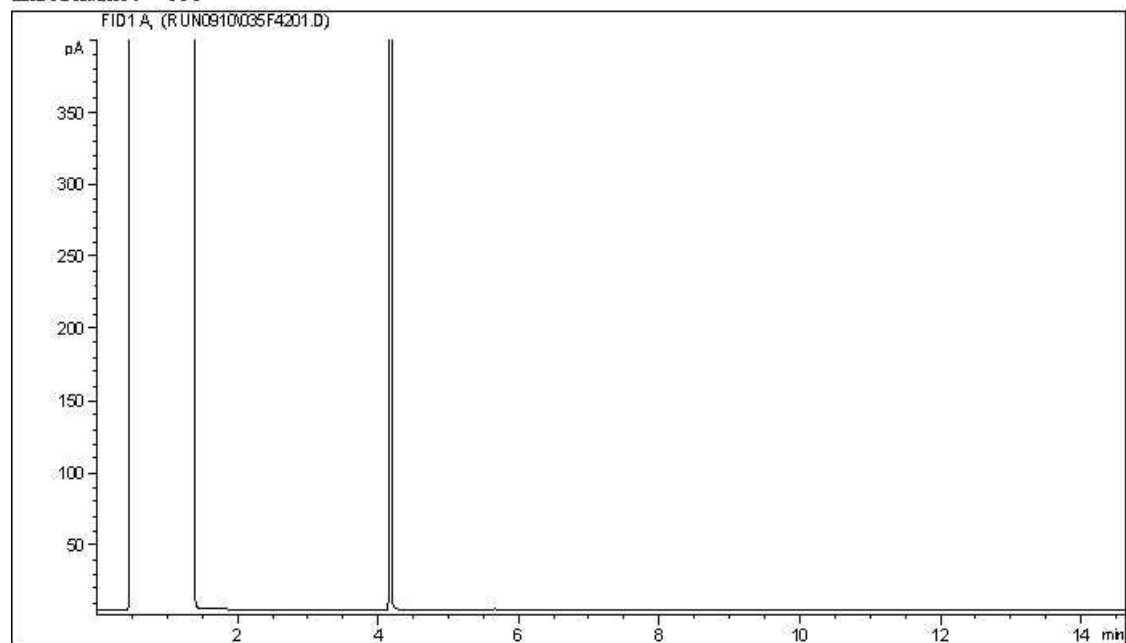
Gasoline:	C4 - C12	Diesel:	C8 - C22
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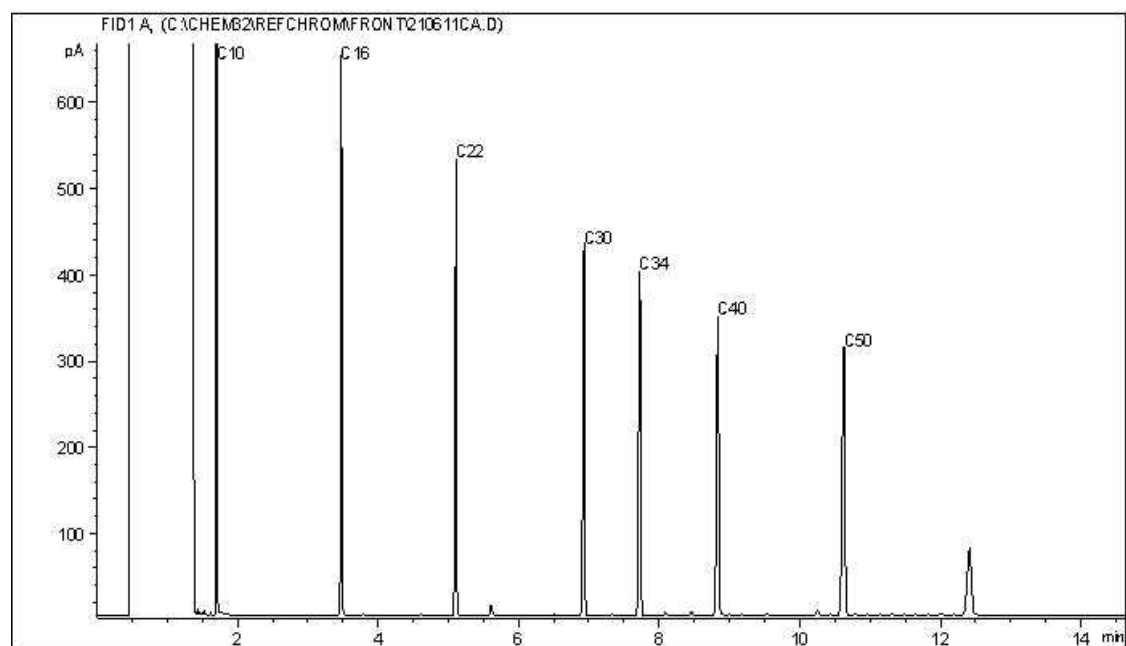


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Carbon Range Distribution - Reference Chromatogram



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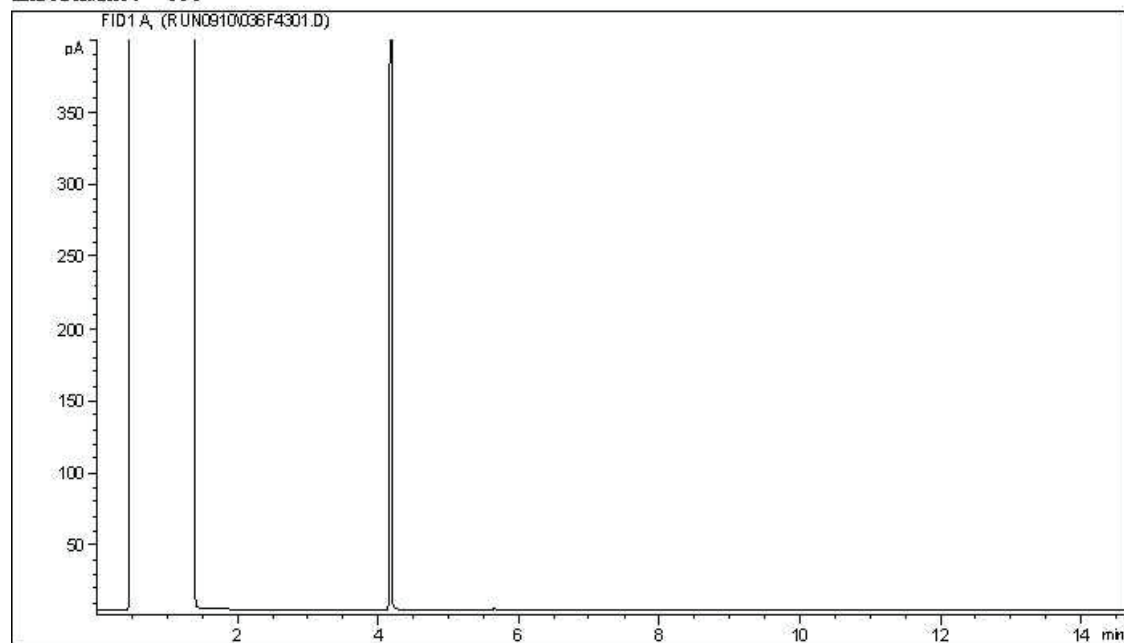
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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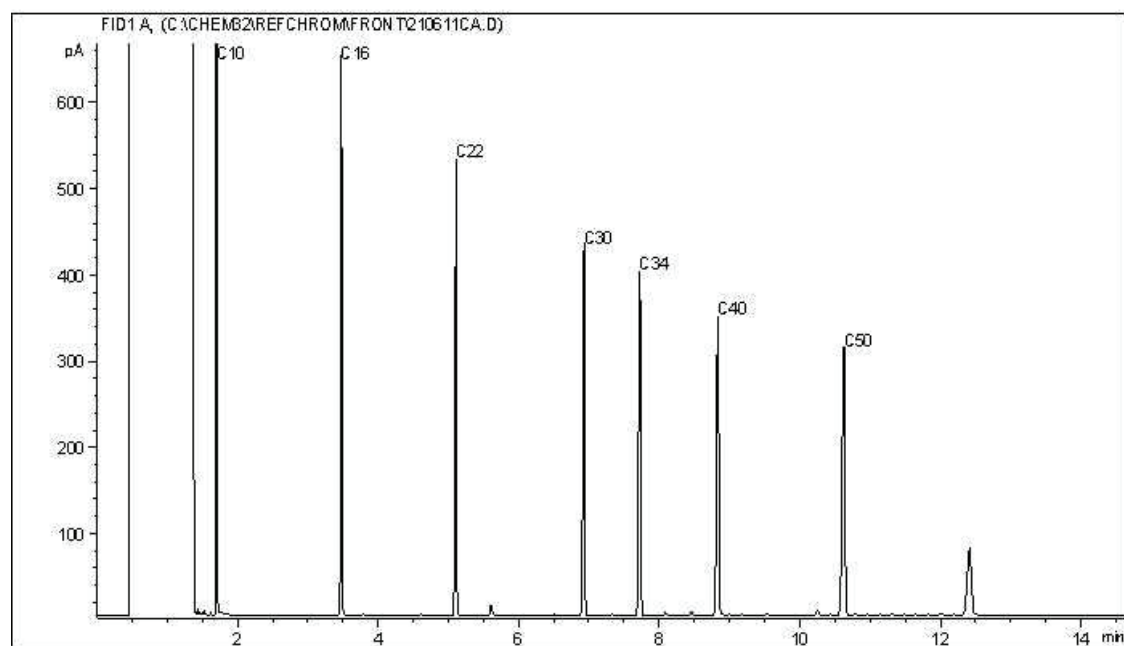


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Carbon Range Distribution - Reference Chromatogram



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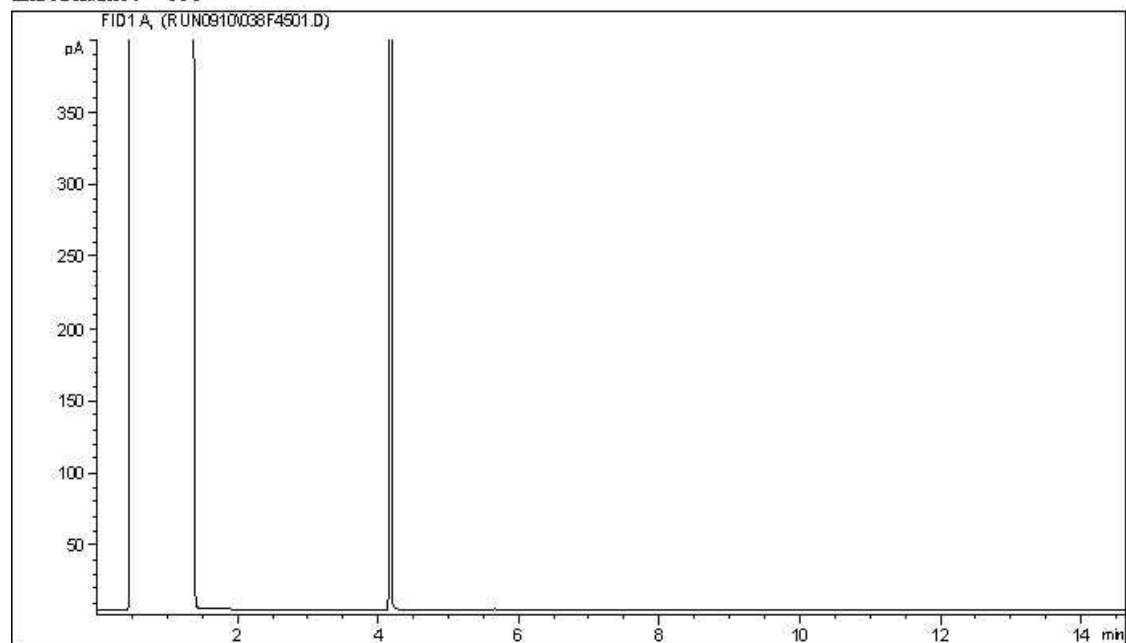
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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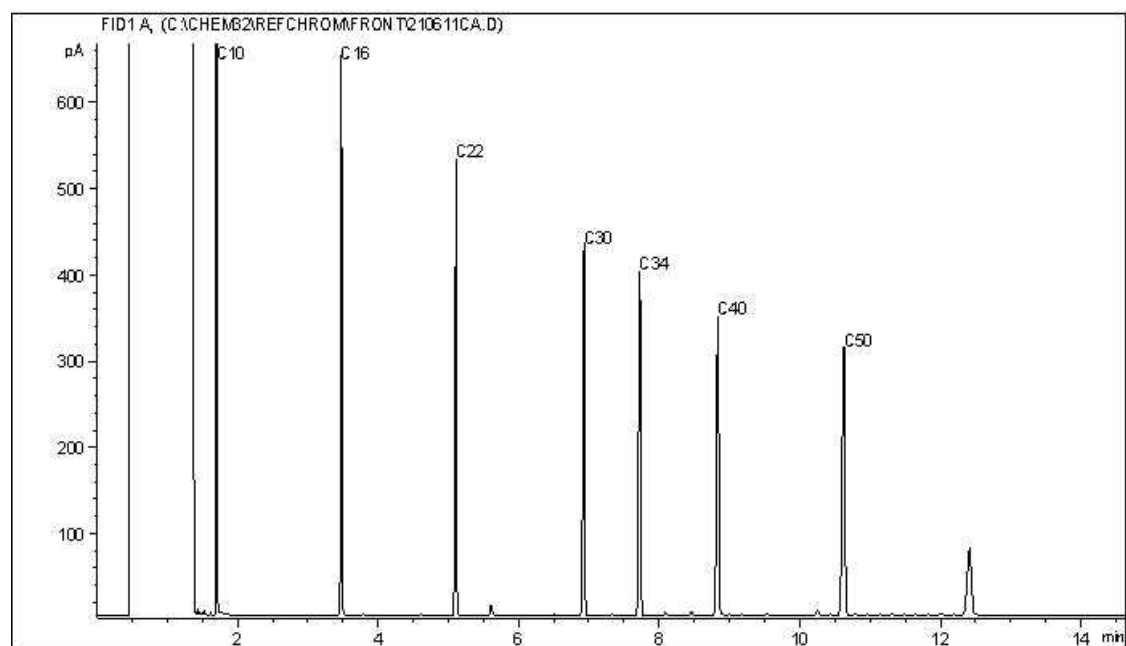


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Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



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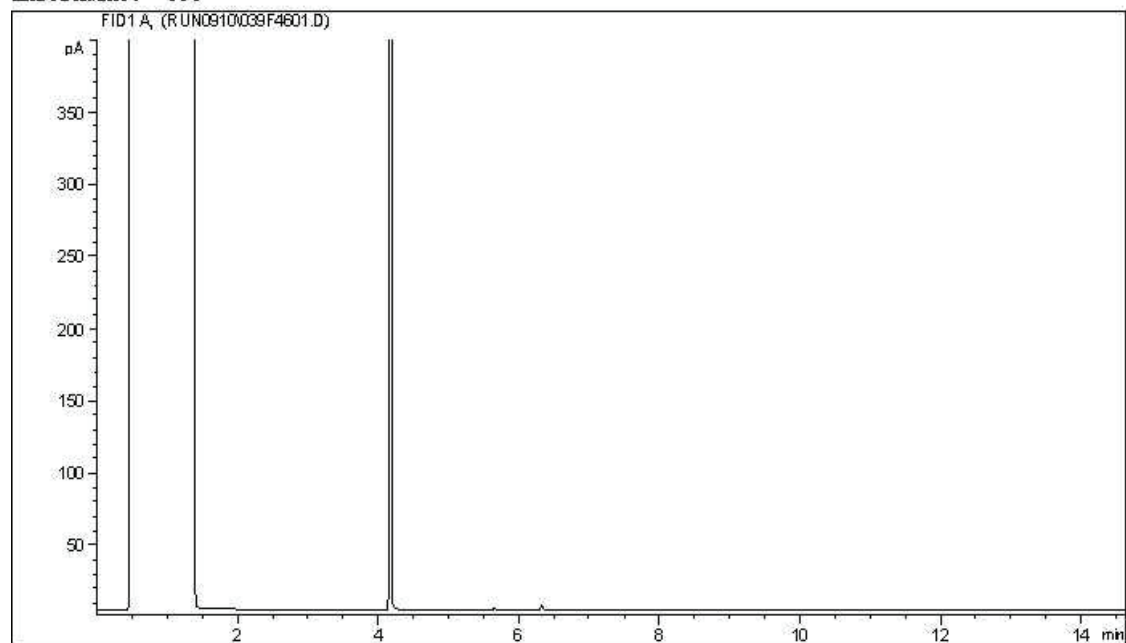
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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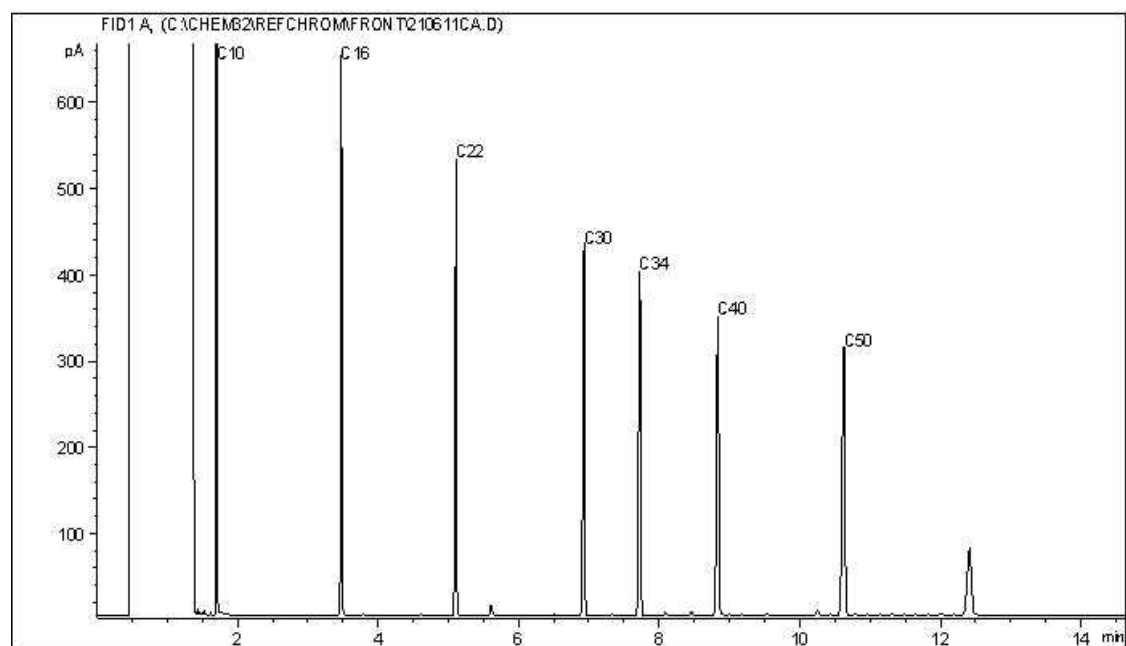


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Carbon Range Distribution - Reference Chromatogram



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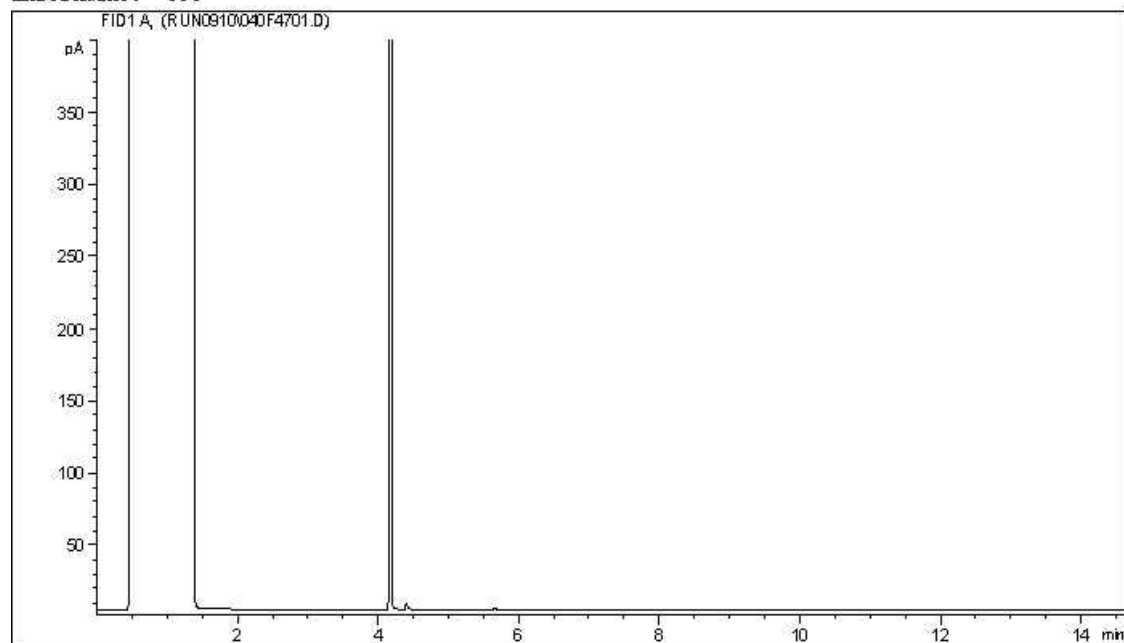
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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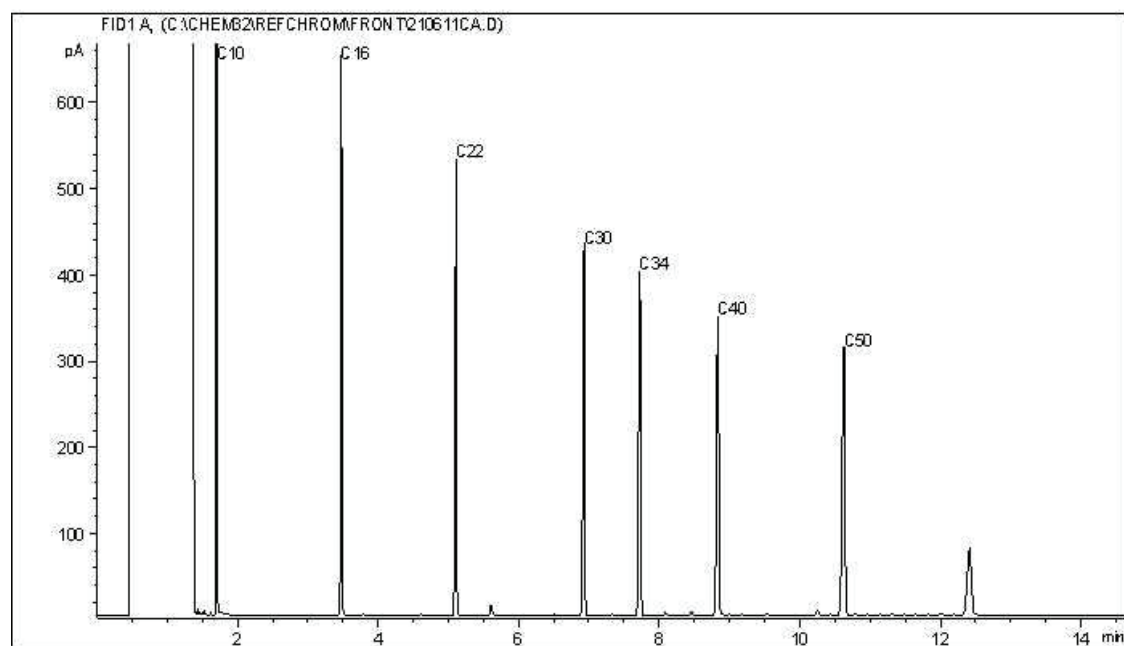


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Carbon Range Distribution - Reference Chromatogram



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Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/07**

Report #: R3082118

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C170041**

**Received: 2021/09/20, 06:00**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	12	N/A	2021/09/21	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	12	2021/09/21	2021/09/26	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	12	N/A	2021/09/29	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	12	N/A	2021/09/29		Auto Calc
Chloride/Sulphate by Auto Colourimetry	3	N/A	2021/09/23	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	5	N/A	2021/09/24	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	1	N/A	2021/09/25	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	3	N/A	2021/09/26	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
COD by Colorimeter	12	N/A	2021/09/23	AB SOP-00016	SM 23 5220D m
True Colour	12	N/A	2021/09/21	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	12	N/A	2021/09/23		Auto Calc
Carbon (DOC) (3)	12	N/A	2021/09/22	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	12	N/A	2021/09/21	AB SOP-00005	SM 23 2510 B m
Fluoride	12	N/A	2021/09/21	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (4)	6	2021/09/22	2021/09/25	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (4)	6	2021/09/22	2021/09/26	AB SOP-00037	CCME PHC-CWS m
Hardness	11	N/A	2021/09/24		Auto Calc
Hardness	1	N/A	2021/09/25		Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	5	N/A	2021/09/27	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	1	N/A	2021/09/28	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	3	N/A	2021/09/29	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	3	N/A	2021/09/30	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	11	N/A	2021/09/24	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	1	N/A	2021/09/25	BBY WI-00033	Auto Calc
Mercury-Low Level, Diss., field filtered (1)	12	N/A	2021/09/29	BBY7SOP-00022	EPA 1631E m
Mercury-Low Level, Total (1)	7	2021/09/22	2021/09/24	BBY7SOP-00022	EPA 1631E m
Mercury-Low Level, Total (1)	1	2021/09/23	2021/09/24	BBY7SOP-00022	EPA 1631E m
Mercury-Low Level, Total (1)	4	2021/09/27	2021/09/27	BBY7SOP-00022	EPA 1631E m
Elements by ICP - Dissolved (6)	9	N/A	2021/09/23	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Dissolved (6)	3	N/A	2021/09/24	AB SOP-00042	EPA 6010d R5 m
Ion Balance	3	N/A	2021/09/24		Auto Calc
Ion Balance	6	N/A	2021/09/25		Auto Calc





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
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CANADA T9H 4C4

**Report Date: 2021/10/07**

Report #: R3082118

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C170041**

**Received: 2021/09/20, 06:00**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Ion Balance	3	N/A	2021/09/27		Auto Calc
Sum of cations, anions	11	N/A	2021/09/24		Auto Calc
Sum of cations, anions	1	N/A	2021/09/25		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	12	N/A	2021/09/29	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (6)	1	N/A	2021/09/28	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Low Level (dissolved) (6)	11	N/A	2021/09/29	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	4	2021/09/24	2021/09/25	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	1	2021/09/24	2021/09/26	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	3	2021/09/24	2021/09/27	CAL SOP-00265	EPA 6020 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	5	N/A	2021/09/27	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	1	N/A	2021/09/28	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	3	N/A	2021/09/29	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	3	N/A	2021/09/30	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	1	N/A	2021/09/28	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Low Level (total)	1	N/A	2021/09/29	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Low Level (total)	2	N/A	2021/09/30	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	12	2021/09/23	2021/09/24	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH3) as N @ 15C	1	2021/10/01	2021/10/05		Auto Calc
Un-Ionized Ammonia (NH3) as N	11	N/A	2021/10/01		Auto Calc
Ammonia-N (Total)	8	N/A	2021/09/23	AB SOP-00007	SM 23 4500 NH3 A G m
Ammonia-N (Total)	4	N/A	2021/09/24	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate and Nitrite	11	N/A	2021/09/21		Auto Calc
Nitrate and Nitrite	1	N/A	2021/09/24		Auto Calc
NO2 (N); NO2 (N) + NO3 (N) in Water	12	N/A	2021/09/21	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	11	2021/09/20	2021/09/21		Auto Calc
Nitrate (as N)	1	2021/09/20	2021/09/24		Auto Calc
Target & Alkylated PAH in Water by GC/MS (7)	8	2021/09/24	2021/09/25	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Target & Alkylated PAH in Water by GC/MS (7)	4	2021/09/27	2021/09/27	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (8)	8	N/A	2021/09/29		Auto Calc
Benzo[a]pyrene Equivalency (8)	4	N/A	2021/10/04		Auto Calc





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

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Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/07**

Report #: R3082118

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C170041**

**Received: 2021/09/20, 06:00**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Filter and HNO3 Preserve for Metals (1)	12	N/A	2021/09/21	BBY7 WI-00004	SM 23 3030B m
pH measured @ 15 C (2, 9)	1	N/A	2021/10/05	EENV SOP-00159	SM 23 4500 H+ B m
pH @25°C (9)	12	N/A	2021/09/21	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	11	N/A	2021/10/01	Field Test	Field Test
Orthophosphate by Konelab (low level) (10)	11	N/A	2021/09/21	AB SOP-00025	SM 23 4500-P A, F m
Orthophosphate by Konelab (low level) (10)	1	N/A	2021/09/22	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	12	2021/09/22	2021/09/22	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	12	2021/09/23	2021/09/23	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	3	N/A	2021/09/24		Auto Calc
Total Dissolved Solids (Calculated)	6	N/A	2021/09/25		Auto Calc
Total Dissolved Solids (Calculated)	3	N/A	2021/09/27		Auto Calc
Temperature (Field)	11	N/A	2021/10/01		
Total Trihalomethanes Calculation	1	N/A	2021/09/25		Auto Calc
Total Trihalomethanes Calculation	11	N/A	2021/09/29		Auto Calc
Carbon (Inorganic)	12	N/A	2021/09/22	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	11	2021/09/23	2021/09/23	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	1	2021/09/23	2021/09/24	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (11)	12	N/A	2021/09/22	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (12)	12	2021/09/22	2021/09/23	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	12	2021/09/22	2021/09/23	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	12	2021/09/24	2021/09/24	AB SOP-00061	SM 23 2540 D m
Turbidity	12	N/A	2021/09/21	CAL SOP-00081	SM 23 2130 B m
VOCs in Water by HS GC/MS (Std List)	1	N/A	2021/09/25	AB SOP-00056	EPA 5021a/8260d m
VOCs in Water by HS GC/MS (Std List)	11	N/A	2021/09/28	AB SOP-00056	EPA 5021a/8260d m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

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## **CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C170041**

**Received: 2021/09/20, 06:00**

Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Bureau Veritas Vancouver, 4606 Canada Way, Burnaby, BC, V5G 1K5

(2) This test was performed by Bureau Veritas Edmonton Environmental, 9331 - 48 St., Edmonton, AB, T6B 2R4

(3) DOC present in the sample should be considered as non-purgeable DOC. Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(4) Silica gel clean up employed.

(5) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(6) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(7) Alkylated PAH results are semiquantitative

(8) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

(9) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

(10) Orthophosphate > Total Phosphorus Imbalance: When applicable, Orthophosphate, Total Phosphorus and dissolved Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(11) TOC present in the sample should be considered as non-purgeable TOC.

(12) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Amanda L'Hirondelle  
Key Account Specialist  
07 Oct 2021 16:39:13

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Amanda L'Hirondelle, Key Account Specialist

Email: Amanda.lhirondelle@bureauveritas.com

Phone# (780)577-7117

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 4

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### RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGH675			AGH676		
Sampling Date		2021/09/19 14:50			2021/09/19 11:00		
COC Number		644187-01-01			644187-01-01		
	UNITS	RIVER WATER TANK	RDL	QC Batch	MESOCOSM TABLE 1	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.6	N/A	A359101	31	N/A	A359101
Cation Sum	meq/L	3.1	N/A	A359101	33	N/A	A359101
Filter and HNO3 Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO3)	mg/L	130	0.50	A358955	80	0.50	A358955
Dissolved Hardness (CaCO3)	mg/L	131	0.50	A359075	79.6	0.50	A359075
Total Hardness (CaCO3)	mg/L	123	0.50	A359074	75.0	0.50	A359074
Ion Balance (% Difference)	%	8.5	N/A	A359097	4.2	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.016	0.010	A359256	0.017	0.010	A358777
Dissolved Nitrate (NO3)	mg/L	0.070	0.044	A359102	0.077	0.044	A359102
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	A359102	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	180	10	A359104	1900	10	A359104
Un-Ionized Ammonia	mg/L	<0.00064	0.00064	A359255	0.0072	0.0028	A359255
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A359406	4.9 (1)	2.0	A359406
Chemical Oxygen Demand	mg/L	18	10	A363123	106	10	A363123
<b>Field Parameters</b>							
Field pH	pH	8.35	N/A	ONSITE	9.15	N/A	ONSITE
Field Temperature (Fd)	deg. C	10.8	N/A	ONSITE	8.5	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	300	2.0	A360202	3100	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	5.9	0.50	A360770	21	0.50	A360770
pH	pH	8.11	N/A	A360201	9.08	N/A	A360201
Total Organic Carbon (C)	mg/L	5.6	0.50	A360740	23	0.50	A360740
Total Dissolved Solids	mg/L	230	10	A362644	1900	10	A362644
Total Suspended Solids	mg/L	25	1.0	A364095	16	1.0	A364095
<b>Anions</b>							
Alkalinity (PP as CaCO3)	mg/L	<1.0	1.0	A360197	59	1.0	A360197
Alkalinity (Total as CaCO3)	mg/L	130	1.0	A360197	380	1.0	A360197
Bicarbonate (HCO3)	mg/L	160	1.0	A360197	310	1.0	A360197
Carbonate (CO3)	mg/L	<1.0	1.0	A360197	71	1.0	A360197
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH675			AGH676		
<b>Sampling Date</b>		2021/09/19 14:50			2021/09/19 11:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 1</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.17	0.050	A360203	2.5	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0030	0.0010	A360200	0.0056	0.0010	A360205
Dissolved Chloride (Cl)	mg/L	4.2	1.0	A365459	400	5.0	A365459
Dissolved Sulphate (SO4)	mg/L	40	1.0	A365459	560	5.0	A365459
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A363115	0.038	0.015	A364701
Total Inorganic Carbon (C)	mg/L	30	1.0	A360207	86	1.0	A360207
Dissolved Phosphorus (P)	mg/L	0.0032	0.0010	A361302	0.0083	0.0010	A361302
Total Phosphorus (P)	mg/L	0.026	0.0010	A361292	0.062	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A360213	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.016	0.010	A360213	0.017	0.010	A360213
Total Nitrogen (N)	mg/L	0.22	0.020	A363014	1.5	0.020	A363014
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A358713	<2.0	2.0	A358713
<b>Physical Properties</b>							
True Colour	PtCo units	18	2.0	A360464	20	2.0	A360464
<b>Physical Properties</b>							
Turbidity	NTU	24	0.10	A359598	13	0.10	A359598
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGH677			AGH678		
Sampling Date		2021/09/19 10:50			2021/09/19 12:00		
COC Number		644187-01-01			644187-01-01		
	UNITS	MESOCOSM TABLE 2	RDL	QC Batch	MESOCOSM TABLE 3	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	12	N/A	A359101	6.1	N/A	A359101
Cation Sum	meq/L	11	N/A	A359101	5.6	N/A	A359101
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO <sub>3</sub> )	mg/L	120	0.50	A358955	130	0.50	A358955
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	115	0.50	A359075	125	0.50	A359075
Total Hardness (CaCO <sub>3</sub> )	mg/L	105	0.50	A359074	127	0.50	A359074
Ion Balance (% Difference)	%	4.8	N/A	A359097	4.2	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.027	0.010	A358777	0.015	0.010	A358777
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.12	0.044	A359102	0.067	0.044	A359102
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A359102	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	720	10	A359104	340	10	A359104
Un-Ionized Ammonia	mg/L	<0.0079	0.0079	A359255	<0.00087	0.00087	A359255
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A359406	<2.0 (1)	2.0	A359406
Chemical Oxygen Demand	mg/L	48	10	A363123	27	10	A363123
<b>Field Parameters</b>							
Field pH	pH	8.83	N/A	ONSITE	8.54	N/A	ONSITE
Field Temperature (Fd)	deg. C	9.2	N/A	ONSITE	9.4	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	1200	2.0	A360202	590	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	11	0.50	A360770	8.1	0.50	A360770
pH	pH	8.69	N/A	A360201	8.26	N/A	A360201
Total Organic Carbon (C)	mg/L	9.9	0.50	A360740	6.8	0.50	A360740
Total Dissolved Solids	mg/L	710	10	A362644	330	10	A362644
Total Suspended Solids	mg/L	30	1.0	A364095	20	0.99	A364095
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	8.7	1.0	A360197	<1.0	1.0	A360197
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	210	1.0	A360197	150	1.0	A360197
Bicarbonate (HCO <sub>3</sub> )	mg/L	230	1.0	A360197	190	1.0	A360197
Carbonate (CO <sub>3</sub> )	mg/L	10	1.0	A360197	<1.0	1.0	A360197
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH677			AGH678		
<b>Sampling Date</b>		2021/09/19 10:50			2021/09/19 12:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.83	0.050	A360203	0.32	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0023	0.0010	A360205	0.0013	0.0010	A360200
Dissolved Chloride (Cl)	mg/L	130	1.0	A365459	40	2.0	A365459
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	210	5.0	A365459	90	1.0	A365459
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.075 (1)	0.075	A364701	<0.015	0.015	A364701
Total Inorganic Carbon (C)	mg/L	47	1.0	A360207	36	1.0	A360207
Dissolved Phosphorus (P)	mg/L	0.0032	0.0010	A361302	0.0025	0.0010	A361302
Total Phosphorus (P)	mg/L	0.058	0.0010	A361292	0.028	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A360213	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.027	0.010	A360213	0.015	0.010	A360213
Total Nitrogen (N)	mg/L	0.68	0.020	A363014	0.40	0.020	A363014
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A358713	<2.0	2.0	A358713
<b>Physical Properties</b>							
True Colour	PtCo units	17	2.0	A360464	17	2.0	A360464
<b>Physical Properties</b>							
Turbidity	NTU	20	0.10	A359598	20	0.10	A359598
RDL = Reportable Detection Limit							
(1) Detection limits raised due to matrix interference.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH679			AGH680		
<b>Sampling Date</b>		2021/09/19 11:30			2021/09/19 11:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	4.6	N/A	A359101	3.7	N/A	A359101
Cation Sum	meq/L	3.8	N/A	A359101	3.3	N/A	A359101
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO <sub>3</sub> )	mg/L	130	0.50	A358955	130	0.50	A358955
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	129	0.50	A359075	130	0.50	A359075
Total Hardness (CaCO <sub>3</sub> )	mg/L	135	0.50	A359074	132	0.50	A359074
Ion Balance (% Difference)	%	8.8	N/A	A359097	5.7	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.024	0.010	A358777	0.015	0.010	A358777
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.11	0.044	A359102	0.067	0.044	A359102
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A359102	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	240	10	A359104	190	10	A359104
Un-Ionized Ammonia	mg/L	<0.00068	0.00068	A359255	<0.00065	0.00065	A359255
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A359406	<2.0 (1)	2.0	A359406
Chemical Oxygen Demand	mg/L	21	10	A363123	21	10	A363123
<b>Field Parameters</b>							
Field pH	pH	8.42	N/A	ONSITE	8.4	N/A	ONSITE
Field Temperature (Fd)	deg. C	9.6	N/A	ONSITE	9.6	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	400	2.0	A360202	340	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	6.0	0.50	A360770	6.4	0.50	A360770
pH	pH	8.20	N/A	A360201	8.15	N/A	A360201
Total Organic Carbon (C)	mg/L	5.6	0.50	A360740	5.8	0.50	A360740
Total Dissolved Solids	mg/L	240	10	A362644	210	10	A362644
Total Suspended Solids	mg/L	23	0.99	A364095	26	0.99	A364095
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	150	1.0	A360197	120	1.0	A360197
Bicarbonate (HCO <sub>3</sub> )	mg/L	180	1.0	A360197	150	1.0	A360197
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
RDL = Reportable Detection Limit							
N/A = Not Applicable							
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH679			AGH680		
<b>Sampling Date</b>		2021/09/19 11:30			2021/09/19 11:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.18	0.050	A360203	0.19	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0013	0.0010	A360200	0.0015	0.0010	A360200
Dissolved Chloride (Cl)	mg/L	16	1.0	A363570	8.2	1.0	A363570
Dissolved Sulphate (SO4)	mg/L	57	1.0	A363570	47	1.0	A363570
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A363115	<0.015	0.015	A363115
Total Inorganic Carbon (C)	mg/L	30	1.0	A360207	29	1.0	A360212
Dissolved Phosphorus (P)	mg/L	0.0019	0.0010	A361302	0.0032	0.0010	A361302
Total Phosphorus (P)	mg/L	0.031	0.0010	A361292	0.023	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A360213	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.024	0.010	A360213	0.015	0.010	A360213
Total Nitrogen (N)	mg/L	0.32	0.020	A363014	0.23	0.020	A363014
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A358713	<2.0	2.0	A358713
<b>Physical Properties</b>							
True Colour	PtCo units	19	2.0	A360464	18	2.0	A360464
<b>Physical Properties</b>							
Turbidity	NTU	21	0.10	A359598	20	0.10	A359598
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGH681		AGH682		
Sampling Date		2021/09/19 12:10		2021/09/19 11:30		
COC Number		644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 6	RDL	MESOCOSM TABLE 7	RDL	QC Batch
<b>Calculated Parameters</b>						
Anion Sum	meq/L	3.4	N/A	3.4	N/A	A359101
Cation Sum	meq/L	3.1	N/A	3.1	N/A	A359101
Filter and HNO3 Preservation	N/A	FIELD		FIELD		ONSITE
Hardness (CaCO3)	mg/L	130	0.50	130	0.50	A358955
Dissolved Hardness (CaCO3)	mg/L	130	0.50	131	0.50	A359075
Total Hardness (CaCO3)	mg/L	672	0.50	137	0.50	A359074
Ion Balance (% Difference)	%	5.2	N/A	6.0	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.014	0.010	0.015	0.010	A359256
Dissolved Nitrate (NO3)	mg/L	0.060	0.044	0.068	0.044	A359102
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	180	10	180	10	A359104
Un-Ionized Ammonia	mg/L	<0.00050	0.00050	<0.00061	0.00061	A359255
<b>Demand Parameters</b>						
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	<2.0 (1)	2.0	A359406
Chemical Oxygen Demand	mg/L	22	10	22	10	A363123
<b>Field Parameters</b>						
Field pH	pH	8.29	N/A	8.38	N/A	ONSITE
Field Temperature (Fd)	deg. C	9.4	N/A	9.4	N/A	ONSITE
<b>Misc. Inorganics</b>						
Conductivity	uS/cm	310	2.0	310	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	5.7	0.50	6.4	0.50	A360770
pH	pH	8.13	N/A	8.05	N/A	A360201
Total Organic Carbon (C)	mg/L	5.3	0.50	4.6	0.50	A360740
Total Dissolved Solids	mg/L	160	10	190	10	A362644
Total Suspended Solids	mg/L	24	1.0	27	1.0	A364095
<b>Anions</b>						
Alkalinity (PP as CaCO3)	mg/L	<1.0	1.0	<1.0	1.0	A360197
Alkalinity (Total as CaCO3)	mg/L	120	1.0	120	1.0	A360197
Bicarbonate (HCO3)	mg/L	150	1.0	150	1.0	A360197
Carbonate (CO3)	mg/L	<1.0	1.0	<1.0	1.0	A360197
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected						





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH681		AGH682		
<b>Sampling Date</b>		2021/09/19 12:10		2021/09/19 11:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.16	0.050	0.11	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0013	0.0010	0.0022	0.0010	A360200
Dissolved Chloride (Cl)	mg/L	5.0	1.0	4.2	1.0	A364606
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	43	1.0	44	1.0	A364606
<b>Nutrients</b>						
Total Ammonia (N)	mg/L	<0.015	0.015	<0.015	0.015	A363115
Total Inorganic Carbon (C)	mg/L	29	1.0	31	1.0	A360207
Dissolved Phosphorus (P)	mg/L	0.0031	0.0010	0.0019	0.0010	A361302
Total Phosphorus (P)	mg/L	0.024	0.0010	0.027	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.014	0.010	0.015	0.010	A360213
Total Nitrogen (N)	mg/L	0.24	0.020	0.25	0.020	A363014
<b>Misc. Organics</b>						
Naphthenic Acids	mg/L	<2.0	2.0	<2.0	2.0	A358713
<b>Physical Properties</b>						
True Colour	PtCo units	19	2.0	18	2.0	A360464
<b>Physical Properties</b>						
Turbidity	NTU	24	0.10	11	0.10	A359598
RDL = Reportable Detection Limit						





### RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AGH683			AGH684		
Sampling Date		2021/09/19 12:10			2021/09/19 14:35		
COC Number		644187-01-01			644187-01-01		
	UNITS	MESOCOSM TABLE 8	RDL	QC Batch	TREATED OSPW TANK	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.8	N/A	A359101	31	N/A	A359101
Cation Sum	meq/L	3.0	N/A	A359101	34	N/A	A359101
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO <sub>3</sub> )	mg/L	130	0.50	A358955	80	0.50	A359248
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	130	0.50	A359075	80.2	0.50	A359075
Total Hardness (CaCO <sub>3</sub> )	mg/L	137	0.50	A359074	81.8	0.50	A359074
Ion Balance (% Difference)	%	11	N/A	A359097	4.1	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.013	0.010	A359256	0.020	0.010	A359256
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.057	0.044	A359102	0.091	0.044	A359102
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A359102	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	190	10	A359104	2000	10	A359104
Un-Ionized Ammonia	mg/L	<0.00059	0.00059	A359255	0.0050	0.0028	A359255
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A359406	4.1 (1)	2.0	A359406
Chemical Oxygen Demand	mg/L	21	10	A363123	103	10	A363123
<b>Field Parameters</b>							
Field pH	pH	8.35	N/A	ONSITE	9.15	N/A	ONSITE
Field Temperature (Fd)	deg. C	9.8	N/A	ONSITE	8.2	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	310	2.0	A360202	3100	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	6.0	0.50	A360770	24	0.50	A360770
pH	pH	8.14	N/A	A360201	9.06	N/A	A360201
Total Organic Carbon (C)	mg/L	4.6	0.50	A360740	23	0.50	A360740
Total Dissolved Solids	mg/L	190	10	A362644	1900	10	A362666
Total Suspended Solids	mg/L	21	1.0	A364095	18	0.99	A364095
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A360197	57	1.0	A360197
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A360197	370	1.0	A360197
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A360197	320	1.0	A360197
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A360197	69	1.0	A360197
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH683			AGH684		
<b>Sampling Date</b>		2021/09/19 12:10			2021/09/19 14:35		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.11	0.050	A360203	2.4	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0016	0.0010	A360200	0.0056	0.0010	A360200
Dissolved Chloride (Cl)	mg/L	4.2	1.0	A364606	400	5.0	A363570
Dissolved Sulphate (SO4)	mg/L	42	1.0	A364606	590	5.0	A363570
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A363115	0.027	0.015	A363115
Total Inorganic Carbon (C)	mg/L	30	1.0	A360207	88	1.0	A360212
Dissolved Phosphorus (P)	mg/L	0.013	0.0010	A361302	0.0089	0.0010	A361302
Total Phosphorus (P)	mg/L	0.024	0.0010	A361292	0.067	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A360215	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.013	0.010	A360215	0.020	0.010	A360213
Total Nitrogen (N)	mg/L	0.21	0.020	A363014	1.5	0.020	A363014
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A360771	<2.0	2.0	A360771
<b>Physical Properties</b>							
True Colour	PtCo units	21	2.0	A360464	15	2.0	A360464
<b>Physical Properties</b>							
Turbidity	NTU	21	0.10	A359598	17	0.10	A359598
RDL = Reportable Detection Limit							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH688			AGH689		
<b>Sampling Date</b>		2021/09/19 10:45			2021/09/19 12:15		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>	<b>FIELD BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	30	N/A	A359101	0.0000	N/A	A359101
Cation Sum	meq/L	31	N/A	A359101	0.0060	N/A	A359101
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO <sub>3</sub> )	mg/L	77	0.50	A358955	<0.50	0.50	A358955
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	77.0	0.50	A359075	<0.50	0.50	A359075
Total Hardness (CaCO <sub>3</sub> )	mg/L	80.1	0.50	A359074	<0.50	0.50	A359074
Ion Balance (% Difference)	%	2.6	N/A	A359097	NC	N/A	A359097
Dissolved Nitrate (N)	mg/L	0.048	0.010	A359256	<0.010	0.010	A359256
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.21	0.044	A359102	<0.044	0.044	A359102
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A359102	<0.033	0.033	A359102
Calculated Total Dissolved Solids	mg/L	1900	10	A359104	<10	10	A359104
Un-Ionized Ammonia	mg/L	0.0065	0.0028	A359255			
Un-Ionized Ammonia @ 15 °C	mg/L				<0.00050	0.00050	A372471
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	4.8 (1)	2.0	A359406	<2.0 (2)	2.0	A359406
Chemical Oxygen Demand	mg/L	104	10	A363123	<10	10	A363123
<b>Field Parameters</b>							
Field pH	pH	9.15	N/A	ONSITE			
Field Temperature (Fd)	deg. C	8.5	N/A	ONSITE			
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	3100	2.0	A360202	<2.0	2.0	A360202
Dissolved Organic Carbon (C)	mg/L	23	0.50	A360770	<0.50	0.50	A360770
pH	pH	9.05	N/A	A360201	5.20	N/A	A360201
Total Organic Carbon (C)	mg/L	21	0.50	A360740	<0.50	0.50	A360740
Total Dissolved Solids	mg/L	2000	10	A362666	<10	10	A362666
Total Suspended Solids	mg/L	19	0.99	A364095	<1.0	1.0	A364095
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	60	1.0	A360197	<1.0	1.0	A360197
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected. (2) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AGH688			AGH689		
<b>Sampling Date</b>		2021/09/19 10:45			2021/09/19 12:15		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>	<b>FIELD BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	370	1.0	A360197	<1.0	1.0	A360197
Bicarbonate (HCO <sub>3</sub> )	mg/L	300	1.0	A360197	<1.0	1.0	A360197
Carbonate (CO <sub>3</sub> )	mg/L	73	1.0	A360197	<1.0	1.0	A360197
Dissolved Fluoride (F)	mg/L	2.5	0.050	A360203	<0.050	0.050	A360203
Hydroxide (OH)	mg/L	<1.0	1.0	A360197	<1.0	1.0	A360197
Orthophosphate (P)	mg/L	0.0042	0.0010	A361381	<0.0010	0.0010	A360200
Dissolved Chloride (Cl)	mg/L	370	5.0	A364610	<1.0	1.0	A364610
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	560	5.0	A364610	<1.0	1.0	A364610
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	0.034	0.015	A364701	<0.015	0.015	A363115
Total Inorganic Carbon (C)	mg/L	89	1.0	A360207	<1.0	1.0	A360207
Dissolved Phosphorus (P)	mg/L	0.0088	0.0010	A361302	<0.0010	0.0010	A361302
Total Phosphorus (P)	mg/L	0.083	0.0010	A361292	<0.0010	0.0010	A361292
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A360213	<0.010	0.010	A360213
Dissolved Nitrate plus Nitrite (N)	mg/L	0.048	0.010	A360213	<0.010	0.010	A360213
Total Nitrogen (N)	mg/L	1.7	0.020	A363014	0.023	0.020	A363015
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A360771	<2.0	2.0	A360771
<b>Physical Properties</b>							
True Colour	PtCo units	15	2.0	A360464	<2.0	2.0	A360464
pH (15 C)	pH				4.70		A376687
<b>Physical Properties</b>							
Turbidity	NTU	12	0.10	A359598	<0.10	0.10	A359598
RDL = Reportable Detection Limit							





### PETROLEUM HYDROCARBONS (CCME)

BV Labs ID		AGH675	AGH676	AGH677	AGH678		
Sampling Date		2021/09/19 14:50	2021/09/19 11:00	2021/09/19 10:50	2021/09/19 12:00		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A360853

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	100	108	104	105		A360853
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RDL = Reportable Detection Limit

BV Labs ID		AGH679	AGH680	AGH681	AGH682		
Sampling Date		2021/09/19 11:30	2021/09/19 11:30	2021/09/19 12:10	2021/09/19 11:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A360853

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	114	108	115	106		A360853
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RDL = Reportable Detection Limit

BV Labs ID		AGH683	AGH684	AGH688	AGH689		
Sampling Date		2021/09/19 12:10	2021/09/19 14:35	2021/09/19 10:45	2021/09/19 12:15		
COC Number		644187-01-01	644187-01-01	644187-02-01	644187-02-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	DUPLICATE	FIELD BLANK	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A360853
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A360853

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	107	110	111	110		A360853
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RDL = Reportable Detection Limit





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH675	AGH676	AGH677		
Sampling Date		2021/09/19 14:50	2021/09/19 11:00	2021/09/19 10:50		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A358685
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A358542
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A358542
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A358542
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A358542
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH675	AGH676	AGH677		
Sampling Date		2021/09/19 14:50	2021/09/19 11:00	2021/09/19 10:50		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C3-fluorene	ug/L	<0.050	0.068	<0.050	0.050	A358542
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1-dibenzothiophene	ug/L	<0.020	0.036	<0.020	0.020	A358542
C2-dibenzothiophene	ug/L	<0.020	0.068	0.023	0.020	A358542
C3-dibenzothiophene	ug/L	<0.020	0.022	<0.020	0.020	A358542
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A358810
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH675	AGH676	AGH677		
Sampling Date		2021/09/19 14:50	2021/09/19 11:00	2021/09/19 10:50		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	97	100	97		A358542
D8-ACENAPHTHYLENE (sur.)	%	77	87	76		A358542
D8-NAPHTHALENE (sur.)	%	68	75	65		A358542
TERPHENYL-D14 (sur.)	%	91	96	90		A358542
2,4,6-TRIBROMOPHENOL (sur.)	%	103	113	118		A360997
2,4-DIBROMOPHENOL (sur.)	%	98	106	112		A360997
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH678	AGH679	AGH680		
Sampling Date		2021/09/19 12:00	2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A358685
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A358542
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A358542
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A358542
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A358542
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A358542
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH678	AGH679	AGH680		
Sampling Date		2021/09/19 12:00	2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A358542
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A358542
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A358542
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A358542
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A358542
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A358810
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH678	AGH679	AGH680		
Sampling Date		2021/09/19 12:00	2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	106	113	112		A358542
D8-ACENAPHTHYLENE (sur.)	%	92	85	90		A358542
D8-NAPHTHALENE (sur.)	%	80	80	78		A358542
TERPHENYL-D14 (sur.)	%	101	110	114		A358542
2,4,6-TRIBROMOPHENOL (sur.)	%	117	115	110		A360997
2,4-DIBROMOPHENOL (sur.)	%	112	108	105		A360997
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH681	AGH682		AGH683		
Sampling Date		2021/09/19 12:10	2021/09/19 11:30		2021/09/19 12:10		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	QC Batch	MESOCOSM TABLE 8	RDL	QC Batch
<b>Polycyclic Aromatics</b>							
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	A358685	<0.010	0.010	A358685
Acenaphthene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
Acenaphthylene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
Acridine	ug/L	<0.040	<0.040	A358542	<0.040	0.040	A360850
Anthracene	ug/L	<0.010	<0.010	A358542	<0.010	0.010	A360850
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	A358542	<0.0075	0.0075	A360850
Benzo(e)pyrene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Chrysene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	A358542	<0.0075	0.0075	A360850
Fluoranthene	ug/L	<0.010	<0.010	A358542	<0.010	0.010	A360850
Fluorene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
2-Methylnaphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
Naphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
Phenanthrene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Perylene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Pyrene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
Quinoline	ug/L	<0.20	<0.20	A358542	<0.20	0.20	A360850
Retene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C1-Naphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
C3-Naphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
C4-Naphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
C2-Naphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
Biphenyl	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C1-biphenyl	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C2-biphenyl	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
RDL = Reportable Detection Limit							





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH681	AGH682		AGH683		
Sampling Date		2021/09/19 12:10	2021/09/19 11:30		2021/09/19 12:10		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	QC Batch	MESOCOSM TABLE 8	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C2-fluorene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C3-fluorene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
Dibenzothiophene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C1-dibenzothiophene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C2-dibenzothiophene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C3-dibenzothiophene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C4-dibenzothiophene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	A358542	<0.050	0.050	A360850
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	A358542	<0.020	0.020	A360850
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	A358542	<0.0085	0.0085	A360850
C1benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	A358542	<0.0075	0.0075	A360850
C2benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	A358542	<0.0075	0.0075	A360850
C1-Acenaphthene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
1-Methylnaphthalene	ug/L	<0.10	<0.10	A358542	<0.10	0.10	A360850
<b>Phenols</b>							
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
Cresols	mg/L	<0.00014	<0.00014	A358810	<0.00014	0.00014	A358810
Phenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH681	AGH682		AGH683		
Sampling Date		2021/09/19 12:10	2021/09/19 11:30		2021/09/19 12:10		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	QC Batch	MESOCOSM TABLE 8	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	A360997	<0.0010	0.0010	A360997
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2-chlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2-methylphenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
2-nitrophenol	mg/L	<0.0010	<0.0010	A360997	<0.0010	0.0010	A360997
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	A360997	<0.0010	0.0010	A360997
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
4-nitrophenol	mg/L	<0.0010	<0.0010	A360997	<0.0010	0.0010	A360997
Pentachlorophenol	mg/L	<0.00010	<0.00010	A360997	<0.00010	0.00010	A360997
<b>Surrogate Recovery (%)</b>							
D10-ANTHRACENE (sur.)	%	98	102	A358542	110		A360850
D8-ACENAPHTHYLENE (sur.)	%	76	87	A358542	96		A360850
D8-NAPHTHALENE (sur.)	%	65	75	A358542	79		A360850
TERPHENYL-D14 (sur.)	%	96	97	A358542	111		A360850
2,4,6-TRIBROMOPHENOL (sur.)	%	114	113	A360997	115		A360997
2,4-DIBROMOPHENOL (sur.)	%	110	110	A360997	108		A360997
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH684	AGH688	AGH689		
Sampling Date		2021/09/19 14:35	2021/09/19 10:45	2021/09/19 12:15		
COC Number		644187-01-01	644187-02-01	644187-02-01		
	UNITS	TREATED OSPW TANK	DUPLICATE	FIELD BLANK	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A358685
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A360850
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A360850
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A360850
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A360850
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A360850
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A360850
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A360850
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
C3-Naphthalene	ug/L	0.12	<0.10	<0.10	0.10	A360850
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A360850
RDL = Reportable Detection Limit						





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH684	AGH688	AGH689		
Sampling Date		2021/09/19 14:35	2021/09/19 10:45	2021/09/19 12:15		
COC Number		644187-01-01	644187-02-01	644187-02-01		
	UNITS	TREATED OSPW TANK	DUPLICATE	FIELD BLANK	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C3-fluorene	ug/L	0.076	0.079	<0.050	0.050	A360850
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C1-dibenzothiophene	ug/L	0.045	0.048	<0.020	0.020	A360850
C2-dibenzothiophene	ug/L	0.10	0.092	<0.020	0.020	A360850
C3-dibenzothiophene	ug/L	0.033	0.037	<0.020	0.020	A360850
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C3 phenanthrene/anthracene	ug/L	0.051	<0.050	<0.050	0.050	A360850
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A360850
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A360850
C3 fluoranthene/pyrene	ug/L	<0.020	0.021	<0.020	0.020	A360850
C4 fluoranthene/pyrene	ug/L	0.041	<0.020	<0.020	0.020	A360850
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A360850
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A360850
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A360850
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A360850
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A358810
Phenol	mg/L	<0.00010	<0.00010	0.00020	0.00010	A360997
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH684	AGH688	AGH689		
Sampling Date		2021/09/19 14:35	2021/09/19 10:45	2021/09/19 12:15		
COC Number		644187-01-01	644187-02-01	644187-02-01		
	UNITS	TREATED OSPW TANK	DUPLICATE	FIELD BLANK	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A360997
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A360997
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	126	109	101		A360850
D8-ACENAPHTHYLENE (sur.)	%	104	90	84		A360850
D8-NAPHTHALENE (sur.)	%	80	66	75		A360850
TERPHENYL-D14 (sur.)	%	125	106	101		A360850
2,4,6-TRIBROMOPHENOL (sur.)	%	122	125	118		A360997
2,4-DIBROMOPHENOL (sur.)	%	113	116	114		A360997
RDL = Reportable Detection Limit						





### MERCURY BY COLD VAPOR (WATER)

<b>BV Labs ID</b>		AGH675	AGH676	AGH677	AGH678		
<b>Sampling Date</b>		2021/09/19 14:50	2021/09/19 11:00	2021/09/19 10:50	2021/09/19 12:00		
<b>COC Number</b>		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>MESOCOSM TABLE 1</b>	<b>MESOCOSM TABLE 2</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>

#### Elements

Dissolved Mercury (Hg)	ug/L	0.00065	0.00068	0.00080	0.00098	0.00010	A370479
Total Mercury (Hg)	ug/L	0.00217	0.00183	0.00244	0.00252	0.00010	A362239

RDL = Reportable Detection Limit

<b>BV Labs ID</b>		AGH679	AGH680	AGH681		
<b>Sampling Date</b>		2021/09/19 11:30	2021/09/19 11:30	2021/09/19 12:10		
<b>COC Number</b>		644187-01-01	644187-01-01	644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>MESOCOSM TABLE 5</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>

#### Elements

Dissolved Mercury (Hg)	ug/L	0.00085	0.00086	0.00081	0.00010	A370479
Total Mercury (Hg)	ug/L	0.00286	0.00239	0.00247	0.00010	A362239

RDL = Reportable Detection Limit

<b>BV Labs ID</b>		AGH682	AGH683		AGH684		
<b>Sampling Date</b>		2021/09/19 11:30	2021/09/19 12:10		2021/09/19 14:35		
<b>COC Number</b>		644187-01-01	644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 7</b>	<b>MESOCOSM TABLE 8</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>

#### Elements

Dissolved Mercury (Hg)	ug/L	0.00090	0.00080	A370479	0.00054	0.00010	A370479
Total Mercury (Hg)	ug/L	0.00210	0.00191	A367626	0.00214	0.00010	A362239

RDL = Reportable Detection Limit

<b>BV Labs ID</b>		AGH688	AGH689		
<b>Sampling Date</b>		2021/09/19 10:45	2021/09/19 12:15		
<b>COC Number</b>		644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>DUPLICATE</b>	<b>FIELD BLANK</b>	<b>RDL</b>	<b>QC Batch</b>

#### Elements

Dissolved Mercury (Hg)	ug/L	0.00063	<0.00010	0.00010	A370479
Total Mercury (Hg)	ug/L	0.00167	0.00016	0.00010	A367626

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH675		AGH676		AGH677		
Sampling Date		2021/09/19 14:50		2021/09/19 11:00		2021/09/19 10:50		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
<b>Elements</b>								
Dissolved Calcium (Ca)	mg/L	36	0.30	15	0.30	29	0.30	A361497
Dissolved Iron (Fe)	mg/L	<0.060	0.060	<0.060	0.060	<0.060	0.060	A361497
Dissolved Magnesium (Mg)	mg/L	10	0.20	9.9	0.20	10	0.20	A361497
Dissolved Manganese (Mn)	mg/L	0.0074	0.0040	0.0044	0.0040	<0.0040	0.0040	A361497
Dissolved Potassium (K)	mg/L	1.0	0.30	11	0.30	4.2	0.30	A361497
Dissolved Sodium (Na)	mg/L	9.2	0.50	720	2.5	200	0.50	A361497
<b>Dissolved Metals by ICPMS</b>								
Dissolved Aluminum (Al)	ug/L	6.79	0.50	79.4	0.50	27.7	0.50	A364431
Dissolved Antimony (Sb)	ug/L	0.057	0.020	0.824	0.020	0.312	0.020	A364431
Dissolved Arsenic (As)	ug/L	0.289	0.020	9.55	0.020	3.17	0.020	A364431
Dissolved Barium (Ba)	ug/L	42.5	0.020	37.7	0.020	43.7	0.020	A364431
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	A364431
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.0050	0.0050	<0.0050	0.0050	A364431
Dissolved Boron (B)	ug/L	133	10	2620 (1)	50	938	10	A364431
Dissolved Cadmium (Cd)	ug/L	0.0089	0.0050	<0.0050	0.0050	<0.0050	0.0050	A364431
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	0.21	0.10	0.13	0.10	A364431
Dissolved Cobalt (Co)	ug/L	0.0801	0.0050	0.265	0.0050	0.132	0.0050	A364431
Dissolved Copper (Cu)	ug/L	0.700	0.050	0.439	0.050	0.735	0.050	A364431
Dissolved Iron (Fe)	ug/L	25.8	1.0	43.2	1.0	29.0	1.0	A364431
Dissolved Lead (Pb)	ug/L	0.0185	0.0050	0.0119	0.0050	0.0150	0.0050	A364431
Dissolved Lithium (Li)	ug/L	5.86	0.50	112	0.50	38.9	0.50	A364431
Dissolved Manganese (Mn)	ug/L	6.45	0.050	3.00	0.050	1.97	0.050	A364431
Dissolved Molybdenum (Mo)	ug/L	1.02	0.050	685	0.050	204	0.050	A364431
Dissolved Nickel (Ni)	ug/L	0.779	0.020	3.52	0.020	1.67	0.020	A364431
Dissolved Selenium (Se)	ug/L	0.213	0.040	2.55	0.040	0.932	0.040	A364431
Dissolved Silicon (Si)	ug/L	1410	50	1680	50	1480	50	A364431
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	<0.0050	0.0050	<0.0050	0.0050	A364431
Dissolved Strontium (Sr)	ug/L	212	0.050	403	0.050	285	0.050	A364431
Dissolved Thallium (Tl)	ug/L	0.0031	0.0020	0.0056	0.0020	0.0053	0.0020	A364431
Dissolved Tin (Sn)	ug/L	<0.20	0.20	<0.20	0.20	<0.20	0.20	A364431
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	A364431
RDL = Reportable Detection Limit								
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH675		AGH676		AGH677		
Sampling Date		2021/09/19 14:50		2021/09/19 11:00		2021/09/19 10:50		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
Dissolved Uranium (U)	ug/L	0.420	0.0020	6.93	0.0020	2.52	0.0020	A364431
Dissolved Vanadium (V)	ug/L	0.25	0.20	1880 (1)	1.0	469	0.20	A364431
Dissolved Zinc (Zn)	ug/L	4.42	0.10	3.77	0.10	1.50	0.10	A364431
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	0.70	0.10	0.24	0.10	A364431
Dissolved Calcium (Ca)	mg/L	35.6	0.050	15.0	0.050	28.9	0.050	A359076
Dissolved Magnesium (Mg)	mg/L	8.89	0.050	8.51	0.050	9.14	0.050	A359076
Dissolved Potassium (K)	mg/L	0.950	0.050	10.8	0.050	3.75	0.050	A359076
Dissolved Sodium (Na)	mg/L	8.29	0.050	633	0.25	187	0.050	A359076
Dissolved Sulphur (S)	mg/L	6.4	3.0	159	3.0	41.4	3.0	A359076
<b>Total Metals by ICPMS</b>								
Total Aluminum (Al)	ug/L	102	0.50	129	0.50	262	0.50	A370485
Total Antimony (Sb)	ug/L	0.064	0.020	0.844	0.020	0.279	0.020	A370485
Total Arsenic (As)	ug/L	0.485	0.020	11.0	0.020	3.46	0.020	A370485
Total Barium (Ba)	ug/L	51.6	0.020	50.8	0.020	49.9	0.020	A370485
Total Beryllium (Be)	ug/L	0.019	0.010	0.015	0.010	0.026	0.010	A370485
Total Bismuth (Bi)	ug/L	0.0053	0.0050	<0.0050	0.0050	0.0058	0.0050	A370485
Total Boron (B)	ug/L	97	10	2360 (1)	50	622	10	A370485
Total Cadmium (Cd)	ug/L	0.0189	0.0050	<0.0050	0.0050	<0.0050	0.0050	A370485
Total Chromium (Cr)	ug/L	0.28	0.10	0.34	0.10	0.50	0.10	A370485
Total Cobalt (Co)	ug/L	0.258	0.0050	0.485	0.0050	0.365	0.0050	A370485
Total Copper (Cu)	ug/L	1.03	0.050	0.480	0.050	0.973	0.050	A370485
Total Iron (Fe)	ug/L	454	1.0	785	1.0	711	1.0	A370485
Total Lead (Pb)	ug/L	0.339	0.0050	0.203	0.0050	0.342	0.0050	A370485
Total Lithium (Li)	ug/L	5.09	0.50	102	0.50	34.1	0.50	A370485
Total Manganese (Mn)	ug/L	34.7	0.050	31.6	0.050	34.4	0.050	A370485
Total Molybdenum (Mo)	ug/L	1.59	0.050	694	0.050	192	0.050	A370485
Total Nickel (Ni)	ug/L	1.20	0.020	4.53	0.020	2.33	0.020	A370485
Total Selenium (Se)	ug/L	0.210	0.040	2.53	0.040	0.888	0.040	A370485
Total Silicon (Si)	ug/L	1420	50	1830	50	1950	50	A370485
Total Silver (Ag)	ug/L	<0.0050	0.0050	<0.0050	0.0050	<0.0050	0.0050	A370485
Total Strontium (Sr)	ug/L	225	0.050	443	0.050	274	0.050	A370485
Total Thallium (Tl)	ug/L	0.0055	0.0020	0.0083	0.0020	0.0080	0.0020	A370485
RDL = Reportable Detection Limit								
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.								



### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH675		AGH676		AGH677		
Sampling Date		2021/09/19 14:50		2021/09/19 11:00		2021/09/19 10:50		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
Total Tin (Sn)	ug/L	<0.20	0.20	<0.20	0.20	<0.20	0.20	A370485
Total Titanium (Ti)	ug/L	1.66	0.50	1.60	0.50	8.98	0.50	A370485
Total Uranium (U)	ug/L	0.461	0.0020	7.03	0.0020	2.44	0.0020	A370485
Total Vanadium (V)	ug/L	1.95	0.20	2100 (1)	1.0	477	0.20	A370485
Total Zinc (Zn)	ug/L	3.65	0.10	4.46	0.10	3.24	0.10	A370485
Total Zirconium (Zr)	ug/L	0.14	0.10	0.77	0.10	0.40	0.10	A370485
Total Calcium (Ca)	mg/L	35.5	0.050	17.1	0.050	29.5	0.050	A359077
Total Magnesium (Mg)	mg/L	8.21	0.050	7.86	0.050	7.73	0.050	A359077
Total Potassium (K)	mg/L	0.941	0.050	9.68	0.050	3.35	0.050	A359077
Total Sodium (Na)	mg/L	7.83	0.050	753	0.25	154	0.050	A359077
Total Sulphur (S)	mg/L	7.1	3.0	167	3.0	41.1	3.0	A359077

RDL = Reportable Detection Limit

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





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH678		AGH679	AGH680		
Sampling Date		2021/09/19 12:00		2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	QC Batch	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	33	A361497	35	35	0.30	A361497
Dissolved Iron (Fe)	mg/L	<0.060	A361497	<0.060	<0.060	0.060	A361497
Dissolved Magnesium (Mg)	mg/L	10	A361497	10	10	0.20	A361497
Dissolved Manganese (Mn)	mg/L	<0.0040	A361497	<0.0040	<0.0040	0.0040	A361497
Dissolved Potassium (K)	mg/L	2.1	A361497	1.3	1.1	0.30	A361497
Dissolved Sodium (Na)	mg/L	70	A361497	28	16	0.50	A361497
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	11.4	A364431	7.25	6.35	0.50	A364431
Dissolved Antimony (Sb)	ug/L	0.122	A364431	0.083	0.072	0.020	A364431
Dissolved Arsenic (As)	ug/L	1.16	A364431	0.586	0.412	0.020	A364431
Dissolved Barium (Ba)	ug/L	42.0	A364431	42.9	41.5	0.020	A364431
Dissolved Beryllium (Be)	ug/L	<0.010	A364431	<0.010	<0.010	0.010	A364431
Dissolved Bismuth (Bi)	ug/L	<0.0050	A364431	<0.0050	<0.0050	0.0050	A364431
Dissolved Boron (B)	ug/L	265	A364431	107	59	10	A364431
Dissolved Cadmium (Cd)	ug/L	<0.0050	A364431	<0.0050	0.0064	0.0050	A364431
Dissolved Chromium (Cr)	ug/L	0.11	A364431	<0.10	<0.10	0.10	A364431
Dissolved Cobalt (Co)	ug/L	0.0843	A364431	0.0803	0.0760	0.0050	A364431
Dissolved Copper (Cu)	ug/L	0.692	A364431	0.758	0.788	0.050	A364431
Dissolved Iron (Fe)	ug/L	22.0	A364431	22.7	25.5	1.0	A364431
Dissolved Lead (Pb)	ug/L	0.0130	A364431	0.0173	0.0186	0.0050	A364431
Dissolved Lithium (Li)	ug/L	16.2	A364431	8.95	6.81	0.50	A364431
Dissolved Manganese (Mn)	ug/L	1.42	A364431	1.74	1.36	0.050	A364431
Dissolved Molybdenum (Mo)	ug/L	59.8	A364431	20.0	7.32	0.050	A364431
Dissolved Nickel (Ni)	ug/L	1.04	A364431	0.879	0.776	0.020	A364431
Dissolved Selenium (Se)	ug/L	0.470	A364431	0.275	0.245	0.040	A364431
Dissolved Silicon (Si)	ug/L	1400	A364431	1190	1120	50	A364431
Dissolved Silver (Ag)	ug/L	<0.0050	A364431	<0.0050	<0.0050	0.0050	A364431
Dissolved Strontium (Sr)	ug/L	230	A364431	222	216	0.050	A364431
Dissolved Thallium (Tl)	ug/L	0.0044	A364431	0.0048	0.0047	0.0020	A364431
Dissolved Tin (Sn)	ug/L	<0.20	A364431	<0.20	<0.20	0.20	A364431
Dissolved Titanium (Ti)	ug/L	<0.50	A364431	<0.50	<0.50	0.50	A364431
Dissolved Uranium (U)	ug/L	1.03	A364431	0.638	0.503	0.0020	A364431
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH678		AGH679	AGH680		
Sampling Date		2021/09/19 12:00		2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	QC Batch	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	138	A364431	45.2	15.9	0.20	A364431
Dissolved Zinc (Zn)	ug/L	1.02	A364431	0.99	1.28	0.10	A364431
Dissolved Zirconium (Zr)	ug/L	<0.10	A364431	<0.10	<0.10	0.10	A364431
Dissolved Calcium (Ca)	mg/L	33.1	A359076	34.6	34.7	0.050	A359076
Dissolved Magnesium (Mg)	mg/L	8.79	A359076	9.06	8.95	0.050	A359076
Dissolved Potassium (K)	mg/L	1.77	A359076	1.25	1.06	0.050	A359076
Dissolved Sodium (Na)	mg/L	61.1	A359076	25.9	14.3	0.050	A359076
Dissolved Sulphur (S)	mg/L	17.0	A359076	10.2	12.1	3.0	A359076
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	510	A364270	496	583	3.0	A366781
Total Antimony (Sb)	ug/L	0.159	A364270	0.111	0.096	0.020	A366781
Total Arsenic (As)	ug/L	1.64	A364270	0.980	0.729	0.020	A366781
Total Barium (Ba)	ug/L	57.6	A364270	57.5	56.3	0.050	A366781
Total Beryllium (Be)	ug/L	0.034	A364270	0.032	0.029	0.010	A366781
Total Bismuth (Bi)	ug/L	<0.010	A364270	<0.010	<0.010	0.010	A366781
Total Boron (B)	ug/L	239	A364270	110	73	10	A366781
Total Cadmium (Cd)	ug/L	0.0138	A364270	0.0146	0.0157	0.0050	A366781
Total Chromium (Cr)	ug/L	0.71	A364270	0.71	0.81	0.10	A366781
Total Cobalt (Co)	ug/L	0.372	A364270	0.410	0.418	0.010	A366781
Total Copper (Cu)	ug/L	1.33	A364270	1.55	1.46	0.10	A366781
Total Iron (Fe)	ug/L	784	A364270	826	860	5.0	A366781
Total Lead (Pb)	ug/L	0.398	A364270	0.436	0.427	0.020	A366781
Total Lithium (Li)	ug/L	14.5	A364270	9.74	7.57	0.50	A366781
Total Manganese (Mn)	ug/L	33.7	A364270	40.0	38.8	0.10	A366781
Total Molybdenum (Mo)	ug/L	72.3	A364270	22.8	8.20	0.050	A366781
Total Nickel (Ni)	ug/L	1.84	A364270	1.72	1.72	0.10	A366781
Total Phosphorus (P)	ug/L	41.3	A364270	34.5	34.3	5.0	A366781
Total Selenium (Se)	ug/L	0.442	A364270	0.263	0.197	0.040	A366781
Total Silicon (Si)	ug/L	2430	A364270	2340	2440	50	A366781
Total Silver (Ag)	ug/L	<0.010	A364270	<0.010	<0.010	0.010	A366781
Total Strontium (Sr)	ug/L	299	A364270	287	275	0.050	A366781
Total Thallium (Tl)	ug/L	0.0130	A364270	0.0102	0.0085	0.0020	A366781
Total Tin (Sn)	ug/L	<0.20	A364270	<0.20	<0.20	0.20	A366781
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH678		AGH679	AGH680		
Sampling Date		2021/09/19 12:00		2021/09/19 11:30	2021/09/19 11:30		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	QC Batch	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
Total Titanium (Ti)	ug/L	11.3	A364270	10.1	16.0	2.0	A366781
Total Uranium (U)	ug/L	1.18	A364270	0.694	0.538	0.0050	A366781
Total Vanadium (V)	ug/L	166	A364270	57.8	20.6	0.20	A366781
Total Zinc (Zn)	ug/L	3.0	A364270	4.8	6.7	1.0	A366781
Total Zirconium (Zr)	ug/L	0.52	A364270	0.51	0.66	0.10	A366781
Total Calcium (Ca)	mg/L	33.5	A359077	35.6	35.0	0.25	A359077
Total Magnesium (Mg)	mg/L	10.5	A359077	11.2	10.9	0.25	A359077
Total Potassium (K)	mg/L	2.20	A359077	1.58	1.38	0.25	A359077
Total Sodium (Na)	mg/L	69.7	A359077	30.2	16.4	0.25	A359077
Total Sulphur (S)	mg/L	29.5	A359077	19.2	15.0	3.0	A359077
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH681		AGH682	AGH683		
Sampling Date		2021/09/19 12:10		2021/09/19 11:30	2021/09/19 12:10		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	QC Batch	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	35	A361497	35	35	0.30	A361497
Dissolved Iron (Fe)	mg/L	<0.060	A361497	<0.060	<0.060	0.060	A361497
Dissolved Magnesium (Mg)	mg/L	10	A361497	10	10	0.20	A361497
Dissolved Manganese (Mn)	mg/L	<0.0040	A361497	<0.0040	<0.0040	0.0040	A361497
Dissolved Potassium (K)	mg/L	1.1	A361497	1.0	1.1	0.30	A361497
Dissolved Sodium (Na)	mg/L	11	A361497	9.3	9.2	0.50	A361497
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	6.03	A364431	5.58	5.87	0.50	A364431
Dissolved Antimony (Sb)	ug/L	0.065	A364431	0.064	0.063	0.020	A364431
Dissolved Arsenic (As)	ug/L	0.344	A364431	0.314	0.289	0.020	A364431
Dissolved Barium (Ba)	ug/L	43.5	A364431	43.2	41.3	0.020	A364431
Dissolved Beryllium (Be)	ug/L	<0.010	A364431	<0.010	<0.010	0.010	A364431
Dissolved Bismuth (Bi)	ug/L	<0.0050	A364431	<0.0050	<0.0050	0.0050	A364431
Dissolved Boron (B)	ug/L	38	A364431	43	101	10	A364431
Dissolved Cadmium (Cd)	ug/L	0.0094	A364431	0.0108	0.0087	0.0050	A364431
Dissolved Chromium (Cr)	ug/L	0.12	A364431	<0.10	<0.10	0.10	A364431
Dissolved Cobalt (Co)	ug/L	0.0649	A364431	0.0666	0.0671	0.0050	A364431
Dissolved Copper (Cu)	ug/L	0.770	A364431	0.760	0.692	0.050	A364431
Dissolved Iron (Fe)	ug/L	22.5	A364431	22.3	26.7	1.0	A364431
Dissolved Lead (Pb)	ug/L	0.0153	A364431	0.0158	0.0170	0.0050	A364431
Dissolved Lithium (Li)	ug/L	5.88	A364431	5.50	5.58	0.50	A364431
Dissolved Manganese (Mn)	ug/L	1.51	A364431	1.58	2.12	0.050	A364431
Dissolved Molybdenum (Mo)	ug/L	2.17	A364431	0.868	1.03	0.050	A364431
Dissolved Nickel (Ni)	ug/L	0.832	A364431	0.804	0.757	0.020	A364431
Dissolved Selenium (Se)	ug/L	0.216	A364431	0.220	0.230	0.040	A364431
Dissolved Silicon (Si)	ug/L	1150	A364431	1110	1210	50	A364431
Dissolved Silver (Ag)	ug/L	<0.0050	A364431	<0.0050	<0.0050	0.0050	A364431
Dissolved Strontium (Sr)	ug/L	222	A364431	223	211	0.050	A364431
Dissolved Thallium (Tl)	ug/L	0.0034	A364431	0.0033	0.0034	0.0020	A364431
Dissolved Tin (Sn)	ug/L	<0.20	A364431	<0.20	<0.20	0.20	A364431
Dissolved Titanium (Ti)	ug/L	<0.50	A364431	<0.50	<0.50	0.50	A364431
Dissolved Uranium (U)	ug/L	0.459	A364431	0.427	0.399	0.0020	A364431
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH681		AGH682	AGH683		
Sampling Date		2021/09/19 12:10		2021/09/19 11:30	2021/09/19 12:10		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	QC Batch	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	3.44	A364431	0.23	0.24	0.20	A364431
Dissolved Zinc (Zn)	ug/L	1.31	A364431	2.71	2.12	0.10	A364431
Dissolved Zirconium (Zr)	ug/L	<0.10	A364431	<0.10	<0.10	0.10	A364431
Dissolved Calcium (Ca)	mg/L	35.0	A359076	34.5	35.4	0.050	A359076
Dissolved Magnesium (Mg)	mg/L	9.17	A359076	8.90	8.38	0.050	A359076
Dissolved Potassium (K)	mg/L	1.01	A359076	0.986	0.916	0.050	A359076
Dissolved Sodium (Na)	mg/L	9.76	A359076	8.46	7.84	0.050	A359076
Dissolved Sulphur (S)	mg/L	6.9	A359076	7.4	5.4	3.0	A359076
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	2750	A366781	661	555	3.0	A364270
Total Antimony (Sb)	ug/L	0.490	A366781	0.089	0.094	0.020	A364270
Total Arsenic (As)	ug/L	3.05	A366781	0.672	0.531	0.020	A364270
Total Barium (Ba)	ug/L	289	A366781	60.8	59.7	0.050	A364270
Total Beryllium (Be)	ug/L	0.162	A366781	0.042	0.030	0.010	A364270
Total Bismuth (Bi)	ug/L	0.039	A366781	<0.010	<0.010	0.010	A364270
Total Boron (B)	ug/L	425	A366781	53	92	10	A364270
Total Cadmium (Cd)	ug/L	0.0763	A366781	0.0269	0.0277	0.0050	A364270
Total Chromium (Cr)	ug/L	4.22	A366781	0.99	0.72	0.10	A364270
Total Cobalt (Co)	ug/L	2.06	A366781	0.454	0.380	0.010	A364270
Total Copper (Cu)	ug/L	7.43	A366781	1.63	1.40	0.10	A364270
Total Iron (Fe)	ug/L	4300	A366781	990	832	5.0	A364270
Total Lead (Pb)	ug/L	2.17	A366781	0.514	0.470	0.020	A364270
Total Lithium (Li)	ug/L	34.9	A366781	5.90	5.96	0.50	A364270
Total Manganese (Mn)	ug/L	191	A366781	41.6	37.1	0.10	A364270
Total Molybdenum (Mo)	ug/L	12.2	A366781	1.00	1.14	0.050	A364270
Total Nickel (Ni)	ug/L	9.04	A366781	2.65	1.72	0.10	A364270
Total Phosphorus (P)	ug/L	33.6	A366781	45.7	38.7	5.0	A364270
Total Selenium (Se)	ug/L	0.990	A366781	0.261	0.265	0.040	A364270
Total Silicon (Si)	ug/L	12100	A366781	2560	2430	50	A364270
Total Silver (Ag)	ug/L	0.020	A366781	<0.010	<0.010	0.010	A364270
Total Strontium (Sr)	ug/L	1380	A366781	284	283	0.050	A364270
Total Thallium (Tl)	ug/L	0.0476	A366781	0.0159	0.0125	0.0020	A364270
Total Tin (Sn)	ug/L	0.21	A366781	<0.20	<0.20	0.20	A364270
RDL = Reportable Detection Limit							





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH681		AGH682	AGH683		
Sampling Date		2021/09/19 12:10		2021/09/19 11:30	2021/09/19 12:10		
COC Number		644187-01-01		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	QC Batch	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
Total Titanium (Ti)	ug/L	53.6	A366781	12.8	12.2	2.0	A364270
Total Uranium (U)	ug/L	2.51	A366781	0.512	0.507	0.0050	A364270
Total Vanadium (V)	ug/L	28.2	A366781	1.81	1.76	0.20	A364270
Total Zinc (Zn)	ug/L	11.6	A366781	4.1	4.3	1.0	A364270
Total Zirconium (Zr)	ug/L	2.55	A366781	0.46	0.46	0.10	A364270
Total Calcium (Ca)	mg/L	179	A359077	36.8	36.6	0.25	A359077
Total Magnesium (Mg)	mg/L	54.7	A359077	11.0	11.1	0.25	A359077
Total Potassium (K)	mg/L	6.52	A359077	1.34	1.31	0.25	A359077
Total Sodium (Na)	mg/L	56.2	A359077	9.69	9.88	0.25	A359077
Total Sulphur (S)	mg/L	67.0	A359077	11.1	12.1	3.0	A359077
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH684		AGH688			AGH689		
Sampling Date		2021/09/19 14:35		2021/09/19 10:45			2021/09/19 12:15		
COC Number		644187-01-01		644187-02-01			644187-02-01		
	UNITS	TREATED OSPW TANK	RDL	DUPLICATE	RDL	QC Batch	FIELD BLANK	RDL	QC Batch

Elements									
Dissolved Calcium (Ca)	mg/L	16	0.30	15	0.30	A361497	<0.30	0.30	A361497
Dissolved Iron (Fe)	mg/L	<0.060	0.060	<0.060	0.060	A361497	<0.060	0.060	A361497
Dissolved Magnesium (Mg)	mg/L	9.9	0.20	9.6	0.20	A361497	<0.20	0.20	A361497
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	<0.0040	0.0040	A361497	<0.0040	0.0040	A361497
Dissolved Potassium (K)	mg/L	11	0.30	11	0.30	A361497	<0.30	0.30	A361497
Dissolved Sodium (Na)	mg/L	730	2.5	680	2.5	A361497	<0.50	0.50	A361497
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	71.1	0.50	81.8	0.50	A364431	0.75	0.50	A364431
Dissolved Antimony (Sb)	ug/L	0.809	0.020	0.845	0.020	A364431	<0.020	0.020	A364431
Dissolved Arsenic (As)	ug/L	9.47	0.020	9.48	0.020	A364431	<0.020	0.020	A364431
Dissolved Barium (Ba)	ug/L	37.0	0.020	39.0	0.020	A364431	0.045	0.020	A364431
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	<0.010	0.010	A364431	<0.010	0.010	A364431
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.0050	0.0050	A364431	<0.0050	0.0050	A364431
Dissolved Boron (B)	ug/L	2630 (1)	50	2560 (1)	50	A364431	<10	10	A364431
Dissolved Cadmium (Cd)	ug/L	<0.0050	0.0050	<0.0050	0.0050	A364431	<0.0050	0.0050	A364431
Dissolved Chromium (Cr)	ug/L	0.20	0.10	0.21	0.10	A364431	<0.10	0.10	A364431
Dissolved Cobalt (Co)	ug/L	0.268	0.0050	0.279	0.0050	A364431	<0.0050	0.0050	A364431
Dissolved Copper (Cu)	ug/L	0.339	0.050	0.420	0.050	A364431	<0.050	0.050	A364431
Dissolved Iron (Fe)	ug/L	52.8	1.0	41.5	1.0	A364431	<1.0	1.0	A364431
Dissolved Lead (Pb)	ug/L	0.0131	0.0050	0.0132	0.0050	A364431	<0.0050	0.0050	A364431
Dissolved Lithium (Li)	ug/L	113	0.50	133	0.50	A364431	<0.50	0.50	A364431
Dissolved Manganese (Mn)	ug/L	3.15	0.050	2.97	0.050	A364431	<0.050	0.050	A364431
Dissolved Molybdenum (Mo)	ug/L	680	0.050	711	0.050	A364431	<0.050	0.050	A364431
Dissolved Nickel (Ni)	ug/L	3.38	0.020	3.52	0.020	A364431	0.039	0.020	A364431
Dissolved Selenium (Se)	ug/L	2.72	0.040	2.42	0.040	A364431	<0.040	0.040	A364431
Dissolved Silicon (Si)	ug/L	1700	50	1770	50	A364431	<50	50	A364431
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	<0.0050	0.0050	A364431	<0.0050	0.0050	A364431
Dissolved Strontium (Sr)	ug/L	411	0.050	425	0.050	A364431	<0.050	0.050	A364431
Dissolved Thallium (Tl)	ug/L	0.0056	0.0020	0.0054	0.0020	A364431	<0.0020	0.0020	A364431
Dissolved Tin (Sn)	ug/L	<0.20	0.20	<0.20	0.20	A364431	<0.20	0.20	A364431
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	<0.50	0.50	A364431	<0.50	0.50	A364431

RDL = Reportable Detection Limit

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





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH684		AGH688			AGH689		
Sampling Date		2021/09/19 14:35		2021/09/19 10:45			2021/09/19 12:15		
COC Number		644187-01-01		644187-02-01			644187-02-01		
	UNITS	TREATED OSPW TANK	RDL	DUPLICATE	RDL	QC Batch	FIELD BLANK	RDL	QC Batch
Dissolved Uranium (U)	ug/L	6.65	0.0020	6.83	0.0020	A364431	<0.0020	0.0020	A364431
Dissolved Vanadium (V)	ug/L	1580 (1)	1.0	1530 (1)	1.0	A364431	<0.20	0.20	A364431
Dissolved Zinc (Zn)	ug/L	0.90	0.10	8.54	0.10	A364431	0.69	0.10	A364431
Dissolved Zirconium (Zr)	ug/L	0.83	0.10	0.90	0.10	A364431	<0.10	0.10	A364431
Dissolved Calcium (Ca)	mg/L	15.6	0.050	15.1	0.050	A359076	<0.050	0.050	A359076
Dissolved Magnesium (Mg)	mg/L	8.15	0.050	8.64	0.050	A359076	<0.050	0.050	A359076
Dissolved Potassium (K)	mg/L	10.5	0.050	11.0	0.050	A359076	<0.050	0.050	A359076
Dissolved Sodium (Na)	mg/L	631	0.25	609	0.25	A359076	<0.050	0.050	A359076
Dissolved Sulphur (S)	mg/L	144	3.0	165	3.0	A359076	<3.0	3.0	A359076
<b>Total Metals by ICPMS</b>									
Total Aluminum (Al)	ug/L	215	15	220	3.0	A364270	1.09	0.50	A365149
Total Antimony (Sb)	ug/L	1.05	0.50	0.981	0.020	A364270	<0.020	0.020	A365149
Total Arsenic (As)	ug/L	11.4	0.50	10.5	0.020	A364270	<0.020	0.020	A365149
Total Barium (Ba)	ug/L	50.5	1.3	50.2	0.050	A364270	<0.020	0.020	A365149
Total Beryllium (Be)	ug/L	<0.25	0.25	0.021	0.010	A364270	<0.010	0.010	A365149
Total Bismuth (Bi)	ug/L	<0.25	0.25	<0.010	0.010	A364270	<0.0050	0.0050	A365149
Total Boron (B)	ug/L	2770	250	2060	10	A364270	13	10	A365149
Total Cadmium (Cd)	ug/L	<0.13	0.13	<0.0050	0.0050	A364270	<0.0050	0.0050	A365149
Total Chromium (Cr)	ug/L	<2.5	2.5	0.47	0.10	A364270	<0.10	0.10	A365149
Total Cobalt (Co)	ug/L	0.583	0.050	0.541	0.010	A364270	<0.0050	0.0050	A365149
Total Copper (Cu)	ug/L	<2.5	2.5	0.48	0.10	A364270	<0.050	0.050	A365149
Total Iron (Fe)	ug/L	739	25	632	5.0	A364270	<1.0	1.0	A365149
Total Lead (Pb)	ug/L	<0.50	0.50	0.169	0.020	A364270	<0.0050	0.0050	A365149
Total Lithium (Li)	ug/L	106	13	107	0.50	A364270	<0.50	0.50	A365149
Total Manganese (Mn)	ug/L	30.6	0.50	26.6	0.10	A364270	<0.050	0.050	A365149
Total Molybdenum (Mo)	ug/L	766	1.3	813	0.050	A364270	<0.050	0.050	A365149
Total Nickel (Ni)	ug/L	4.8	2.5	6.46	0.10	A364270	<0.020	0.020	A365149
Total Phosphorus (P)	ug/L	105	25	90.4	5.0	A364270			
Total Selenium (Se)	ug/L	2.9	1.0	2.35	0.040	A364270	<0.040	0.040	A365149
Total Silicon (Si)	ug/L	2310	1300	2210	50	A364270	<50	50	A365149
Total Silver (Ag)	ug/L	<0.25	0.25	<0.010	0.010	A364270	<0.0050	0.0050	A365149
Total Strontium (Sr)	ug/L	516	1.3	542	0.050	A364270	<0.050	0.050	A365149
RDL = Reportable Detection Limit									
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.									





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AGH684		AGH688			AGH689		
Sampling Date		2021/09/19 14:35		2021/09/19 10:45			2021/09/19 12:15		
COC Number		644187-01-01		644187-02-01			644187-02-01		
	UNITS	TREATED OSPW TANK	RDL	DUPLICATE	RDL	QC Batch	FIELD BLANK	RDL	QC Batch
Total Thallium (Tl)	ug/L	<0.050	0.050	0.0092	0.0020	A364270	<0.0020	0.0020	A365149
Total Tin (Sn)	ug/L	<5.0	5.0	<0.20	0.20	A364270	<0.20	0.20	A365149
Total Titanium (Ti)	ug/L	<50	50	6.1	2.0	A364270	<0.50	0.50	A365149
Total Uranium (U)	ug/L	7.41	0.13	7.41	0.0050	A364270	<0.0020	0.0020	A365149
Total Vanadium (V)	ug/L	1720	5.0	1750	0.20	A364270	<0.20	0.20	A365149
Total Zinc (Zn)	ug/L	<25	25	4.0	1.0	A364270	0.41	0.10	A365149
Total Zirconium (Zr)	ug/L	<2.5	2.5	1.06	0.10	A364270	<0.10	0.10	A365149
Total Calcium (Ca)	mg/L	15.8	6.3	15.7	0.25	A359077	<0.050	0.050	A359077
Total Magnesium (Mg)	mg/L	10.3	6.3	9.91	0.25	A359077	<0.050	0.050	A359077
Total Potassium (K)	mg/L	11.2	6.3	11.2	0.25	A359077	<0.050	0.050	A359077
Total Sodium (Na)	mg/L	651	6.3	680	1.3	A359077	<0.050	0.050	A359077
Total Sulphur (S)	mg/L	205	75	192	3.0	A359077	<3.0	3.0	A359077
RDL = Reportable Detection Limit									





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH675		AGH676		AGH677		
Sampling Date		2021/09/19 14:50		2021/09/19 11:00		2021/09/19 10:50		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	QC Batch	MESOCOSM TABLE 1	QC Batch	MESOCOSM TABLE 2	RDL	QC Batch
<b>Volatiles</b>								
Total Trihalomethanes	ug/L	<1.3	A358819	<1.3	A358819	<1.3	1.3	A358819
Benzene	ug/L	<0.40	A360366	<0.40	A360366	<0.40	0.40	A360366
Bromodichloromethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Toluene	ug/L	<0.40	A360366	<0.40	A360366	<0.40	0.40	A360366
Bromoform	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Ethylbenzene	ug/L	<0.40	A360366	<0.40	A360366	<0.40	0.40	A360366
Bromomethane	ug/L	<2.0	A360451	<2.0	A363344	<2.0	2.0	A360451
m & p-Xylene	ug/L	<0.80	A360366	<0.80	A360366	<0.80	0.80	A360366
Carbon tetrachloride	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
o-Xylene	ug/L	<0.40	A360366	<0.40	A360366	<0.40	0.40	A360366
Chlorobenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Dibromochloromethane	ug/L	<1.0	A360451	<1.0	A363344	<1.0	1.0	A360451
Xylenes (Total)	ug/L	<0.89	A359161	<0.89	A359161	<0.89	0.89	A359161
Chloroethane	ug/L	<1.0	A360451	<1.0	A363344	<1.0	1.0	A360451
F1 (C6-C10) - BTEX	ug/L	<100	A359161	<100	A359161	<100	100	A359161
Chloroform	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Chloromethane	ug/L	<2.0	A360451	<2.0	A363344	<2.0	2.0	A360451
F1 (C6-C10)	ug/L	<100	A360366	<100	A360366	<100	100	A360366
1,2-dibromoethane	ug/L	<0.20	A360451	<0.20	A363344	<0.20	0.20	A360451
1,2-dichlorobenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,3-dichlorobenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,4-dichlorobenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,1-dichloroethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,2-dichloroethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,1-dichloroethene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
cis-1,2-dichloroethene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
trans-1,2-dichloroethene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Dichloromethane	ug/L	<2.0	A360451	<2.0	A363344	<2.0	2.0	A360451
1,2-dichloropropane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
cis-1,3-dichloropropene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
trans-1,3-dichloropropene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Methyl methacrylate	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH675		AGH676		AGH677		
Sampling Date		2021/09/19 14:50		2021/09/19 11:00		2021/09/19 10:50		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	QC Batch	MESOCOSM TABLE 1	QC Batch	MESOCOSM TABLE 2	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Styrene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,1,1,2-tetrachloroethane	ug/L	<1.0	A360451	<1.0	A363344	<1.0	1.0	A360451
1,1,2,2-tetrachloroethane	ug/L	<2.0	A360451	<2.0	A363344	<2.0	2.0	A360451
Tetrachloroethene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,2,3-trichlorobenzene	ug/L	<1.0	A360451	<1.0	A363344	<1.0	1.0	A360451
1,2,4-trichlorobenzene	ug/L	<1.0	A360451	<1.0	A363344	<1.0	1.0	A360451
1,3,5-trichlorobenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,1,1-trichloroethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,1,2-trichloroethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Trichloroethene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Trichlorofluoromethane	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,2,4-trimethylbenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
1,3,5-trimethylbenzene	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
Vinyl chloride	ug/L	<0.50	A360451	<0.50	A363344	<0.50	0.50	A360451
<b>Surrogate Recovery (%)</b>								
1,4-Difluorobenzene (sur.)	%	106	A360366	107	A360366	105		A360366
4-Bromofluorobenzene (sur.)	%	99	A360366	101	A360366	100		A360366
D4-1,2-Dichloroethane (sur.)	%	97	A360366	99	A360366	97		A360366
1,4-Difluorobenzene (sur.)	%	99	A360451	102	A363344	100		A360451
4-Bromofluorobenzene (sur.)	%	97	A360451	96	A363344	96		A360451
D4-1,2-Dichloroethane (sur.)	%	102	A360451	101	A363344	102		A360451
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH678	AGH679	AGH680	AGH681		
Sampling Date		2021/09/19 12:00	2021/09/19 11:30	2021/09/19 11:30	2021/09/19 12:10		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	RDL	QC Batch
<b>Volatiles</b>							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A358819
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A360366
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A359161
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A359161
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A360366
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A360451
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH678	AGH679	AGH680	AGH681		
Sampling Date		2021/09/19 12:00	2021/09/19 11:30	2021/09/19 11:30	2021/09/19 12:10		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	107	106	107	108		A360366
4-Bromofluorobenzene (sur.)	%	100	99	100	99		A360366
D4-1,2-Dichloroethane (sur.)	%	98	97	98	98		A360366
1,4-Difluorobenzene (sur.)	%	101	101	100	100		A360451
4-Bromofluorobenzene (sur.)	%	96	96	97	96		A360451
D4-1,2-Dichloroethane (sur.)	%	103	105	105	108		A360451
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH682	AGH683	AGH684	AGH688		
Sampling Date		2021/09/19 11:30	2021/09/19 12:10	2021/09/19 14:35	2021/09/19 10:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-02-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	TREATED OSPW TANK	DUPLICATE	RDL	QC Batch
<b>Volatiles</b>							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A358819
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A360366
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A360366
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A359161
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A359161
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A360366
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A360451
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AGH682	AGH683	AGH684	AGH688		
Sampling Date		2021/09/19 11:30	2021/09/19 12:10	2021/09/19 14:35	2021/09/19 10:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-02-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	TREATED OSPW TANK	DUPLICATE	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A360451
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A360451
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A360451
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	107	106	108	107		A360366
4-Bromofluorobenzene (sur.)	%	100	99	99	101		A360366
D4-1,2-Dichloroethane (sur.)	%	97	96	97	97		A360366
1,4-Difluorobenzene (sur.)	%	101	101	100	101		A360451
4-Bromofluorobenzene (sur.)	%	96	97	97	96		A360451
D4-1,2-Dichloroethane (sur.)	%	105	105	106	105		A360451
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

<b>BV Labs ID</b>		AGH689		
<b>Sampling Date</b>		2021/09/19 12:15		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>FIELD BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Volatiles</b>				
Total Trihalomethanes	ug/L	<1.3	1.3	A358819
Benzene	ug/L	<0.40	0.40	A360366
Bromodichloromethane	ug/L	<0.50	0.50	A360451
Toluene	ug/L	<0.40	0.40	A360366
Bromoform	ug/L	<0.50	0.50	A360451
Ethylbenzene	ug/L	<0.40	0.40	A360366
Bromomethane	ug/L	<2.0	2.0	A360451
m & p-Xylene	ug/L	<0.80	0.80	A360366
Carbon tetrachloride	ug/L	<0.50	0.50	A360451
o-Xylene	ug/L	<0.40	0.40	A360366
Chlorobenzene	ug/L	<0.50	0.50	A360451
Dibromochloromethane	ug/L	<1.0	1.0	A360451
Xylenes (Total)	ug/L	<0.89	0.89	A359161
Chloroethane	ug/L	<1.0	1.0	A360451
F1 (C6-C10) - BTEX	ug/L	<100	100	A359161
Chloroform	ug/L	<0.50	0.50	A360451
Chloromethane	ug/L	<2.0	2.0	A360451
F1 (C6-C10)	ug/L	<100	100	A360366
1,2-dibromoethane	ug/L	<0.20	0.20	A360451
1,2-dichlorobenzene	ug/L	<0.50	0.50	A360451
1,3-dichlorobenzene	ug/L	<0.50	0.50	A360451
1,4-dichlorobenzene	ug/L	<0.50	0.50	A360451
1,1-dichloroethane	ug/L	<0.50	0.50	A360451
1,2-dichloroethane	ug/L	<0.50	0.50	A360451
1,1-dichloroethene	ug/L	<0.50	0.50	A360451
cis-1,2-dichloroethene	ug/L	<0.50	0.50	A360451
trans-1,2-dichloroethene	ug/L	<0.50	0.50	A360451
Dichloromethane	ug/L	<2.0	2.0	A360451
1,2-dichloropropane	ug/L	<0.50	0.50	A360451
cis-1,3-dichloropropene	ug/L	<0.50	0.50	A360451
trans-1,3-dichloropropene	ug/L	<0.50	0.50	A360451
Methyl methacrylate	ug/L	<0.50	0.50	A360451
RDL = Reportable Detection Limit				





### VOLATILE ORGANICS BY GC-MS (WATER)

<b>BV Labs ID</b>		AGH689		
<b>Sampling Date</b>		2021/09/19 12:15		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>FIELD BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
Methyl-tert-butylether (MTBE)	ug/L	<0.50	0.50	A360451
Styrene	ug/L	<0.50	0.50	A360451
1,1,1,2-tetrachloroethane	ug/L	<1.0	1.0	A360451
1,1,2,2-tetrachloroethane	ug/L	<2.0	2.0	A360451
Tetrachloroethene	ug/L	<0.50	0.50	A360451
1,2,3-trichlorobenzene	ug/L	<1.0	1.0	A360451
1,2,4-trichlorobenzene	ug/L	<1.0	1.0	A360451
1,3,5-trichlorobenzene	ug/L	<0.50	0.50	A360451
1,1,1-trichloroethane	ug/L	<0.50	0.50	A360451
1,1,2-trichloroethane	ug/L	<0.50	0.50	A360451
Trichloroethene	ug/L	<0.50	0.50	A360451
Trichlorofluoromethane	ug/L	<0.50	0.50	A360451
1,2,4-trimethylbenzene	ug/L	<0.50	0.50	A360451
1,3,5-trimethylbenzene	ug/L	<0.50	0.50	A360451
Vinyl chloride	ug/L	<0.50	0.50	A360451
<b>Surrogate Recovery (%)</b>				
1,4-Difluorobenzene (sur.)	%	107		A360366
4-Bromofluorobenzene (sur.)	%	98		A360366
D4-1,2-Dichloroethane (sur.)	%	99		A360366
1,4-Difluorobenzene (sur.)	%	101		A360451
4-Bromofluorobenzene (sur.)	%	97		A360451
D4-1,2-Dichloroethane (sur.)	%	104		A360451
RDL = Reportable Detection Limit				





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

## GENERAL COMMENTS

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample AGH684 [TREATED OSPW TANK] Elements by ICPMS Digested LL (total): Detection limits raised due to sample matrix.

**Results relate only to the items tested.**





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A358542	DM	Matrix Spike	D10-ANTHRACENE (sur.)	2021/09/24	126	%	50 - 130		
			D8-ACENAPHTHYLENE (sur.)	2021/09/24	118	%	50 - 130		
			D8-NAPHTHALENE (sur.)	2021/09/24	94	%	50 - 130		
			TERPHENYL-D14 (sur.)	2021/09/24	143 (1)	%	50 - 130		
			Acenaphthene	2021/09/24	122	%	50 - 130		
			Acenaphthylene	2021/09/24	122	%	50 - 130		
			Acridine	2021/09/24	107	%	50 - 130		
			Anthracene	2021/09/24	104	%	50 - 130		
			Benzo(a)anthracene	2021/09/24	127	%	50 - 130		
			Benzo(b&j)fluoranthene	2021/09/24	127	%	50 - 130		
			Benzo(k)fluoranthene	2021/09/24	117	%	50 - 130		
			Benzo(g,h,i)perylene	2021/09/24	118	%	50 - 130		
			Benzo(c)phenanthrene	2021/09/24	127	%	50 - 130		
			Benzo(a)pyrene	2021/09/24	114	%	50 - 130		
			Benzo(e)pyrene	2021/09/24	120	%	50 - 130		
			Chrysene	2021/09/24	121	%	50 - 130		
			Dibenz(a,h)anthracene	2021/09/24	123	%	50 - 130		
			Fluoranthene	2021/09/24	134 (1)	%	50 - 130		
			Fluorene	2021/09/24	129	%	50 - 130		
			Indeno(1,2,3-cd)pyrene	2021/09/24	123	%	50 - 130		
			2-Methylnaphthalene	2021/09/24	112	%	50 - 130		
			Naphthalene	2021/09/24	110	%	50 - 130		
			Phenanthrene	2021/09/24	125	%	50 - 130		
			Perylene	2021/09/24	119	%	50 - 130		
			Pyrene	2021/09/24	129	%	50 - 130		
			Quinoline	2021/09/24	114	%	50 - 130		
			C1-Naphthalene	2021/09/24	108	%	50 - 130		
			C3-Naphthalene	2021/09/24	121	%	50 - 130		
			C2-Naphthalene	2021/09/24	112	%	50 - 130		
			C1-biphenyl	2021/09/24	103	%	50 - 130		
			C1 phenanthrene/anthracene	2021/09/24	129	%	50 - 130		
			C2 phenanthrene/anthracene	2021/09/24	135 (1)	%	50 - 130		
			C1 fluoranthene/pyrene	2021/09/24	129	%	50 - 130		
			C2 benzo(a)anthracene/chrysene	2021/09/24	21 (1)	%	30 - 130		
			1-Methylnaphthalene	2021/09/24	108	%	50 - 130		
A358542	DM	Spiked Blank	D10-ANTHRACENE (sur.)	2021/09/24	106	%	50 - 130		
			D8-ACENAPHTHYLENE (sur.)	2021/09/24	82	%	50 - 130		
			D8-NAPHTHALENE (sur.)	2021/09/24	67	%	50 - 130		
			TERPHENYL-D14 (sur.)	2021/09/24	108	%	50 - 130		
			Acenaphthene	2021/09/24	86	%	50 - 130		
			Acenaphthylene	2021/09/24	82	%	50 - 130		
			Acridine	2021/09/24	80	%	50 - 130		
			Anthracene	2021/09/24	80	%	50 - 130		
			Benzo(a)anthracene	2021/09/24	103	%	50 - 130		
			Benzo(b&j)fluoranthene	2021/09/24	103	%	50 - 130		
			Benzo(k)fluoranthene	2021/09/24	100	%	50 - 130		
			Benzo(g,h,i)perylene	2021/09/24	99	%	50 - 130		
			Benzo(c)phenanthrene	2021/09/24	99	%	50 - 130		
			Benzo(a)pyrene	2021/09/24	97	%	50 - 130		
			Benzo(e)pyrene	2021/09/24	102	%	50 - 130		
Chrysene	2021/09/24	99	%	50 - 130					
Dibenz(a,h)anthracene	2021/09/24	102	%	50 - 130					
Fluoranthene	2021/09/24	104	%	50 - 130					
Fluorene	2021/09/24	87	%	50 - 130					
Indeno(1,2,3-cd)pyrene	2021/09/24	103	%	50 - 130					





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A358542	DM	Method Blank	2-Methylnaphthalene	2021/09/24		80	%	50 - 130
			Naphthalene	2021/09/24		74	%	50 - 130
			Phenanthrene	2021/09/24		92	%	50 - 130
			Perylene	2021/09/24		105	%	50 - 130
			Pyrene	2021/09/24		103	%	50 - 130
			Quinoline	2021/09/24		109	%	50 - 130
			C1-Naphthalene	2021/09/24		72	%	50 - 130
			C3-Naphthalene	2021/09/24		81	%	50 - 130
			C2-Naphthalene	2021/09/24		77	%	50 - 130
			C1-biphenyl	2021/09/24		70	%	50 - 130
			C1 phenanthrene/anthracene	2021/09/24		113	%	50 - 130
			C2 phenanthrene/anthracene	2021/09/24		107	%	50 - 130
			C1 fluoranthene/pyrene	2021/09/24		106	%	50 - 130
			C2 benzo(a)anthracene/chrysene	2021/09/24		21 (1)	%	30 - 130
			1-Methylnaphthalene	2021/09/24		72	%	50 - 130
			D10-ANTHRACENE (sur.)	2021/09/24		100	%	50 - 130
			D8-ACENAPHTHYLENE (sur.)	2021/09/24		79	%	50 - 130
			D8-NAPHTHALENE (sur.)	2021/09/24		65	%	50 - 130
			TERPHENYL-D14 (sur.)	2021/09/24		101	%	50 - 130
			Acenaphthene	2021/09/24	<0.10		ug/L	
			Acenaphthylene	2021/09/24	<0.10		ug/L	
			Acridine	2021/09/24	<0.040		ug/L	
			Anthracene	2021/09/24	<0.010		ug/L	
			Benzo(a)anthracene	2021/09/24	<0.0085		ug/L	
			Benzo(b&j)fluoranthene	2021/09/24	<0.0085		ug/L	
			Benzo(k)fluoranthene	2021/09/24	<0.0085		ug/L	
			Benzo(g,h,i)perylene	2021/09/24	<0.0085		ug/L	
			Benzo(c)phenanthrene	2021/09/24	<0.050		ug/L	
			Benzo(a)pyrene	2021/09/24	<0.0075		ug/L	
			Benzo(e)pyrene	2021/09/24	<0.050		ug/L	
			Chrysene	2021/09/24	<0.0085		ug/L	
			Dibenz(a,h)anthracene	2021/09/24	<0.0075		ug/L	
			Fluoranthene	2021/09/24	<0.010		ug/L	
			Fluorene	2021/09/24	<0.050		ug/L	
			Indeno(1,2,3-cd)pyrene	2021/09/24	<0.0085		ug/L	
			Indeno(1,2,3-cd)fluoranthene	2021/09/24	<0.0085		ug/L	
			2-Methylnaphthalene	2021/09/24	<0.10		ug/L	
			Naphthalene	2021/09/24	<0.10		ug/L	
			Phenanthrene	2021/09/24	<0.050		ug/L	
			Perylene	2021/09/24	<0.050		ug/L	
			Pyrene	2021/09/24	<0.020		ug/L	
			Quinoline	2021/09/24	<0.20		ug/L	
			Retene	2021/09/24	<0.050		ug/L	
			C1-Naphthalene	2021/09/24	<0.10		ug/L	
			C3-Naphthalene	2021/09/24	<0.10		ug/L	
			C4-Naphthalene	2021/09/24	<0.10		ug/L	
			C2-Naphthalene	2021/09/24	<0.10		ug/L	
			Biphenyl	2021/09/24	<0.020		ug/L	
			C1-biphenyl	2021/09/24	<0.020		ug/L	
			C2-biphenyl	2021/09/24	<0.020		ug/L	
			C1-fluorene	2021/09/24	<0.050		ug/L	
			C2-fluorene	2021/09/24	<0.050		ug/L	
			C3-fluorene	2021/09/24	<0.050		ug/L	
			Dibenzothiophene	2021/09/24	<0.020		ug/L	
			C1-dibenzothiophene	2021/09/24	<0.020		ug/L	





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A358542	DM	RPD		C2-dibenzothiophene	2021/09/24	<0.020		ug/L	
				C3-dibenzothiophene	2021/09/24	<0.020		ug/L	
				C4-dibenzothiophene	2021/09/24	<0.020		ug/L	
				C1 phenanthrene/anthracene	2021/09/24	<0.050		ug/L	
				C2 phenanthrene/anthracene	2021/09/24	<0.050		ug/L	
				C3 phenanthrene/anthracene	2021/09/24	<0.050		ug/L	
				C4 phenanthrene/anthracene	2021/09/24	<0.050		ug/L	
				C1 fluoranthene/pyrene	2021/09/24	<0.020		ug/L	
				C2 fluoranthene/pyrene	2021/09/24	<0.020		ug/L	
				C3 fluoranthene/pyrene	2021/09/24	<0.020		ug/L	
				C4 fluoranthene/pyrene	2021/09/24	<0.020		ug/L	
				C1 benzo(a)anthracene/chrysene	2021/09/24	<0.0085		ug/L	
				C2 benzo(a)anthracene/chrysene	2021/09/24	<0.0085		ug/L	
				C3 benzo(a)anthracene/chrysene	2021/09/24	<0.0085		ug/L	
				C4 benzo(a)anthracene/chrysene	2021/09/24	<0.0085		ug/L	
				C1benzobkfluoranthene/benzoapyrene	2021/09/24	<0.0075		ug/L	
				C2benzobkfluoranthene/benzoapyrene	2021/09/24	<0.0075		ug/L	
				C1-Acenaphthene	2021/09/24	<0.10		ug/L	
				1-Methylnaphthalene	2021/09/24	<0.10		ug/L	
				Acenaphthene	2021/09/24	NC		%	30
				Acenaphthylene	2021/09/24	NC		%	30
				Acridine	2021/09/24	NC		%	30
				Anthracene	2021/09/24	NC		%	30
				Benzo(a)anthracene	2021/09/24	NC		%	30
				Benzo(b&j)fluoranthene	2021/09/24	NC		%	30
				Benzo(k)fluoranthene	2021/09/24	NC		%	30
				Benzo(g,h,i)perylene	2021/09/24	NC		%	30
				Benzo(c)phenanthrene	2021/09/24	NC		%	30
				Benzo(a)pyrene	2021/09/24	NC		%	30
				Benzo(e)pyrene	2021/09/24	NC		%	30
				Chrysene	2021/09/24	NC		%	30
				Dibenz(a,h)anthracene	2021/09/24	NC		%	30
				Fluoranthene	2021/09/24	NC		%	30
				Fluorene	2021/09/24	NC		%	30
				Indeno(1,2,3-cd)pyrene	2021/09/24	NC		%	30
				Indeno(1,2,3-cd)fluoranthene	2021/09/24	24		%	30
				2-Methylnaphthalene	2021/09/24	NC		%	30
				Naphthalene	2021/09/24	NC		%	30
				Phenanthrene	2021/09/24	NC		%	30
				Perylene	2021/09/24	NC		%	30
				Pyrene	2021/09/24	NC		%	30
				Quinoline	2021/09/24	NC		%	30
				Retene	2021/09/24	NC		%	30
				C1-Naphthalene	2021/09/24	NC		%	30
				C3-Naphthalene	2021/09/24	NC		%	30
				C4-Naphthalene	2021/09/24	NC		%	30
				C2-Naphthalene	2021/09/24	NC		%	30
				Biphenyl	2021/09/24	NC		%	30
				C1-biphenyl	2021/09/24	NC		%	30
				C2-biphenyl	2021/09/24	NC		%	30
				C1-fluorene	2021/09/24	NC		%	30
				C2-fluorene	2021/09/24	NC		%	30
				C3-fluorene	2021/09/24	NC		%	30
				Dibenzothiophene	2021/09/24	NC		%	30
				C1-dibenzothiophene	2021/09/24	NC		%	30





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				C2-dibenzothiophene	2021/09/24	NC		%	30
				C3-dibenzothiophene	2021/09/24	NC		%	30
				C4-dibenzothiophene	2021/09/24	NC		%	30
				C1 phenanthrene/anthracene	2021/09/24	NC		%	30
				C2 phenanthrene/anthracene	2021/09/24	NC		%	30
				C3 phenanthrene/anthracene	2021/09/24	NC		%	30
				C4 phenanthrene/anthracene	2021/09/24	NC		%	30
				C1 fluoranthene/pyrene	2021/09/24	NC		%	30
				C2 fluoranthene/pyrene	2021/09/24	NC		%	30
				C3 fluoranthene/pyrene	2021/09/24	NC		%	30
				C4 fluoranthene/pyrene	2021/09/24	NC		%	30
				C1 benzo(a)anthracene/chrysene	2021/09/24	NC		%	30
				C2 benzo(a)anthracene/chrysene	2021/09/24	NC		%	30
				C3 benzo(a)anthracene/chrysene	2021/09/24	NC		%	30
				C4 benzo(a)anthracene/chrysene	2021/09/24	NC		%	30
				C1benzobkfluoranthene/benzoapyrene	2021/09/24	NC		%	30
				C2benzobkfluoranthene/benzoapyrene	2021/09/24	NC		%	30
				C1-Acenaphthene	2021/09/24	NC		%	30
				1-Methylnaphthalene	2021/09/24	NC		%	30
A358713	CAU		Matrix Spike	Naphthenic Acids	2021/09/24		85	%	70 - 130
A358713	CAU		Spiked Blank	Naphthenic Acids	2021/09/24		87	%	70 - 130
A358713	CAU		Method Blank	Naphthenic Acids	2021/09/24	<2.0		mg/L	
A358713	CAU		RPD	Naphthenic Acids	2021/09/24	NC		%	30
A359406	BYM		Spiked Blank	Biochemical Oxygen Demand	2021/09/26		94	%	85 - 115
A359406	BYM		Method Blank	Biochemical Oxygen Demand	2021/09/26	<2.0		mg/L	
A359406	BYM		RPD [AGH688-03]	Biochemical Oxygen Demand	2021/09/26	3.2		%	20
A359598	AP1		Spiked Blank	Turbidity	2021/09/21		103	%	80 - 120
A359598	AP1		Method Blank	Turbidity	2021/09/21	<0.10		NTU	
A359598	AP1		RPD	Turbidity	2021/09/21	0.75		%	20
A360197	IKO		Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/21		94	%	80 - 120
A360197	IKO		Method Blank	Alkalinity (PP as CaCO3)	2021/09/21	<1.0		mg/L	
				Alkalinity (Total as CaCO3)	2021/09/21	<1.0		mg/L	
				Bicarbonate (HCO3)	2021/09/21	<1.0		mg/L	
				Carbonate (CO3)	2021/09/21	<1.0		mg/L	
				Hydroxide (OH)	2021/09/21	<1.0		mg/L	
A360197	IKO		RPD [AGH678-02]	Alkalinity (PP as CaCO3)	2021/09/21	NC		%	20
				Alkalinity (Total as CaCO3)	2021/09/21	1.6		%	20
				Bicarbonate (HCO3)	2021/09/21	3.3		%	20
				Carbonate (CO3)	2021/09/21	NC		%	20
				Hydroxide (OH)	2021/09/21	NC		%	20
A360200	FM0		Matrix Spike	Orthophosphate (P)	2021/09/21		120	%	80 - 120
A360200	FM0		Spiked Blank	Orthophosphate (P)	2021/09/21		99	%	80 - 120
A360200	FM0		Method Blank	Orthophosphate (P)	2021/09/21	<0.0010		mg/L	
A360200	FM0		RPD	Orthophosphate (P)	2021/09/21	NC		%	20
A360201	IKO		Spiked Blank	pH	2021/09/21		100	%	97 - 103
A360201	IKO		RPD [AGH678-02]	pH	2021/09/21	1.3		%	N/A
A360202	IKO		Spiked Blank	Conductivity	2021/09/21		103	%	90 - 110
A360202	IKO		Method Blank	Conductivity	2021/09/21	<2.0		uS/cm	
A360202	IKO		RPD [AGH678-02]	Conductivity	2021/09/21	0.69		%	10
A360203	IKO		Matrix Spike [AGH678-02]	Dissolved Fluoride (F)	2021/09/21		101	%	80 - 120
A360203	IKO		Spiked Blank	Dissolved Fluoride (F)	2021/09/21		97	%	80 - 120
A360203	IKO		Method Blank	Dissolved Fluoride (F)	2021/09/21	<0.050		mg/L	
A360203	IKO		RPD [AGH678-02]	Dissolved Fluoride (F)	2021/09/21	4.3		%	20





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HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360205	FM0	Matrix Spike [AGH677-02]	Orthophosphate (P)	2021/09/21		95	%	80 - 120
A360205	FM0	Spiked Blank	Orthophosphate (P)	2021/09/21		110	%	80 - 120
A360205	FM0	Method Blank	Orthophosphate (P)	2021/09/21	<0.0010		mg/L	
A360205	FM0	RPD [AGH677-02]	Orthophosphate (P)	2021/09/21	17		%	20
A360207	TMU	Matrix Spike	Total Inorganic Carbon (C)	2021/09/22		NC	%	80 - 120
A360207	TMU	Spiked Blank	Total Inorganic Carbon (C)	2021/09/22		102	%	80 - 120
A360207	TMU	Method Blank	Total Inorganic Carbon (C)	2021/09/22	<1.0		mg/L	
A360207	TMU	RPD	Total Inorganic Carbon (C)	2021/09/22	1.4		%	20
A360212	TMU	Matrix Spike [AGH680-02]	Total Inorganic Carbon (C)	2021/09/22		85	%	80 - 120
A360212	TMU	Spiked Blank	Total Inorganic Carbon (C)	2021/09/22		100	%	80 - 120
A360212	TMU	Method Blank	Total Inorganic Carbon (C)	2021/09/22	<1.0		mg/L	
A360212	TMU	RPD [AGH680-02]	Total Inorganic Carbon (C)	2021/09/22	1.3		%	20
A360213	JFH	Matrix Spike	Dissolved Nitrite (N)	2021/09/21		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/21		114	%	80 - 120
A360213	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/21		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/21		101	%	80 - 120
A360213	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/21	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/21	<0.010		mg/L	
A360213	JFH	RPD	Dissolved Nitrite (N)	2021/09/21	0.069		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/21	0.31		%	20
A360215	JFH	Matrix Spike	Dissolved Nitrite (N)	2021/09/24		99	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/24		108	%	80 - 120
A360215	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/21		103	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/21		101	%	80 - 120
A360215	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/21	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/21	<0.010		mg/L	
A360215	JFH	RPD	Dissolved Nitrite (N)	2021/09/24	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/24	NC		%	20
A360366	DO1	Matrix Spike [AGH676-20]	1,4-Difluorobenzene (sur.)	2021/09/29		92	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/29		99	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/29		94	%	50 - 140
			Benzene	2021/09/29		85	%	50 - 140
			Toluene	2021/09/29		80	%	50 - 140
			Ethylbenzene	2021/09/29		84	%	50 - 140
			m & p-Xylene	2021/09/29		84	%	50 - 140
			o-Xylene	2021/09/29		87	%	50 - 140
			F1 (C6-C10)	2021/09/29		93	%	60 - 140
A360366	DO1	Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/29		93	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/29		99	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/29		94	%	50 - 140
			Benzene	2021/09/29		90	%	60 - 130
			Toluene	2021/09/29		85	%	60 - 130
			Ethylbenzene	2021/09/29		89	%	60 - 130
			m & p-Xylene	2021/09/29		89	%	60 - 130
			o-Xylene	2021/09/29		91	%	60 - 130
			F1 (C6-C10)	2021/09/29		106	%	60 - 140
A360366	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/29		105	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/29		100	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/29		95	%	50 - 140
			Benzene	2021/09/29	<0.40		ug/L	
			Toluene	2021/09/29	<0.40		ug/L	
			Ethylbenzene	2021/09/29	<0.40		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360366	DO1	RPD [AGH675-20]	m & p-Xylene	2021/09/29	<0.80		ug/L	
			o-Xylene	2021/09/29	<0.40		ug/L	
			F1 (C6-C10)	2021/09/29	<100		ug/L	
			Benzene	2021/09/29	NC		%	30
			Toluene	2021/09/29	NC		%	30
			Ethylbenzene	2021/09/29	NC		%	30
			m & p-Xylene	2021/09/29	NC		%	30
			o-Xylene	2021/09/29	NC		%	30
A360451	QW1	Matrix Spike [AGH677-19]	F1 (C6-C10)	2021/09/29	NC		%	30
			1,4-Difluorobenzene (sur.)	2021/09/28		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/28		101	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/28		101	%	50 - 140
			Bromodichloromethane	2021/09/28		93	%	50 - 140
			Bromoform	2021/09/28		106	%	50 - 140
			Bromomethane	2021/09/28		87	%	50 - 140
			Carbon tetrachloride	2021/09/28		91	%	50 - 140
			Chlorobenzene	2021/09/28		99	%	50 - 140
			Dibromochloromethane	2021/09/28		105	%	50 - 140
			Chloroethane	2021/09/28		76	%	50 - 140
			Chloroform	2021/09/28		100	%	50 - 140
			Chloromethane	2021/09/28		64	%	50 - 140
			1,2-dibromoethane	2021/09/28		100	%	50 - 140
			1,2-dichlorobenzene	2021/09/28		95	%	50 - 140
			1,3-dichlorobenzene	2021/09/28		94	%	50 - 140
			1,4-dichlorobenzene	2021/09/28		92	%	50 - 140
			1,1-dichloroethane	2021/09/28		98	%	50 - 140
			1,2-dichloroethane	2021/09/28		94	%	50 - 140
			1,1-dichloroethene	2021/09/28		90	%	50 - 140
			cis-1,2-dichloroethene	2021/09/28		100	%	50 - 140
			trans-1,2-dichloroethene	2021/09/28		92	%	50 - 140
			Dichloromethane	2021/09/28		90	%	50 - 140
			1,2-dichloropropane	2021/09/28		98	%	50 - 140
			cis-1,3-dichloropropene	2021/09/28		125	%	50 - 140
			trans-1,3-dichloropropene	2021/09/28		143 (1)	%	50 - 140
			Methyl methacrylate	2021/09/28		104	%	50 - 140
			Methyl-tert-butylether (MTBE)	2021/09/28		106	%	50 - 140
			Styrene	2021/09/28		96	%	50 - 140
			1,1,1,2-tetrachloroethane	2021/09/28		101	%	50 - 140
			1,1,2,2-tetrachloroethane	2021/09/28		105	%	50 - 140
			Tetrachloroethene	2021/09/28		87	%	50 - 140
			1,2,3-trichlorobenzene	2021/09/28		95	%	50 - 140
			1,2,4-trichlorobenzene	2021/09/28		93	%	50 - 140
			1,3,5-trichlorobenzene	2021/09/28		87	%	50 - 140
			1,1,1-trichloroethane	2021/09/28		94	%	50 - 140
			1,1,2-trichloroethane	2021/09/28		106	%	50 - 140
			Trichloroethene	2021/09/28		93	%	50 - 140
			Trichlorofluoromethane	2021/09/28		90	%	50 - 140
			1,2,4-trimethylbenzene	2021/09/28		94	%	50 - 140
			1,3,5-trimethylbenzene	2021/09/28		95	%	50 - 140
			Vinyl chloride	2021/09/28		82	%	50 - 140
A360451	QW1	Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/28		100	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/28		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/28		93	%	50 - 140
			Bromodichloromethane	2021/09/28		90	%	60 - 130





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Bromoform	2021/09/28		102	%	60 - 130
				Bromomethane	2021/09/28		80	%	60 - 130
				Carbon tetrachloride	2021/09/28		91	%	60 - 130
				Chlorobenzene	2021/09/28		98	%	60 - 130
				Dibromochloromethane	2021/09/28		101	%	60 - 130
				Chloroethane	2021/09/28		73	%	60 - 130
				Chloroform	2021/09/28		96	%	60 - 130
				Chloromethane	2021/09/28		61	%	60 - 130
				1,2-dibromoethane	2021/09/28		94	%	60 - 130
				1,2-dichlorobenzene	2021/09/28		93	%	60 - 130
				1,3-dichlorobenzene	2021/09/28		92	%	60 - 130
				1,4-dichlorobenzene	2021/09/28		90	%	60 - 130
				1,1-dichloroethane	2021/09/28		94	%	60 - 130
				1,2-dichloroethane	2021/09/28		90	%	60 - 130
				1,1-dichloroethene	2021/09/28		88	%	60 - 130
				cis-1,2-dichloroethene	2021/09/28		96	%	60 - 130
				trans-1,2-dichloroethene	2021/09/28		89	%	60 - 130
				Dichloromethane	2021/09/28		84	%	60 - 130
				1,2-dichloropropane	2021/09/28		94	%	60 - 130
				cis-1,3-dichloropropene	2021/09/28		115	%	60 - 130
				trans-1,3-dichloropropene	2021/09/28		130	%	60 - 130
				Methyl methacrylate	2021/09/28		97	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/09/28		100	%	60 - 130
				Styrene	2021/09/28		95	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/09/28		99	%	60 - 130
				1,1,2,2-tetrachloroethane	2021/09/28		100	%	60 - 130
				Tetrachloroethene	2021/09/28		87	%	60 - 130
				1,2,3-trichlorobenzene	2021/09/28		93	%	60 - 130
				1,2,4-trichlorobenzene	2021/09/28		92	%	60 - 130
				1,3,5-trichlorobenzene	2021/09/28		86	%	60 - 130
				1,1,1-trichloroethane	2021/09/28		93	%	60 - 130
				1,1,2-trichloroethane	2021/09/28		100	%	60 - 130
				Trichloroethene	2021/09/28		92	%	60 - 130
				Trichlorofluoromethane	2021/09/28		87	%	60 - 130
				1,2,4-trimethylbenzene	2021/09/28		93	%	60 - 130
				1,3,5-trimethylbenzene	2021/09/28		93	%	60 - 130
				Vinyl chloride	2021/09/28		79	%	60 - 130
A360451	QW1	Method Blank		1,4-Difluorobenzene (sur.)	2021/09/28		100	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/28		97	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/28		100	%	50 - 140
				Bromodichloromethane	2021/09/28	<0.50		ug/L	
				Bromoform	2021/09/28	<0.50		ug/L	
				Bromomethane	2021/09/28	<2.0		ug/L	
				Carbon tetrachloride	2021/09/28	<0.50		ug/L	
				Chlorobenzene	2021/09/28	<0.50		ug/L	
				Dibromochloromethane	2021/09/28	<1.0		ug/L	
				Chloroethane	2021/09/28	<1.0		ug/L	
				Chloroform	2021/09/28	<0.50		ug/L	
				Chloromethane	2021/09/28	<2.0		ug/L	
				1,2-dibromoethane	2021/09/28	<0.20		ug/L	
				1,2-dichlorobenzene	2021/09/28	<0.50		ug/L	
				1,3-dichlorobenzene	2021/09/28	<0.50		ug/L	
				1,4-dichlorobenzene	2021/09/28	<0.50		ug/L	
				1,1-dichloroethane	2021/09/28	<0.50		ug/L	
				1,2-dichloroethane	2021/09/28	<0.50		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360451	QW1	RPD [AGH675-19]		1,1-dichloroethene	2021/09/28	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/09/28	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/09/28	<0.50		ug/L	
				Dichloromethane	2021/09/28	<2.0		ug/L	
				1,2-dichloropropane	2021/09/28	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/09/28	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/09/28	<0.50		ug/L	
				Methyl methacrylate	2021/09/28	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/09/28	<0.50		ug/L	
				Styrene	2021/09/28	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/09/28	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/09/28	<2.0		ug/L	
				Tetrachloroethene	2021/09/28	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/09/28	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/09/28	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/09/28	<0.50		ug/L	
				1,1,1-trichloroethane	2021/09/28	<0.50		ug/L	
				1,1,2-trichloroethane	2021/09/28	<0.50		ug/L	
				Trichloroethene	2021/09/28	<0.50		ug/L	
				Trichlorofluoromethane	2021/09/28	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/09/28	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/09/28	<0.50		ug/L	
				Vinyl chloride	2021/09/28	<0.50		ug/L	
				Bromodichloromethane	2021/09/28	NC		%	30
				Bromoform	2021/09/28	NC		%	30
				Bromomethane	2021/09/28	NC		%	30
				Carbon tetrachloride	2021/09/28	NC		%	30
				Chlorobenzene	2021/09/28	NC		%	30
				Dibromochloromethane	2021/09/28	NC		%	30
				Chloroethane	2021/09/28	NC		%	30
				Chloroform	2021/09/28	NC		%	30
				Chloromethane	2021/09/28	NC		%	30
				1,2-dibromoethane	2021/09/28	NC		%	30
				1,2-dichlorobenzene	2021/09/28	NC		%	30
				1,3-dichlorobenzene	2021/09/28	NC		%	30
				1,4-dichlorobenzene	2021/09/28	NC		%	30
				1,1-dichloroethane	2021/09/28	NC		%	30
				1,2-dichloroethane	2021/09/28	NC		%	30
				1,1-dichloroethene	2021/09/28	NC		%	30
				cis-1,2-dichloroethene	2021/09/28	NC		%	30
				trans-1,2-dichloroethene	2021/09/28	NC		%	30
				Dichloromethane	2021/09/28	NC		%	30
				1,2-dichloropropane	2021/09/28	NC		%	30
				cis-1,3-dichloropropene	2021/09/28	NC		%	30
				trans-1,3-dichloropropene	2021/09/28	NC		%	30
				Methyl methacrylate	2021/09/28	NC		%	30
				Methyl-tert-butylether (MTBE)	2021/09/28	NC		%	30
				Styrene	2021/09/28	NC		%	30
				1,1,1,2-tetrachloroethane	2021/09/28	NC		%	30
				1,1,2,2-tetrachloroethane	2021/09/28	NC		%	30
				Tetrachloroethene	2021/09/28	NC		%	30
				1,2,3-trichlorobenzene	2021/09/28	NC		%	30
				1,2,4-trichlorobenzene	2021/09/28	NC		%	30
				1,3,5-trichlorobenzene	2021/09/28	NC		%	30
				1,1,1-trichloroethane	2021/09/28	NC		%	30





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360464	STI	Matrix Spike [AGH688-02]	1,1,2-trichloroethane	2021/09/28	NC		%	30
			Trichloroethene	2021/09/28	NC		%	30
			Trichlorofluoromethane	2021/09/28	NC		%	30
			1,2,4-trimethylbenzene	2021/09/28	NC		%	30
			1,3,5-trimethylbenzene	2021/09/28	NC		%	30
			Vinyl chloride	2021/09/28	NC		%	30
			True Colour	2021/09/21		82	%	80 - 120
A360464	STI	Spiked Blank	True Colour	2021/09/21		90	%	80 - 120
A360464	STI	Method Blank	True Colour	2021/09/21	<2.0		PtCo units	
A360464	STI	RPD [AGH688-02]	True Colour	2021/09/21	2.1		%	20
A360740	ZWU	Matrix Spike [AGH680-06]	Total Organic Carbon (C)	2021/09/22		98	%	80 - 120
A360740	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/09/22		119	%	80 - 120
A360740	ZWU	Method Blank	Total Organic Carbon (C)	2021/09/22	<0.50		mg/L	
A360740	ZWU	RPD [AGH680-06]	Total Organic Carbon (C)	2021/09/22	1.1		%	20
A360770	ZWU	Matrix Spike	Dissolved Organic Carbon (C)	2021/09/22		119	%	80 - 120
A360770	ZWU	Spiked Blank	Dissolved Organic Carbon (C)	2021/09/22		118	%	80 - 120
A360770	ZWU	Method Blank	Dissolved Organic Carbon (C)	2021/09/22	<0.50		mg/L	
A360770	ZWU	RPD	Dissolved Organic Carbon (C)	2021/09/22	NC		%	20
A360771	CAU	Matrix Spike	Naphthenic Acids	2021/09/24		87	%	70 - 130
A360771	CAU	Spiked Blank	Naphthenic Acids	2021/09/24		83	%	70 - 130
A360771	CAU	Method Blank	Naphthenic Acids	2021/09/24	<2.0		mg/L	
A360771	CAU	RPD	Naphthenic Acids	2021/09/24	NC		%	30
A360850	JU2	Matrix Spike [AGH683-15]	D10-ANTHRACENE (sur.)	2021/09/27		128	%	50 - 130
			D8-ACENAPHTHYLENE (sur.)	2021/09/27		109	%	50 - 130
			D8-NAPHTHALENE (sur.)	2021/09/27		86	%	50 - 130
			TERPHENYL-D14 (sur.)	2021/09/27		130	%	50 - 130
			Acenaphthene	2021/09/27		106	%	50 - 130
			Acenaphthylene	2021/09/27		109	%	50 - 130
			Acridine	2021/09/27		93	%	50 - 130
			Anthracene	2021/09/27		88	%	50 - 130
			Benzo(a)anthracene	2021/09/27		105	%	50 - 130
			Benzo(b&j)fluoranthene	2021/09/27		108	%	50 - 130
			Benzo(k)fluoranthene	2021/09/27		99	%	50 - 130
			Benzo(g,h,i)perylene	2021/09/27		107	%	50 - 130
			Benzo(c)phenanthrene	2021/09/27		105	%	50 - 130
			Benzo(a)pyrene	2021/09/27		101	%	50 - 130
			Benzo(e)pyrene	2021/09/27		106	%	50 - 130
			Chrysene	2021/09/27		100	%	50 - 130
			Dibenz(a,h)anthracene	2021/09/27		110	%	50 - 130
			Fluoranthene	2021/09/27		113	%	50 - 130
			Fluorene	2021/09/27		113	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2021/09/27		112	%	50 - 130
			2-Methylnaphthalene	2021/09/27		96	%	50 - 130
			Naphthalene	2021/09/27		97	%	50 - 130
			Phenanthrene	2021/09/27		105	%	50 - 130
			Perylene	2021/09/27		104	%	50 - 130
			Pyrene	2021/09/27		113	%	50 - 130
			Quinoline	2021/09/27		108	%	50 - 130
			C1-Naphthalene	2021/09/27		94	%	50 - 130
			C3-Naphthalene	2021/09/27		101	%	50 - 130
			C2-Naphthalene	2021/09/27		94	%	50 - 130
			C1-biphenyl	2021/09/27		85	%	50 - 130





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360850	JU2	Spiked Blank		C1 phenanthrene/anthracene	2021/09/27		113	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/27		116	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/27		113	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/27		23 (1)	%	30 - 130
				1-Methylnaphthalene	2021/09/27		94	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/09/27		109	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/27		87	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/27		68	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/27		111	%	50 - 130
				Acenaphthene	2021/09/27		89	%	50 - 130
				Acenaphthylene	2021/09/27		85	%	50 - 130
				Acridine	2021/09/27		78	%	50 - 130
				Anthracene	2021/09/27		80	%	50 - 130
				Benzo(a)anthracene	2021/09/27		102	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/27		106	%	50 - 130
				Benzo(k)fluoranthene	2021/09/27		98	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/27		107	%	50 - 130
				Benzo(c)phenanthrene	2021/09/27		97	%	50 - 130
				Benzo(a)pyrene	2021/09/27		100	%	50 - 130
				Benzo(e)pyrene	2021/09/27		105	%	50 - 130
				Chrysene	2021/09/27		96	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/27		108	%	50 - 130
				Fluoranthene	2021/09/27		106	%	50 - 130
				Fluorene	2021/09/27		91	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/27		112	%	50 - 130
				2-Methylnaphthalene	2021/09/27		80	%	50 - 130
				Naphthalene	2021/09/27		75	%	50 - 130
				Phenanthrene	2021/09/27		94	%	50 - 130
				Perylene	2021/09/27		103	%	50 - 130
				Pyrene	2021/09/27		106	%	50 - 130
				Quinoline	2021/09/27		107	%	50 - 130
				C1-Naphthalene	2021/09/27		74	%	50 - 130
				C3-Naphthalene	2021/09/27		83	%	50 - 130
				C2-Naphthalene	2021/09/27		78	%	50 - 130
				C1-biphenyl	2021/09/27		71	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/27		102	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/27		109	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/27		110	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/27		22 (1)	%	30 - 130
A360850	JU2	Method Blank		1-Methylnaphthalene	2021/09/27		74	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/09/27		94	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/27		75	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/27		57	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/27		94	%	50 - 130
				Acenaphthene	2021/09/27	<0.10		ug/L	
				Acenaphthylene	2021/09/27	<0.10		ug/L	
				Acridine	2021/09/27	<0.040		ug/L	
				Anthracene	2021/09/27	<0.010		ug/L	
				Benzo(a)anthracene	2021/09/27	<0.0085		ug/L	
				Benzo(b&j)fluoranthene	2021/09/27	<0.0085		ug/L	
				Benzo(k)fluoranthene	2021/09/27	<0.0085		ug/L	
				Benzo(g,h,i)perylene	2021/09/27	<0.0085		ug/L	
				Benzo(c)phenanthrene	2021/09/27	<0.050		ug/L	
				Benzo(a)pyrene	2021/09/27	<0.0075		ug/L	
				Benzo(e)pyrene	2021/09/27	<0.050		ug/L	





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HATFIELD CONSULTANTS  
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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Chrysene	2021/09/27	<0.0085		ug/L	
			Dibenz(a,h)anthracene	2021/09/27	<0.0075		ug/L	
			Fluoranthene	2021/09/27	<0.010		ug/L	
			Fluorene	2021/09/27	<0.050		ug/L	
			Indeno(1,2,3-cd)pyrene	2021/09/27	<0.0085		ug/L	
			Indeno(1,2,3-cd)fluoranthene	2021/09/27	<0.0085		ug/L	
			2-Methylnaphthalene	2021/09/27	<0.10		ug/L	
			Naphthalene	2021/09/27	<0.10		ug/L	
			Phenanthrene	2021/09/27	<0.050		ug/L	
			Perylene	2021/09/27	<0.050		ug/L	
			Pyrene	2021/09/27	<0.020		ug/L	
			Quinoline	2021/09/27	<0.20		ug/L	
			Retene	2021/09/27	<0.050		ug/L	
			C1-Naphthalene	2021/09/27	<0.10		ug/L	
			C3-Naphthalene	2021/09/27	<0.10		ug/L	
			C4-Naphthalene	2021/09/27	<0.10		ug/L	
			C2-Naphthalene	2021/09/27	<0.10		ug/L	
			Biphenyl	2021/09/27	<0.020		ug/L	
			C1-biphenyl	2021/09/27	<0.020		ug/L	
			C2-biphenyl	2021/09/27	<0.020		ug/L	
			C1-fluorene	2021/09/27	<0.050		ug/L	
			C2-fluorene	2021/09/27	<0.050		ug/L	
			C3-fluorene	2021/09/27	<0.050		ug/L	
			Dibenzothiophene	2021/09/27	<0.020		ug/L	
			C1-dibenzothiophene	2021/09/27	<0.020		ug/L	
			C2-dibenzothiophene	2021/09/27	<0.020		ug/L	
			C3-dibenzothiophene	2021/09/27	<0.020		ug/L	
			C4-dibenzothiophene	2021/09/27	<0.020		ug/L	
			C1 phenanthrene/anthracene	2021/09/27	<0.050		ug/L	
			C2 phenanthrene/anthracene	2021/09/27	<0.050		ug/L	
			C3 phenanthrene/anthracene	2021/09/27	<0.050		ug/L	
			C4 phenanthrene/anthracene	2021/09/27	<0.050		ug/L	
			C1 fluoranthene/pyrene	2021/09/27	<0.020		ug/L	
			C2 fluoranthene/pyrene	2021/09/27	<0.020		ug/L	
			C3 fluoranthene/pyrene	2021/09/27	<0.020		ug/L	
			C4 fluoranthene/pyrene	2021/09/27	<0.020		ug/L	
			C1 benzo(a)anthracene/chrysene	2021/09/27	<0.0085		ug/L	
			C2 benzo(a)anthracene/chrysene	2021/09/27	<0.0085		ug/L	
			C3 benzo(a)anthracene/chrysene	2021/09/27	<0.0085		ug/L	
			C4 benzo(a)anthracene/chrysene	2021/09/27	<0.0085		ug/L	
			C1benzobjkfluoranthene/benzoapyrene	2021/09/27	<0.0075		ug/L	
			C2benzobjkfluoranthene/benzoapyrene	2021/09/27	<0.0075		ug/L	
			C1-Acenaphthene	2021/09/27	<0.10		ug/L	
			1-Methylnaphthalene	2021/09/27	<0.10		ug/L	
A360850	JU2	RPD [AGH689-15]	Acenaphthene	2021/09/27	NC		%	30
			Acenaphthylene	2021/09/27	NC		%	30
			Acridine	2021/09/27	NC		%	30
			Anthracene	2021/09/27	NC		%	30
			Benzo(a)anthracene	2021/09/27	NC		%	30
			Benzo(b&j)fluoranthene	2021/09/27	NC		%	30
			Benzo(k)fluoranthene	2021/09/27	NC		%	30
			Benzo(g,h,i)perylene	2021/09/27	NC		%	30
			Benzo(c)phenanthrene	2021/09/27	NC		%	30
			Benzo(a)pyrene	2021/09/27	NC		%	30
			Benzo(e)pyrene	2021/09/27	NC		%	30





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Chrysene	2021/09/27	NC		%	30
				Dibenz(a,h)anthracene	2021/09/27	NC		%	30
				Fluoranthene	2021/09/27	NC		%	30
				Fluorene	2021/09/27	NC		%	30
				Indeno(1,2,3-cd)pyrene	2021/09/27	NC		%	30
				Indeno(1,2,3-cd)fluoranthene	2021/09/27	NC		%	30
				2-Methylnaphthalene	2021/09/27	NC		%	30
				Naphthalene	2021/09/27	NC		%	30
				Phenanthrene	2021/09/27	NC		%	30
				Perylene	2021/09/27	NC		%	30
				Pyrene	2021/09/27	NC		%	30
				Quinoline	2021/09/27	NC		%	30
				Retene	2021/09/27	NC		%	30
				C1-Naphthalene	2021/09/27	NC		%	30
				C3-Naphthalene	2021/09/27	NC		%	30
				C4-Naphthalene	2021/09/27	NC		%	30
				C2-Naphthalene	2021/09/27	NC		%	30
				Biphenyl	2021/09/27	NC		%	30
				C1-biphenyl	2021/09/27	NC		%	30
				C2-biphenyl	2021/09/27	NC		%	30
				C1-fluorene	2021/09/27	NC		%	30
				C2-fluorene	2021/09/27	NC		%	30
				C3-fluorene	2021/09/27	NC		%	30
				Dibenzothiophene	2021/09/27	NC		%	30
				C1-dibenzothiophene	2021/09/27	NC		%	30
				C2-dibenzothiophene	2021/09/27	NC		%	30
				C3-dibenzothiophene	2021/09/27	NC		%	30
				C4-dibenzothiophene	2021/09/27	NC		%	30
				C1 phenanthrene/anthracene	2021/09/27	NC		%	30
				C2 phenanthrene/anthracene	2021/09/27	NC		%	30
				C3 phenanthrene/anthracene	2021/09/27	NC		%	30
				C4 phenanthrene/anthracene	2021/09/27	NC		%	30
				C1 fluoranthene/pyrene	2021/09/27	NC		%	30
				C2 fluoranthene/pyrene	2021/09/27	NC		%	30
				C3 fluoranthene/pyrene	2021/09/27	NC		%	30
				C4 fluoranthene/pyrene	2021/09/27	NC		%	30
				C1 benzo(a)anthracene/chrysene	2021/09/27	NC		%	30
				C2 benzo(a)anthracene/chrysene	2021/09/27	NC		%	30
				C3 benzo(a)anthracene/chrysene	2021/09/27	NC		%	30
				C4 benzo(a)anthracene/chrysene	2021/09/27	NC		%	30
				C1benzobjkfluoranthene/benzoapyrene	2021/09/27	NC		%	30
				C2benzobjkfluoranthene/benzoapyrene	2021/09/27	NC		%	30
				C1-Acenaphthene	2021/09/27	NC		%	30
				1-Methylnaphthalene	2021/09/27	NC		%	30
A360853	MHF	Matrix Spike		O-TERPHENYL (sur.)	2021/09/25		109	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/09/25		100	%	60 - 140
				F3 (C16-C34 Hydrocarbons)	2021/09/25		102	%	60 - 140
				F4 (C34-C50 Hydrocarbons)	2021/09/25		100	%	60 - 140
A360853	MHF	Spiked Blank		O-TERPHENYL (sur.)	2021/09/25		113	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/09/25		100	%	60 - 140
				F3 (C16-C34 Hydrocarbons)	2021/09/25		118	%	60 - 140
				F4 (C34-C50 Hydrocarbons)	2021/09/25		118	%	60 - 140
A360853	MHF	Method Blank		O-TERPHENYL (sur.)	2021/09/25		104	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/09/25	<0.10		mg/L	
				F3 (C16-C34 Hydrocarbons)	2021/09/25	<0.10		mg/L	





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A360853	MHF	RPD [AGH689-14]	F4 (C34-C50 Hydrocarbons)	2021/09/25	<0.20		mg/L	
			F2 (C10-C16 Hydrocarbons)	2021/09/25	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2021/09/25	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2021/09/25	NC		%	30
A360997	SJ1	Spiked Blank	2,3,4-trichlorophenol	2021/09/22		104	%	50 - 140
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/22		111	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/22		105	%	50 - 140
			Phenol	2021/09/22		48	%	30 - 130
			3 & 4-chlorophenol	2021/09/22		94	%	50 - 140
			2,3,5,6-tetrachlorophenol	2021/09/22		108	%	50 - 140
			2,3,4,6-tetrachlorophenol	2021/09/22		100	%	50 - 140
			2,4,5-trichlorophenol	2021/09/22		112	%	50 - 140
			2,4,6-trichlorophenol	2021/09/22		104	%	50 - 140
			2,3,5-trichlorophenol	2021/09/22		96	%	50 - 140
			2,4-dichlorophenol	2021/09/22		96	%	50 - 140
			2,4-dimethylphenol	2021/09/22		92	%	50 - 140
			2,4-dinitrophenol	2021/09/22		96	%	30 - 130
			2,6-dichlorophenol	2021/09/22		100	%	50 - 140
			2-chlorophenol	2021/09/22		84	%	50 - 140
			2-methylphenol	2021/09/22		76	%	50 - 140
			2-nitrophenol	2021/09/22		80	%	50 - 140
			3 & 4-methylphenol	2021/09/22		74	%	50 - 140
			4,6-dinitro-2-methylphenol	2021/09/22		92	%	30 - 130
			4-chloro-3-methylphenol	2021/09/22		92	%	50 - 140
			4-nitrophenol	2021/09/22		52	%	50 - 140
			Pentachlorophenol	2021/09/22		88	%	50 - 140
A360997	SJ1	Method Blank	2,3,4-trichlorophenol	2021/09/22	<0.00010		mg/L	
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/22		108	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/22		104	%	50 - 140
			Phenol	2021/09/22	<0.00010		mg/L	
			3 & 4-chlorophenol	2021/09/22	<0.00010		mg/L	
			2,3,5,6-tetrachlorophenol	2021/09/22	<0.00010		mg/L	
			2,3,4,6-tetrachlorophenol	2021/09/22	<0.00010		mg/L	
			2,4,5-trichlorophenol	2021/09/22	<0.00010		mg/L	
			2,4,6-trichlorophenol	2021/09/22	<0.00010		mg/L	
			2,3,5-trichlorophenol	2021/09/22	<0.00010		mg/L	
			2,4-dichlorophenol	2021/09/22	<0.00010		mg/L	
			2,4-dimethylphenol	2021/09/22	<0.00010		mg/L	
			2,4-dinitrophenol	2021/09/22	<0.0010		mg/L	
			2,6-dichlorophenol	2021/09/22	<0.00010		mg/L	
			2-chlorophenol	2021/09/22	<0.00010		mg/L	
			2-methylphenol	2021/09/22	<0.00010		mg/L	
			2-nitrophenol	2021/09/22	<0.0010		mg/L	
			3 & 4-methylphenol	2021/09/22	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/09/22	<0.0010		mg/L	
			4-chloro-3-methylphenol	2021/09/22	<0.00010		mg/L	
			4-nitrophenol	2021/09/22	<0.0010		mg/L	
			Pentachlorophenol	2021/09/22	<0.00010		mg/L	
A361292	STI	Matrix Spike [AGH682-06]	Total Phosphorus (P)	2021/09/23		101	%	80 - 120
A361292	STI	QC Standard	Total Phosphorus (P)	2021/09/23		90	%	80 - 120
A361292	STI	Spiked Blank	Total Phosphorus (P)	2021/09/23		96	%	80 - 120
A361292	STI	Method Blank	Total Phosphorus (P)	2021/09/23	0.0012, RDL=0.0010 (2)		mg/L	
A361292	STI	RPD [AGH682-06]	Total Phosphorus (P)	2021/09/23	2.0		%	20





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A361302	STI	Matrix Spike [AGH684-07]	Dissolved Phosphorus (P)	2021/09/23		96	%	80 - 120
A361302	STI	QC Standard	Dissolved Phosphorus (P)	2021/09/23		86	%	80 - 120
A361302	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/09/23		82	%	80 - 120
A361302	STI	Method Blank	Dissolved Phosphorus (P)	2021/09/23	<0.0010		mg/L	
A361302	STI	RPD [AGH684-07]	Dissolved Phosphorus (P)	2021/09/23	0.90		%	20
A361381	STI	Matrix Spike	Orthophosphate (P)	2021/09/22		NC	%	80 - 120
A361381	STI	Spiked Blank	Orthophosphate (P)	2021/09/22		105	%	80 - 120
A361381	STI	Method Blank	Orthophosphate (P)	2021/09/22	<0.0010		mg/L	
A361497	MPU	Matrix Spike [AGH676-09]	Dissolved Calcium (Ca)	2021/09/23		94	%	80 - 120
			Dissolved Iron (Fe)	2021/09/23		89	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/23		95	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/23		91	%	80 - 120
			Dissolved Potassium (K)	2021/09/23		96	%	80 - 120
			Dissolved Sodium (Na)	2021/09/23		NC	%	80 - 120
A361497	MPU	Spiked Blank	Dissolved Calcium (Ca)	2021/09/23		98	%	80 - 120
			Dissolved Iron (Fe)	2021/09/23		97	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/23		100	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/23		97	%	80 - 120
			Dissolved Potassium (K)	2021/09/23		99	%	80 - 120
			Dissolved Sodium (Na)	2021/09/23		97	%	80 - 120
A361497	MPU	Method Blank	Dissolved Calcium (Ca)	2021/09/23	<0.30		mg/L	
			Dissolved Iron (Fe)	2021/09/23	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2021/09/23	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/23	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/23	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/09/23	<0.50		mg/L	
A361497	MPU	RPD [AGH676-09]	Dissolved Calcium (Ca)	2021/09/24	2.0		%	20
			Dissolved Iron (Fe)	2021/09/24	NC		%	20
			Dissolved Magnesium (Mg)	2021/09/24	0.95		%	20
			Dissolved Manganese (Mn)	2021/09/24	4.7		%	20
			Dissolved Potassium (K)	2021/09/24	2.1		%	20
			Dissolved Sodium (Na)	2021/09/24	4.8		%	20
A362239	JLP	Matrix Spike	Total Mercury (Hg)	2021/09/24		100	%	70 - 130
A362239	JLP	Spiked Blank	Total Mercury (Hg)	2021/09/24		94	%	70 - 130
A362239	JLP	Method Blank	Total Mercury (Hg)	2021/09/24	<0.00010		ug/L	
A362239	JLP	RPD	Total Mercury (Hg)	2021/09/24	0.52		%	20
A362644	HE1	Matrix Spike	Total Dissolved Solids	2021/09/23		90	%	80 - 120
A362644	HE1	Spiked Blank	Total Dissolved Solids	2021/09/23		98	%	80 - 120
A362644	HE1	Method Blank	Total Dissolved Solids	2021/09/23	<10		mg/L	
A362644	HE1	RPD	Total Dissolved Solids	2021/09/23	3.2		%	20
A362666	AP1	Matrix Spike [AGH684-01]	Total Dissolved Solids	2021/09/23		NC	%	80 - 120
A362666	AP1	Spiked Blank	Total Dissolved Solids	2021/09/23		101	%	80 - 120
A362666	AP1	Method Blank	Total Dissolved Solids	2021/09/23	<10		mg/L	
A362666	AP1	RPD [AGH684-01]	Total Dissolved Solids	2021/09/23	0.21		%	20
A363014	STI	Matrix Spike [AGH678-06]	Total Nitrogen (N)	2021/09/23		92	%	80 - 120
A363014	STI	QC Standard	Total Nitrogen (N)	2021/09/23		91	%	80 - 120
A363014	STI	Spiked Blank	Total Nitrogen (N)	2021/09/23		99	%	80 - 120
A363014	STI	Method Blank	Total Nitrogen (N)	2021/09/23	<0.020		mg/L	
A363014	STI	RPD [AGH678-06]	Total Nitrogen (N)	2021/09/23	11		%	20
A363015	FM0	Matrix Spike [AGH689-06]	Total Nitrogen (N)	2021/09/24		100	%	80 - 120





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A363015	FM0		QC Standard	Total Nitrogen (N)	2021/09/24		88	%	80 - 120
A363015	FM0		Spiked Blank	Total Nitrogen (N)	2021/09/24		99	%	80 - 120
A363015	FM0		Method Blank	Total Nitrogen (N)	2021/09/24	<0.020		mg/L	
A363015	FM0		RPD [AGH689-06]	Total Nitrogen (N)	2021/09/24	12		%	20
A363115	SKM		Matrix Spike	Total Ammonia (N)	2021/09/23		100	%	80 - 120
A363115	SKM		Spiked Blank	Total Ammonia (N)	2021/09/23		102	%	80 - 120
A363115	SKM		Method Blank	Total Ammonia (N)	2021/09/23	<0.015		mg/L	
A363115	SKM		RPD	Total Ammonia (N)	2021/09/23	NC		%	20
A363123	BYM		Matrix Spike	Chemical Oxygen Demand	2021/09/23		NC	%	80 - 120
A363123	BYM		Spiked Blank	Chemical Oxygen Demand	2021/09/23		101	%	80 - 120
A363123	BYM		Method Blank	Chemical Oxygen Demand	2021/09/23	<10		mg/L	
A363123	BYM		RPD	Chemical Oxygen Demand	2021/09/23	2.4		%	20
A363344	YPA		Matrix Spike	1,4-Difluorobenzene (sur.)	2021/09/25		102	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/25		100	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/25		92	%	50 - 140
				Bromodichloromethane	2021/09/25		98	%	50 - 140
				Bromoform	2021/09/25		114	%	50 - 140
				Bromomethane	2021/09/25		86	%	50 - 140
				Carbon tetrachloride	2021/09/25		95	%	50 - 140
				Chlorobenzene	2021/09/25		103	%	50 - 140
				Dibromochloromethane	2021/09/25		111	%	50 - 140
				Chloroethane	2021/09/25		79	%	50 - 140
				Chloroform	2021/09/25		99	%	50 - 140
				Chloromethane	2021/09/25		76	%	50 - 140
				1,2-dibromoethane	2021/09/25		104	%	50 - 140
				1,2-dichlorobenzene	2021/09/25		98	%	50 - 140
				1,3-dichlorobenzene	2021/09/25		97	%	50 - 140
				1,4-dichlorobenzene	2021/09/25		95	%	50 - 140
				1,1-dichloroethane	2021/09/25		94	%	50 - 140
				1,2-dichloroethane	2021/09/25		100	%	50 - 140
				1,1-dichloroethene	2021/09/25		95	%	50 - 140
				cis-1,2-dichloroethene	2021/09/25		100	%	50 - 140
				trans-1,2-dichloroethene	2021/09/25		92	%	50 - 140
				Dichloromethane	2021/09/25		94	%	50 - 140
				1,2-dichloropropane	2021/09/25		99	%	50 - 140
				cis-1,3-dichloropropene	2021/09/25		92	%	50 - 140
				trans-1,3-dichloropropene	2021/09/25		111	%	50 - 140
				Methyl methacrylate	2021/09/25		109	%	50 - 140
				Methyl-tert-butylether (MTBE)	2021/09/25		98	%	50 - 140
				Styrene	2021/09/25		100	%	50 - 140
				1,1,1,2-tetrachloroethane	2021/09/25		105	%	50 - 140
				1,1,2,2-tetrachloroethane	2021/09/25		109	%	50 - 140
				Tetrachloroethene	2021/09/25		97	%	50 - 140
				1,2,3-trichlorobenzene	2021/09/25		126	%	50 - 140
				1,2,4-trichlorobenzene	2021/09/25		130	%	50 - 140
				1,3,5-trichlorobenzene	2021/09/25		113	%	50 - 140
				1,1,1-trichloroethane	2021/09/25		101	%	50 - 140
				1,1,2-trichloroethane	2021/09/25		106	%	50 - 140
				Trichloroethene	2021/09/25		99	%	50 - 140
				Trichlorofluoromethane	2021/09/25		94	%	50 - 140
				1,2,4-trimethylbenzene	2021/09/25		NC	%	50 - 140
				1,3,5-trimethylbenzene	2021/09/25		87	%	50 - 140
				Vinyl chloride	2021/09/25		89	%	50 - 140
A363344	YPA		Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/25		102	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/25		102	%	50 - 140





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				D4-1,2-Dichloroethane (sur.)	2021/09/25		93	%	50 - 140
				Bromodichloromethane	2021/09/25		93	%	60 - 130
				Bromoform	2021/09/25		110	%	60 - 130
				Bromomethane	2021/09/25		81	%	60 - 130
				Carbon tetrachloride	2021/09/25		94	%	60 - 130
				Chlorobenzene	2021/09/25		100	%	60 - 130
				Dibromochloromethane	2021/09/25		107	%	60 - 130
				Chloroethane	2021/09/25		76	%	60 - 130
				Chloroform	2021/09/25		94	%	60 - 130
				Chloromethane	2021/09/25		73	%	60 - 130
				1,2-dibromoethane	2021/09/25		99	%	60 - 130
				1,2-dichlorobenzene	2021/09/25		97	%	60 - 130
				1,3-dichlorobenzene	2021/09/25		98	%	60 - 130
				1,4-dichlorobenzene	2021/09/25		96	%	60 - 130
				1,1-dichloroethane	2021/09/25		92	%	60 - 130
				1,2-dichloroethane	2021/09/25		96	%	60 - 130
				1,1-dichloroethene	2021/09/25		92	%	60 - 130
				cis-1,2-dichloroethene	2021/09/25		96	%	60 - 130
				trans-1,2-dichloroethene	2021/09/25		90	%	60 - 130
				Dichloromethane	2021/09/25		90	%	60 - 130
				1,2-dichloropropane	2021/09/25		95	%	60 - 130
				cis-1,3-dichloropropene	2021/09/25		84	%	60 - 130
				trans-1,3-dichloropropene	2021/09/25		98	%	60 - 130
				Methyl methacrylate	2021/09/25		105	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/09/25		97	%	60 - 130
				Styrene	2021/09/25		98	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/09/25		101	%	60 - 130
				1,1,2,2-tetrachloroethane	2021/09/25		104	%	60 - 130
				Tetrachloroethene	2021/09/25		93	%	60 - 130
				1,2,3-trichlorobenzene	2021/09/25		87	%	60 - 130
				1,2,4-trichlorobenzene	2021/09/25		86	%	60 - 130
				1,3,5-trichlorobenzene	2021/09/25		84	%	60 - 130
				1,1,1-trichloroethane	2021/09/25		97	%	60 - 130
				1,1,2-trichloroethane	2021/09/25		97	%	60 - 130
				Trichloroethene	2021/09/25		96	%	60 - 130
				Trichlorofluoromethane	2021/09/25		92	%	60 - 130
				1,2,4-trimethylbenzene	2021/09/25		98	%	60 - 130
				1,3,5-trimethylbenzene	2021/09/25		98	%	60 - 130
				Vinyl chloride	2021/09/25		86	%	60 - 130
A363344	YPA	Method Blank		1,4-Difluorobenzene (sur.)	2021/09/25		102	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/25		96	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/25		103	%	50 - 140
				Bromodichloromethane	2021/09/25	<0.50		ug/L	
				Bromoform	2021/09/25	<0.50		ug/L	
				Bromomethane	2021/09/25	<2.0		ug/L	
				Carbon tetrachloride	2021/09/25	<0.50		ug/L	
				Chlorobenzene	2021/09/25	<0.50		ug/L	
				Dibromochloromethane	2021/09/25	<1.0		ug/L	
				Chloroethane	2021/09/25	<1.0		ug/L	
				Chloroform	2021/09/25	<0.50		ug/L	
				Chloromethane	2021/09/25	<2.0		ug/L	
				1,2-dibromoethane	2021/09/25	<0.20		ug/L	
				1,2-dichlorobenzene	2021/09/25	<0.50		ug/L	
				1,3-dichlorobenzene	2021/09/25	<0.50		ug/L	
				1,4-dichlorobenzene	2021/09/25	<0.50		ug/L	





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				1,1-dichloroethane	2021/09/25	<0.50		ug/L	
				1,2-dichloroethane	2021/09/25	<0.50		ug/L	
				1,1-dichloroethene	2021/09/25	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/09/25	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/09/25	<0.50		ug/L	
				Dichloromethane	2021/09/25	<2.0		ug/L	
				1,2-dichloropropane	2021/09/25	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/09/25	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/09/25	<0.50		ug/L	
				Methyl methacrylate	2021/09/25	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/09/25	<0.50		ug/L	
				Styrene	2021/09/25	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/09/25	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/09/25	<2.0		ug/L	
				Tetrachloroethene	2021/09/25	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/09/25	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/09/25	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/09/25	<0.50		ug/L	
				1,1,1-trichloroethane	2021/09/25	<0.50		ug/L	
				1,1,2-trichloroethane	2021/09/25	<0.50		ug/L	
				Trichloroethene	2021/09/25	<0.50		ug/L	
				Trichlorofluoromethane	2021/09/25	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/09/25	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/09/25	<0.50		ug/L	
				Vinyl chloride	2021/09/25	<0.50		ug/L	
A363344	YPA	RPD		1,2-dichloroethane	2021/09/25	NC		%	30
A363570	BFE	Matrix Spike		Dissolved Chloride (Cl)	2021/09/23		98	%	80 - 120
				Dissolved Sulphate (SO4)	2021/09/23		NC	%	80 - 120
A363570	BFE	Spiked Blank		Dissolved Chloride (Cl)	2021/09/23		100	%	80 - 120
				Dissolved Sulphate (SO4)	2021/09/23		99	%	80 - 120
A363570	BFE	Method Blank		Dissolved Chloride (Cl)	2021/09/23	<1.0		mg/L	
				Dissolved Sulphate (SO4)	2021/09/23	<1.0		mg/L	
A363570	BFE	RPD		Dissolved Chloride (Cl)	2021/09/23	3.6		%	20
				Dissolved Sulphate (SO4)	2021/09/23	1.3		%	20
A364095	AP1	Matrix Spike [AGH675-01]		Total Suspended Solids	2021/09/24		89	%	80 - 120
A364095	AP1	Spiked Blank		Total Suspended Solids	2021/09/24		96	%	80 - 120
A364095	AP1	Method Blank		Total Suspended Solids	2021/09/24	<1.0		mg/L	
A364095	AP1	RPD [AGH675-01]		Total Suspended Solids	2021/09/24	3.4		%	20
A364270	ANE	Matrix Spike [AGH688-17]		Total Aluminum (Al)	2021/09/25		161 (1)	%	80 - 120
				Total Antimony (Sb)	2021/09/25		113	%	80 - 120
				Total Arsenic (As)	2021/09/25		96	%	80 - 120
				Total Barium (Ba)	2021/09/25		NC	%	80 - 120
				Total Beryllium (Be)	2021/09/25		89	%	80 - 120
				Total Bismuth (Bi)	2021/09/25		95	%	80 - 120
				Total Boron (B)	2021/09/25		NC	%	80 - 120
				Total Cadmium (Cd)	2021/09/25		86	%	80 - 120
				Total Chromium (Cr)	2021/09/25		97	%	80 - 120
				Total Cobalt (Co)	2021/09/25		94	%	80 - 120
				Total Copper (Cu)	2021/09/25		88	%	80 - 120
				Total Iron (Fe)	2021/09/25		NC	%	80 - 120
				Total Lead (Pb)	2021/09/25		100	%	80 - 120
				Total Lithium (Li)	2021/09/25		NC	%	80 - 120
				Total Manganese (Mn)	2021/09/25		99	%	80 - 120





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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC									
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits	
A364270	ANE	Spiked Blank	Total Molybdenum (Mo)	2021/09/25		NC	%	80 - 120	
			Total Nickel (Ni)	2021/09/25		86	%	80 - 120	
			Total Phosphorus (P)	2021/09/25		102	%	80 - 120	
			Total Selenium (Se)	2021/09/25		88	%	80 - 120	
			Total Silicon (Si)	2021/09/25		78 (1)	%	80 - 120	
			Total Silver (Ag)	2021/09/25		94	%	80 - 120	
			Total Strontium (Sr)	2021/09/25		NC	%	80 - 120	
			Total Thallium (Tl)	2021/09/25		98	%	80 - 120	
			Total Tin (Sn)	2021/09/25		103	%	80 - 120	
			Total Titanium (Ti)	2021/09/25		107	%	80 - 120	
			Total Uranium (U)	2021/09/25		108	%	80 - 120	
			Total Vanadium (V)	2021/09/25		NC	%	80 - 120	
			Total Zinc (Zn)	2021/09/25		82	%	80 - 120	
			Total Zirconium (Zr)	2021/09/25		126 (1)	%	80 - 120	
			Total Aluminum (Al)	2021/09/24		105	%	80 - 120	
			Total Antimony (Sb)	2021/09/24		117	%	80 - 120	
			Total Arsenic (As)	2021/09/24		92	%	80 - 120	
			Total Barium (Ba)	2021/09/24		101	%	80 - 120	
			Total Beryllium (Be)	2021/09/24		96	%	80 - 120	
			Total Bismuth (Bi)	2021/09/24		104	%	80 - 120	
			Total Boron (B)	2021/09/24		102	%	80 - 120	
			Total Cadmium (Cd)	2021/09/24		97	%	80 - 120	
			Total Chromium (Cr)	2021/09/24		101	%	80 - 120	
			Total Cobalt (Co)	2021/09/24		101	%	80 - 120	
			Total Copper (Cu)	2021/09/24		100	%	80 - 120	
			Total Iron (Fe)	2021/09/24		106	%	80 - 120	
			Total Lead (Pb)	2021/09/24		103	%	80 - 120	
			Total Lithium (Li)	2021/09/24		95	%	80 - 120	
			Total Manganese (Mn)	2021/09/24		103	%	80 - 120	
			Total Molybdenum (Mo)	2021/09/24		104	%	80 - 120	
			Total Nickel (Ni)	2021/09/24		101	%	80 - 120	
			Total Phosphorus (P)	2021/09/24		102	%	80 - 120	
			Total Selenium (Se)	2021/09/24		91	%	80 - 120	
			Total Silicon (Si)	2021/09/24		75 (1)	%	80 - 120	
			Total Silver (Ag)	2021/09/24		102	%	80 - 120	
			Total Strontium (Sr)	2021/09/24		105	%	80 - 120	
			Total Thallium (Tl)	2021/09/24		100	%	80 - 120	
			Total Tin (Sn)	2021/09/24		100	%	80 - 120	
			Total Titanium (Ti)	2021/09/24		110	%	80 - 120	
			Total Uranium (U)	2021/09/24		106	%	80 - 120	
			Total Vanadium (V)	2021/09/24		102	%	80 - 120	
			Total Zinc (Zn)	2021/09/24		100	%	80 - 120	
			Total Zirconium (Zr)	2021/09/24		104	%	80 - 120	
A364270	ANE	Method Blank	Total Aluminum (Al)	2021/09/25	<3.0		ug/L		
			Total Antimony (Sb)	2021/09/25	<0.020		ug/L		
			Total Arsenic (As)	2021/09/25	<0.020		ug/L		
			Total Barium (Ba)	2021/09/25	<0.050		ug/L		
			Total Beryllium (Be)	2021/09/25	<0.010		ug/L		
			Total Bismuth (Bi)	2021/09/25	<0.010		ug/L		
			Total Boron (B)	2021/09/25	<10		ug/L		
			Total Cadmium (Cd)	2021/09/25	<0.0050		ug/L		
			Total Chromium (Cr)	2021/09/25	<0.10		ug/L		
			Total Cobalt (Co)	2021/09/25	<0.010		ug/L		
			Total Copper (Cu)	2021/09/25	0.17,		ug/L		
					RDL=0.10 (3)				





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A364270	ANE	RPD [AGH684-17]	Total Iron (Fe)	2021/09/25	<5.0		ug/L	
			Total Lead (Pb)	2021/09/25	<0.020		ug/L	
			Total Lithium (Li)	2021/09/25	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/25	0.12, RDL=0.10 (3)		ug/L	
			Total Molybdenum (Mo)	2021/09/25	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/25	<0.10		ug/L	
			Total Phosphorus (P)	2021/09/25	<5.0		ug/L	
			Total Selenium (Se)	2021/09/25	<0.040		ug/L	
			Total Silicon (Si)	2021/09/25	<50		ug/L	
			Total Silver (Ag)	2021/09/25	<0.010		ug/L	
			Total Strontium (Sr)	2021/09/25	<0.050		ug/L	
			Total Thallium (Tl)	2021/09/25	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/25	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/25	<2.0		ug/L	
			Total Uranium (U)	2021/09/25	<0.0050		ug/L	
			Total Vanadium (V)	2021/09/25	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/25	1.1, RDL=1.0 (3)		ug/L	
			Total Zirconium (Zr)	2021/09/25	<0.10		ug/L	
			Total Aluminum (Al)	2021/09/26	3.5		%	20
			Total Antimony (Sb)	2021/09/26	9.8		%	20
			Total Arsenic (As)	2021/09/26	2.8		%	20
			Total Barium (Ba)	2021/09/26	12		%	20
			Total Beryllium (Be)	2021/09/26	NC		%	20
			Total Bismuth (Bi)	2021/09/26	NC		%	20
			Total Boron (B)	2021/09/26	6.2		%	20
			Total Cadmium (Cd)	2021/09/26	NC		%	20
			Total Chromium (Cr)	2021/09/26	NC		%	20
			Total Cobalt (Co)	2021/09/26	2.0		%	20
			Total Copper (Cu)	2021/09/26	NC		%	20
			Total Iron (Fe)	2021/09/26	2.3		%	20
			Total Lead (Pb)	2021/09/26	NC		%	20
			Total Lithium (Li)	2021/09/26	2.9		%	20
			Total Manganese (Mn)	2021/09/26	1.8		%	20
			Total Molybdenum (Mo)	2021/09/26	3.2		%	20
			Total Nickel (Ni)	2021/09/26	13		%	20
			Total Phosphorus (P)	2021/09/26	0.11		%	20
			Total Selenium (Se)	2021/09/26	8.6		%	20
			Total Silicon (Si)	2021/09/26	16		%	20
			Total Silver (Ag)	2021/09/26	NC		%	20
			Total Strontium (Sr)	2021/09/26	4.3		%	20
			Total Thallium (Tl)	2021/09/26	NC		%	20
			Total Tin (Sn)	2021/09/26	NC		%	20
			Total Titanium (Ti)	2021/09/26	NC		%	20
			Total Uranium (U)	2021/09/26	3.4		%	20
			Total Vanadium (V)	2021/09/26	3.1		%	20
			Total Zinc (Zn)	2021/09/26	NC		%	20
			Total Zirconium (Zr)	2021/09/26	NC		%	20
A364431	ANE	Matrix Spike	Dissolved Aluminum (Al)	2021/09/24		88	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/24		94	%	80 - 120
			Dissolved Arsenic (As)	2021/09/24		84	%	80 - 120
			Dissolved Barium (Ba)	2021/09/24		85	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/24		112	%	80 - 120
			Dissolved Bismuth (Bi)	2021/09/24		89	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A364431	ANE	Spiked Blank	Dissolved Boron (B)	2021/09/24		129 (1)	%	80 - 120
			Dissolved Cadmium (Cd)	2021/09/24		85	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/24		88	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/24		86	%	80 - 120
			Dissolved Copper (Cu)	2021/09/24		87	%	80 - 120
			Dissolved Iron (Fe)	2021/09/24		106	%	80 - 120
			Dissolved Lead (Pb)	2021/09/24		91	%	80 - 120
			Dissolved Lithium (Li)	2021/09/24		109	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/24		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/24		86	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/24		87	%	80 - 120
			Dissolved Selenium (Se)	2021/09/24		95	%	80 - 120
			Dissolved Silicon (Si)	2021/09/24		77 (1)	%	80 - 120
			Dissolved Silver (Ag)	2021/09/24		83	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/24		84	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/24		88	%	80 - 120
			Dissolved Tin (Sn)	2021/09/24		102	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/24		85	%	80 - 120
			Dissolved Uranium (U)	2021/09/24		92	%	80 - 120
			Dissolved Vanadium (V)	2021/09/24		87	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/24		99	%	80 - 120
			Dissolved Zirconium (Zr)	2021/09/24		91	%	80 - 120
			Dissolved Aluminum (Al)	2021/09/24		95	%	80 - 120
			Dissolved Antimony (Sb)	2021/09/24		102	%	80 - 120
			Dissolved Arsenic (As)	2021/09/24		90	%	80 - 120
			Dissolved Barium (Ba)	2021/09/24		92	%	80 - 120
			Dissolved Beryllium (Be)	2021/09/24		114	%	80 - 120
			Dissolved Bismuth (Bi)	2021/09/24		96	%	80 - 120
			Dissolved Boron (B)	2021/09/24		126 (1)	%	80 - 120
			Dissolved Cadmium (Cd)	2021/09/24		92	%	80 - 120
			Dissolved Chromium (Cr)	2021/09/24		95	%	80 - 120
			Dissolved Cobalt (Co)	2021/09/24		92	%	80 - 120
			Dissolved Copper (Cu)	2021/09/24		93	%	80 - 120
			Dissolved Iron (Fe)	2021/09/24		106	%	80 - 120
			Dissolved Lead (Pb)	2021/09/24		97	%	80 - 120
			Dissolved Lithium (Li)	2021/09/24		109	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/24		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/09/24		94	%	80 - 120
			Dissolved Nickel (Ni)	2021/09/24		93	%	80 - 120
			Dissolved Selenium (Se)	2021/09/24		98	%	80 - 120
			Dissolved Silicon (Si)	2021/09/24		74 (1)	%	80 - 120
			Dissolved Silver (Ag)	2021/09/24		88	%	80 - 120
			Dissolved Strontium (Sr)	2021/09/24		90	%	80 - 120
			Dissolved Thallium (Tl)	2021/09/24		94	%	80 - 120
			Dissolved Tin (Sn)	2021/09/24		104	%	80 - 120
			Dissolved Titanium (Ti)	2021/09/24		91	%	80 - 120
			Dissolved Uranium (U)	2021/09/24		98	%	80 - 120
			Dissolved Vanadium (V)	2021/09/24		94	%	80 - 120
			Dissolved Zinc (Zn)	2021/09/24		108	%	80 - 120
			Dissolved Zirconium (Zr)	2021/09/24		119	%	80 - 120
A364431	ANE	Method Blank	Dissolved Aluminum (Al)	2021/09/28	<0.50		ug/L	
			Dissolved Antimony (Sb)	2021/09/28	<0.020		ug/L	
			Dissolved Arsenic (As)	2021/09/28	<0.020		ug/L	
			Dissolved Barium (Ba)	2021/09/28	0.023, RDL=0.020 (4)		ug/L	





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A364431	ANE	RPD	Dissolved Beryllium (Be)	2021/09/28	<0.010		ug/L	
			Dissolved Bismuth (Bi)	2021/09/28	<0.0050		ug/L	
			Dissolved Boron (B)	2021/09/28	<10		ug/L	
			Dissolved Cadmium (Cd)	2021/09/28	<0.0050		ug/L	
			Dissolved Chromium (Cr)	2021/09/28	<0.10		ug/L	
			Dissolved Cobalt (Co)	2021/09/28	<0.0050		ug/L	
			Dissolved Copper (Cu)	2021/09/28	<0.050		ug/L	
			Dissolved Iron (Fe)	2021/09/28	<1.0		ug/L	
			Dissolved Lead (Pb)	2021/09/28	<0.0050		ug/L	
			Dissolved Lithium (Li)	2021/09/28	<0.50		ug/L	
			Dissolved Manganese (Mn)	2021/09/28	<0.050		ug/L	
			Dissolved Molybdenum (Mo)	2021/09/28	<0.050		ug/L	
			Dissolved Nickel (Ni)	2021/09/28	0.031, RDL=0.020 (4)		ug/L	
			Dissolved Selenium (Se)	2021/09/28	<0.040		ug/L	
			Dissolved Silicon (Si)	2021/09/28	<50		ug/L	
			Dissolved Silver (Ag)	2021/09/28	<0.0050		ug/L	
			Dissolved Strontium (Sr)	2021/09/28	<0.050		ug/L	
			Dissolved Thallium (Tl)	2021/09/28	0.0030, RDL=0.0020 (4)		ug/L	
			Dissolved Tin (Sn)	2021/09/28	<0.20		ug/L	
			Dissolved Titanium (Ti)	2021/09/28	<0.50		ug/L	
			Dissolved Uranium (U)	2021/09/28	<0.0020		ug/L	
			Dissolved Vanadium (V)	2021/09/28	<0.20		ug/L	
			Dissolved Zinc (Zn)	2021/09/28	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2021/09/28	<0.10		ug/L	
			Dissolved Antimony (Sb)	2021/09/28	NC		%	20
			Dissolved Arsenic (As)	2021/09/28	NC		%	20
			Dissolved Barium (Ba)	2021/09/28	NC		%	20
			Dissolved Beryllium (Be)	2021/09/28	NC		%	20
			Dissolved Bismuth (Bi)	2021/09/28	NC		%	20
			Dissolved Boron (B)	2021/09/28	NC		%	20
			Dissolved Cadmium (Cd)	2021/09/28	NC		%	20
			Dissolved Chromium (Cr)	2021/09/28	NC		%	20
			Dissolved Cobalt (Co)	2021/09/28	NC		%	20
			Dissolved Copper (Cu)	2021/09/28	NC		%	20
			Dissolved Iron (Fe)	2021/09/28	NC		%	20
			Dissolved Lead (Pb)	2021/09/28	NC		%	20
			Dissolved Lithium (Li)	2021/09/28	NC		%	20
			Dissolved Manganese (Mn)	2021/09/28	NC		%	20
			Dissolved Molybdenum (Mo)	2021/09/28	NC		%	20
			Dissolved Nickel (Ni)	2021/09/28	NC		%	20
			Dissolved Selenium (Se)	2021/09/28	NC		%	20
			Dissolved Silicon (Si)	2021/09/28	NC		%	20
			Dissolved Silver (Ag)	2021/09/28	NC		%	20
			Dissolved Strontium (Sr)	2021/09/28	11		%	20
			Dissolved Thallium (Tl)	2021/09/28	NC		%	20
			Dissolved Tin (Sn)	2021/09/28	NC		%	20
			Dissolved Titanium (Ti)	2021/09/28	NC		%	20
			Dissolved Uranium (U)	2021/09/28	NC		%	20
			Dissolved Vanadium (V)	2021/09/28	NC		%	20
			Dissolved Zirconium (Zr)	2021/09/28	NC		%	20
A364606	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/09/26		108	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/26		NC	%	80 - 120
A364606	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/09/26		102	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A364606	BFE	Method Blank	Dissolved Sulphate (SO4)	2021/09/26		101	%	80 - 120
			Dissolved Chloride (Cl)	2021/09/26	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/26	<1.0		mg/L	
A364606	BFE	RPD	Dissolved Chloride (Cl)	2021/09/26	1.8		%	20
			Dissolved Sulphate (SO4)	2021/09/26	1.1		%	20
			Dissolved Chloride (Cl)	2021/09/24		109	%	80 - 120
A364610	BFE	Matrix Spike	Dissolved Sulphate (SO4)	2021/09/24		NC	%	80 - 120
			Dissolved Chloride (Cl)	2021/09/24		105	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/24		99	%	80 - 120
A364610	BFE	Method Blank	Dissolved Chloride (Cl)	2021/09/24	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/24	<1.0		mg/L	
			Dissolved Chloride (Cl)	2021/09/24	3.2		%	20
A364610	BFE	RPD	Dissolved Sulphate (SO4)	2021/09/24	1.5		%	20
			Total Ammonia (N)	2021/09/24		101	%	80 - 120
			[AGH688-16]					
A364701	JFH	Matrix Spike	Total Ammonia (N)	2021/09/24		101	%	80 - 120
A364701	JFH	Spiked Blank	Total Ammonia (N)	2021/09/24			%	80 - 120
A364701	JFH	Method Blank	Total Ammonia (N)	2021/09/24	<0.015		mg/L	
A364701	JFH	RPD [AGH688-16]	Total Ammonia (N)	2021/09/24	0.97		%	20
A365149	ANE	Matrix Spike	Total Aluminum (Al)	2021/09/24		88	%	80 - 120
			Total Antimony (Sb)	2021/09/24		102	%	80 - 120
			Total Arsenic (As)	2021/09/24		89	%	80 - 120
			Total Barium (Ba)	2021/09/24		94	%	80 - 120
			Total Beryllium (Be)	2021/09/24		102	%	80 - 120
			Total Bismuth (Bi)	2021/09/24		96	%	80 - 120
			Total Boron (B)	2021/09/24		112	%	80 - 120
			Total Cadmium (Cd)	2021/09/24		94	%	80 - 120
			Total Chromium (Cr)	2021/09/24		95	%	80 - 120
			Total Cobalt (Co)	2021/09/24		93	%	80 - 120
			Total Copper (Cu)	2021/09/24		92	%	80 - 120
			Total Iron (Fe)	2021/09/24		102	%	80 - 120
			Total Lead (Pb)	2021/09/24		95	%	80 - 120
			Total Lithium (Li)	2021/09/24		102	%	80 - 120
			Total Manganese (Mn)	2021/09/24		93	%	80 - 120
			Total Molybdenum (Mo)	2021/09/24		97	%	80 - 120
			Total Nickel (Ni)	2021/09/24		95	%	80 - 120
			Total Selenium (Se)	2021/09/24		95	%	80 - 120
			Total Silicon (Si)	2021/09/24		78 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/24		93	%	80 - 120
			Total Strontium (Sr)	2021/09/24		97	%	80 - 120
			Total Thallium (Tl)	2021/09/24		94	%	80 - 120
			Total Tin (Sn)	2021/09/24		101	%	80 - 120
			Total Titanium (Ti)	2021/09/24		95	%	80 - 120
			Total Uranium (U)	2021/09/24		94	%	80 - 120
			Total Vanadium (V)	2021/09/24		94	%	80 - 120
			Total Zinc (Zn)	2021/09/24		103	%	80 - 120
			Total Zirconium (Zr)	2021/09/24		96	%	80 - 120
A365149	ANE	Spiked Blank	Total Aluminum (Al)	2021/09/24		85	%	80 - 120
			Total Antimony (Sb)	2021/09/24		101	%	80 - 120
			Total Arsenic (As)	2021/09/24		87	%	80 - 120
			Total Barium (Ba)	2021/09/24		92	%	80 - 120
			Total Beryllium (Be)	2021/09/24		99	%	80 - 120
			Total Bismuth (Bi)	2021/09/24		89	%	80 - 120
			Total Boron (B)	2021/09/24		109	%	80 - 120
			Total Cadmium (Cd)	2021/09/24		92	%	80 - 120
A365149	ANE	Spiked Blank	Total Chromium (Cr)	2021/09/24		92	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A365149	ANE	Method Blank	Total Cobalt (Co)	2021/09/24		90	%	80 - 120
			Total Copper (Cu)	2021/09/24		89	%	80 - 120
			Total Iron (Fe)	2021/09/24		98	%	80 - 120
			Total Lead (Pb)	2021/09/24		91	%	80 - 120
			Total Lithium (Li)	2021/09/24		98	%	80 - 120
			Total Manganese (Mn)	2021/09/24		90	%	80 - 120
			Total Molybdenum (Mo)	2021/09/24		92	%	80 - 120
			Total Nickel (Ni)	2021/09/24		92	%	80 - 120
			Total Selenium (Se)	2021/09/24		93	%	80 - 120
			Total Silicon (Si)	2021/09/24		73 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/24		87	%	80 - 120
			Total Strontium (Sr)	2021/09/24		93	%	80 - 120
			Total Thallium (Tl)	2021/09/24		89	%	80 - 120
			Total Tin (Sn)	2021/09/24		99	%	80 - 120
			Total Titanium (Ti)	2021/09/24		93	%	80 - 120
			Total Uranium (U)	2021/09/24		90	%	80 - 120
			Total Vanadium (V)	2021/09/24		92	%	80 - 120
			Total Zinc (Zn)	2021/09/24		102	%	80 - 120
			Total Zirconium (Zr)	2021/09/24		95	%	80 - 120
			Total Aluminum (Al)	2021/09/28	<0.50		ug/L	
			Total Antimony (Sb)	2021/09/28	<0.020		ug/L	
			Total Arsenic (As)	2021/09/28	<0.020		ug/L	
			Total Barium (Ba)	2021/09/28	<0.020		ug/L	
			Total Beryllium (Be)	2021/09/28	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/28	<0.0050		ug/L	
			Total Boron (B)	2021/09/28	<10		ug/L	
			Total Cadmium (Cd)	2021/09/28	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/28	<0.10		ug/L	
			Total Cobalt (Co)	2021/09/28	<0.0050		ug/L	
			Total Copper (Cu)	2021/09/28	<0.050		ug/L	
			Total Iron (Fe)	2021/09/28	<1.0		ug/L	
			Total Lead (Pb)	2021/09/28	<0.0050		ug/L	
			Total Lithium (Li)	2021/09/28	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/28	<0.050		ug/L	
			Total Molybdenum (Mo)	2021/09/28	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/28	<0.020		ug/L	
			Total Selenium (Se)	2021/09/28	<0.040		ug/L	
			Total Silicon (Si)	2021/09/28	<50		ug/L	
			Total Silver (Ag)	2021/09/28	<0.0050		ug/L	
			Total Strontium (Sr)	2021/09/28	<0.050		ug/L	
			Total Thallium (Tl)	2021/09/28	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/28	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/28	<0.50		ug/L	
			Total Uranium (U)	2021/09/28	<0.0020		ug/L	
			Total Vanadium (V)	2021/09/28	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/28	0.12, RDL=0.10 (5)		ug/L	
A365149	ANE	RPD	Total Zirconium (Zr)	2021/09/28	<0.10		ug/L	
			Total Antimony (Sb)	2021/09/28	NC		%	20
			Total Arsenic (As)	2021/09/28	NC		%	20
			Total Barium (Ba)	2021/09/28	NC		%	20
			Total Beryllium (Be)	2021/09/28	NC		%	20
			Total Bismuth (Bi)	2021/09/28	NC		%	20
			Total Boron (B)	2021/09/28	12		%	20
			Total Cadmium (Cd)	2021/09/28	NC		%	20





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Total Chromium (Cr)	2021/09/28	NC		%	20
				Total Cobalt (Co)	2021/09/28	NC		%	20
				Total Copper (Cu)	2021/09/28	NC		%	20
				Total Iron (Fe)	2021/09/28	NC		%	20
				Total Lead (Pb)	2021/09/28	NC		%	20
				Total Lithium (Li)	2021/09/28	NC		%	20
				Total Manganese (Mn)	2021/09/28	NC		%	20
				Total Molybdenum (Mo)	2021/09/28	NC		%	20
				Total Nickel (Ni)	2021/09/28	NC		%	20
				Total Selenium (Se)	2021/09/28	NC		%	20
				Total Silicon (Si)	2021/09/28	NC		%	20
				Total Silver (Ag)	2021/09/28	NC		%	20
				Total Strontium (Sr)	2021/09/28	NC		%	20
				Total Thallium (Tl)	2021/09/28	NC		%	20
				Total Tin (Sn)	2021/09/28	NC		%	20
				Total Titanium (Ti)	2021/09/28	NC		%	20
				Total Uranium (U)	2021/09/28	NC		%	20
				Total Vanadium (V)	2021/09/28	NC		%	20
				Total Zirconium (Zr)	2021/09/28	NC		%	20
A365459	BFE		Matrix Spike	Dissolved Chloride (Cl)	2021/09/24		112	%	80 - 120
				Dissolved Sulphate (SO4)	2021/09/24		103	%	80 - 120
A365459	BFE		Spiked Blank	Dissolved Chloride (Cl)	2021/09/24		108	%	80 - 120
				Dissolved Sulphate (SO4)	2021/09/24		100	%	80 - 120
A365459	BFE		Method Blank	Dissolved Chloride (Cl)	2021/09/25	<1.0		mg/L	
				Dissolved Sulphate (SO4)	2021/09/25	<1.0		mg/L	
A365459	BFE		RPD	Dissolved Chloride (Cl)	2021/09/25	8.3		%	20
				Dissolved Sulphate (SO4)	2021/09/25	0.22		%	20
A366781	ANE		Matrix Spike	Total Aluminum (Al)	2021/09/27		NC	%	80 - 120
				Total Antimony (Sb)	2021/09/27		113	%	80 - 120
				Total Arsenic (As)	2021/09/27		103	%	80 - 120
				Total Barium (Ba)	2021/09/27		NC	%	80 - 120
				Total Beryllium (Be)	2021/09/27		101	%	80 - 120
				Total Bismuth (Bi)	2021/09/27		96	%	80 - 120
				Total Boron (B)	2021/09/27		NC	%	80 - 120
				Total Cadmium (Cd)	2021/09/27		93	%	80 - 120
				Total Chromium (Cr)	2021/09/27		105	%	80 - 120
				Total Cobalt (Co)	2021/09/27		98	%	80 - 120
				Total Copper (Cu)	2021/09/27		93	%	80 - 120
				Total Iron (Fe)	2021/09/27		125 (1)	%	80 - 120
				Total Lead (Pb)	2021/09/27		98	%	80 - 120
				Total Lithium (Li)	2021/09/27		NC	%	80 - 120
				Total Manganese (Mn)	2021/09/27		102	%	80 - 120
				Total Molybdenum (Mo)	2021/09/27		NC	%	80 - 120
				Total Nickel (Ni)	2021/09/27		95	%	80 - 120
				Total Phosphorus (P)	2021/09/27		106	%	80 - 120
				Total Selenium (Se)	2021/09/27		89	%	80 - 120
				Total Silicon (Si)	2021/09/27		88	%	80 - 120
				Total Silver (Ag)	2021/09/27		94	%	80 - 120
				Total Strontium (Sr)	2021/09/27		NC	%	80 - 120
				Total Thallium (Tl)	2021/09/27		96	%	80 - 120
				Total Tin (Sn)	2021/09/27		101	%	80 - 120
				Total Titanium (Ti)	2021/09/27		112	%	80 - 120
				Total Uranium (U)	2021/09/27		103	%	80 - 120
				Total Vanadium (V)	2021/09/27		109	%	80 - 120
				Total Zinc (Zn)	2021/09/27		106	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A366781	ANE	Spiked Blank	Total Zirconium (Zr)	2021/09/27		133 (1)	%	80 - 120
			Total Aluminum (Al)	2021/09/27		100	%	80 - 120
			Total Antimony (Sb)	2021/09/27		111	%	80 - 120
			Total Arsenic (As)	2021/09/27		99	%	80 - 120
			Total Barium (Ba)	2021/09/27		97	%	80 - 120
			Total Beryllium (Be)	2021/09/27		101	%	80 - 120
			Total Bismuth (Bi)	2021/09/27		101	%	80 - 120
			Total Boron (B)	2021/09/27		108	%	80 - 120
			Total Cadmium (Cd)	2021/09/27		96	%	80 - 120
			Total Chromium (Cr)	2021/09/27		109	%	80 - 120
			Total Cobalt (Co)	2021/09/27		105	%	80 - 120
			Total Copper (Cu)	2021/09/27		104	%	80 - 120
			Total Iron (Fe)	2021/09/27		102	%	80 - 120
			Total Lead (Pb)	2021/09/27		101	%	80 - 120
			Total Lithium (Li)	2021/09/27		101	%	80 - 120
			Total Manganese (Mn)	2021/09/27		108	%	80 - 120
			Total Molybdenum (Mo)	2021/09/27		100	%	80 - 120
			Total Nickel (Ni)	2021/09/27		105	%	80 - 120
			Total Phosphorus (P)	2021/09/27		101	%	80 - 120
			Total Selenium (Se)	2021/09/27		88	%	80 - 120
			Total Silicon (Si)	2021/09/27		71 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/27		97	%	80 - 120
			Total Strontium (Sr)	2021/09/27		103	%	80 - 120
			Total Thallium (Tl)	2021/09/27		98	%	80 - 120
			Total Tin (Sn)	2021/09/27		98	%	80 - 120
			Total Titanium (Ti)	2021/09/27		109	%	80 - 120
			Total Uranium (U)	2021/09/27		102	%	80 - 120
			Total Vanadium (V)	2021/09/27		108	%	80 - 120
			Total Zinc (Zn)	2021/09/27		107	%	80 - 120
			Total Zirconium (Zr)	2021/09/27		106	%	80 - 120
A366781	ANE	Method Blank	Total Aluminum (Al)	2021/09/27	<3.0		ug/L	
			Total Antimony (Sb)	2021/09/27	0.034, RDL=0.020 (6)		ug/L	
			Total Arsenic (As)	2021/09/27	0.037, RDL=0.020 (6)		ug/L	
			Total Barium (Ba)	2021/09/27	0.098, RDL=0.050 (6)		ug/L	
			Total Beryllium (Be)	2021/09/27	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/27	<0.010		ug/L	
			Total Boron (B)	2021/09/27	<10		ug/L	
			Total Cadmium (Cd)	2021/09/27	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/27	<0.10		ug/L	
			Total Cobalt (Co)	2021/09/27	<0.010		ug/L	
			Total Copper (Cu)	2021/09/27	<0.10		ug/L	
			Total Iron (Fe)	2021/09/27	<5.0		ug/L	
			Total Lead (Pb)	2021/09/27	<0.020		ug/L	
			Total Lithium (Li)	2021/09/27	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/27	<0.10		ug/L	
			Total Molybdenum (Mo)	2021/09/27	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/27	0.16, RDL=0.10 (6)		ug/L	
			Total Phosphorus (P)	2021/09/27	5.3, RDL=5.0 (6)		ug/L	
			Total Selenium (Se)	2021/09/27	<0.040		ug/L	
			Total Silicon (Si)	2021/09/27	<50		ug/L	





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A366781	ANE	RPD	Total Silver (Ag)	2021/09/27	<0.010		ug/L	
			Total Strontium (Sr)	2021/09/27	0.094,		ug/L	
					RDL=0.050 (6)			
			Total Thallium (Tl)	2021/09/27	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/27	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/27	<2.0		ug/L	
			Total Uranium (U)	2021/09/27	<0.0050		ug/L	
			Total Vanadium (V)	2021/09/27	0.32,		ug/L	
					RDL=0.20 (6)			
			Total Zinc (Zn)	2021/09/27	<1.0		ug/L	
			Total Zirconium (Zr)	2021/09/27	<0.10		ug/L	
			Total Aluminum (Al)	2021/09/27	16		%	20
			Total Antimony (Sb)	2021/09/27	5.5		%	20
			Total Arsenic (As)	2021/09/27	0.83		%	20
			Total Barium (Ba)	2021/09/27	1.0		%	20
			Total Beryllium (Be)	2021/09/27	8.7		%	20
			Total Bismuth (Bi)	2021/09/27	NC		%	20
			Total Boron (B)	2021/09/27	5.4		%	20
			Total Cadmium (Cd)	2021/09/27	NC		%	20
			Total Chromium (Cr)	2021/09/27	2.3		%	20
			Total Cobalt (Co)	2021/09/27	5.5		%	20
			Total Copper (Cu)	2021/09/27	18		%	20
			Total Iron (Fe)	2021/09/27	14		%	20
			Total Lead (Pb)	2021/09/27	5.9		%	20
			Total Lithium (Li)	2021/09/27	2.3		%	20
			Total Manganese (Mn)	2021/09/27	8.7		%	20
			Total Molybdenum (Mo)	2021/09/27	0.96		%	20
			Total Nickel (Ni)	2021/09/27	0.36		%	20
			Total Phosphorus (P)	2021/09/27	13		%	20
			Total Selenium (Se)	2021/09/27	1.7		%	20
			Total Silicon (Si)	2021/09/27	6.1		%	20
			Total Silver (Ag)	2021/09/27	NC		%	20
			Total Strontium (Sr)	2021/09/27	7.6		%	20
			Total Thallium (Tl)	2021/09/27	NC		%	20
			Total Tin (Sn)	2021/09/27	NC		%	20
			Total Titanium (Ti)	2021/09/27	NC		%	20
			Total Uranium (U)	2021/09/27	1.1		%	20
			Total Vanadium (V)	2021/09/27	0.37		%	20
			Total Zinc (Zn)	2021/09/27	NC		%	20
			Total Zirconium (Zr)	2021/09/27	8.2		%	20
A367626	JC8	Matrix Spike [AGH689-10]	Total Mercury (Hg)	2021/09/27		102	%	70 - 130
A367626	JC8	Spiked Blank	Total Mercury (Hg)	2021/09/27		100	%	70 - 130
A367626	JC8	Method Blank	Total Mercury (Hg)	2021/09/27	<0.00010		ug/L	
A367626	JC8	RPD [AGH689-10]	Total Mercury (Hg)	2021/09/27	4.3		%	20
A370479	JLP	Matrix Spike [AGH676-11]	Dissolved Mercury (Hg)	2021/09/29		94	%	70 - 130
A370479	JLP	Spiked Blank	Dissolved Mercury (Hg)	2021/09/29		90	%	70 - 130
A370479	JLP	Method Blank	Dissolved Mercury (Hg)	2021/09/29	<0.00010		ug/L	
A370479	JLP	RPD [AGH675-11]	Dissolved Mercury (Hg)	2021/09/29	2.3		%	20
A370485	ANE	Matrix Spike [AGH677-17]	Total Aluminum (Al)	2021/09/29		83	%	80 - 120
			Total Antimony (Sb)	2021/09/29		93	%	80 - 120
			Total Arsenic (As)	2021/09/29		90	%	80 - 120
			Total Barium (Ba)	2021/09/29		86	%	80 - 120





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits			
				Total Beryllium (Be)	2021/09/29		94	%	80 - 120			
				Total Bismuth (Bi)	2021/09/29		90	%	80 - 120			
				Total Boron (B)	2021/09/29		NC	%	80 - 120			
				Total Cadmium (Cd)	2021/09/29		78 (1)	%	80 - 120			
				Total Chromium (Cr)	2021/09/29		86	%	80 - 120			
				Total Cobalt (Co)	2021/09/29		83	%	80 - 120			
				Total Copper (Cu)	2021/09/29		84	%	80 - 120			
				Total Iron (Fe)	2021/09/29		NC	%	80 - 120			
				Total Lead (Pb)	2021/09/29		91	%	80 - 120			
				Total Lithium (Li)	2021/09/29		94	%	80 - 120			
				Total Manganese (Mn)	2021/09/29		83	%	80 - 120			
				Total Molybdenum (Mo)	2021/09/29		NC	%	80 - 120			
				Total Nickel (Ni)	2021/09/29		84	%	80 - 120			
				Total Selenium (Se)	2021/09/29		96	%	80 - 120			
				Total Silicon (Si)	2021/09/29		72 (1)	%	80 - 120			
				Total Silver (Ag)	2021/09/29		76 (1)	%	80 - 120			
				Total Strontium (Sr)	2021/09/29		NC	%	80 - 120			
				Total Thallium (Tl)	2021/09/29		89	%	80 - 120			
				Total Tin (Sn)	2021/09/29		98	%	80 - 120			
				Total Titanium (Ti)	2021/09/29		88	%	80 - 120			
				Total Uranium (U)	2021/09/29		95	%	80 - 120			
				Total Vanadium (V)	2021/09/29		NC	%	80 - 120			
				Total Zinc (Zn)	2021/09/29		95	%	80 - 120			
				Total Zirconium (Zr)	2021/09/29		83	%	80 - 120			
				A370485	ANE	Spiked Blank	Total Aluminum (Al)	2021/09/30		82	%	80 - 120
							Total Antimony (Sb)	2021/09/30		96	%	80 - 120
							Total Arsenic (As)	2021/09/30		93	%	80 - 120
							Total Barium (Ba)	2021/09/30		89	%	80 - 120
							Total Beryllium (Be)	2021/09/30		98	%	80 - 120
							Total Bismuth (Bi)	2021/09/30		95	%	80 - 120
							Total Boron (B)	2021/09/30		99	%	80 - 120
							Total Cadmium (Cd)	2021/09/30		86	%	80 - 120
							Total Chromium (Cr)	2021/09/30		92	%	80 - 120
							Total Cobalt (Co)	2021/09/30		90	%	80 - 120
							Total Copper (Cu)	2021/09/30		90	%	80 - 120
							Total Iron (Fe)	2021/09/30		105	%	80 - 120
							Total Lead (Pb)	2021/09/30		96	%	80 - 120
							Total Lithium (Li)	2021/09/30		95	%	80 - 120
							Total Manganese (Mn)	2021/09/30		91	%	80 - 120
							Total Molybdenum (Mo)	2021/09/30		86	%	80 - 120
							Total Nickel (Ni)	2021/09/30		92	%	80 - 120
							Total Selenium (Se)	2021/09/30		101	%	80 - 120
			Total Silicon (Si)	2021/09/30		72 (1)	%	80 - 120				
			Total Silver (Ag)	2021/09/30		81	%	80 - 120				
			Total Strontium (Sr)	2021/09/30		84	%	80 - 120				
			Total Thallium (Tl)	2021/09/30		94	%	80 - 120				
			Total Tin (Sn)	2021/09/30		99	%	80 - 120				
			Total Titanium (Ti)	2021/09/30		91	%	80 - 120				
			Total Uranium (U)	2021/09/30		98	%	80 - 120				
			Total Vanadium (V)	2021/09/30		91	%	80 - 120				
			Total Zinc (Zn)	2021/09/30		111	%	80 - 120				
			Total Zirconium (Zr)	2021/09/30		96	%	80 - 120				
A370485	ANE	Method Blank	Total Aluminum (Al)	2021/09/29	<0.50			ug/L				
			Total Antimony (Sb)	2021/09/29	<0.020			ug/L				
			Total Arsenic (As)	2021/09/29	<0.020			ug/L				





BV Labs Job #: C170041  
Report Date: 2021/10/07

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A370485	ANE	RPD [AGH677-17]	Total Barium (Ba)	2021/09/29	<0.020		ug/L	
			Total Beryllium (Be)	2021/09/29	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/29	<0.0050		ug/L	
			Total Boron (B)	2021/09/29	<10		ug/L	
			Total Cadmium (Cd)	2021/09/29	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/29	<0.10		ug/L	
			Total Cobalt (Co)	2021/09/29	<0.0050		ug/L	
			Total Copper (Cu)	2021/09/29	<0.050		ug/L	
			Total Iron (Fe)	2021/09/29	<1.0		ug/L	
			Total Lead (Pb)	2021/09/29	<0.0050		ug/L	
			Total Lithium (Li)	2021/09/29	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/29	<0.050		ug/L	
			Total Molybdenum (Mo)	2021/09/29	<0.050		ug/L	
			Total Nickel (Ni)	2021/09/29	<0.020		ug/L	
			Total Selenium (Se)	2021/09/29	<0.040		ug/L	
			Total Silicon (Si)	2021/09/29	<50		ug/L	
			Total Silver (Ag)	2021/09/29	<0.0050		ug/L	
			Total Strontium (Sr)	2021/09/29	<0.050		ug/L	
			Total Thallium (Tl)	2021/09/29	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/29	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/29	<0.50		ug/L	
			Total Uranium (U)	2021/09/29	<0.0020		ug/L	
			Total Vanadium (V)	2021/09/29	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/29	<0.10		ug/L	
			Total Zirconium (Zr)	2021/09/29	<0.10		ug/L	
			Total Aluminum (Al)	2021/09/29	0.42		%	20
			Total Antimony (Sb)	2021/09/29	7.2		%	20
			Total Arsenic (As)	2021/09/29	1.5		%	20
			Total Barium (Ba)	2021/09/29	0.78		%	20
			Total Beryllium (Be)	2021/09/29	11		%	20
			Total Bismuth (Bi)	2021/09/29	4.0		%	20
			Total Boron (B)	2021/09/29	1.2		%	20
			Total Cadmium (Cd)	2021/09/29	NC		%	20
			Total Chromium (Cr)	2021/09/29	0.97		%	20
			Total Cobalt (Co)	2021/09/29	1.5		%	20
			Total Copper (Cu)	2021/09/29	2.1		%	20
			Total Iron (Fe)	2021/09/29	1.3		%	20
			Total Lead (Pb)	2021/09/29	1.3		%	20
			Total Lithium (Li)	2021/09/29	4.2		%	20
			Total Manganese (Mn)	2021/09/29	0.50		%	20
			Total Molybdenum (Mo)	2021/09/29	1.1		%	20
			Total Nickel (Ni)	2021/09/29	0.43		%	20
			Total Selenium (Se)	2021/09/29	1.7		%	20
			Total Silicon (Si)	2021/09/29	4.1		%	20
			Total Silver (Ag)	2021/09/29	NC		%	20
			Total Strontium (Sr)	2021/09/29	1.6		%	20
			Total Thallium (Tl)	2021/09/29	0.87		%	20
			Total Tin (Sn)	2021/09/29	NC		%	20
			Total Titanium (Ti)	2021/09/29	9.7		%	20
			Total Uranium (U)	2021/09/29	1.3		%	20
			Total Vanadium (V)	2021/09/29	0.063		%	20
			Total Zinc (Zn)	2021/09/29	1.4		%	20
			Total Zirconium (Zr)	2021/09/29	3.9		%	20
A376687	DBA	Spiked Blank	pH (15 C)	2021/10/05		98	%	97 - 103





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
A376687	DBA	RPD [AGH689-01]	pH (15 C)	2021/10/05	4.3		%	N/A
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <math>\leq 2 \times \text{RDL}</math>).</p> <p>(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.</p> <p>(2) Method Blank <math>&lt; 2 \times \text{RDL}</math>.</p> <p>(3) Method blank <math>&lt; 2 \times \text{RDL}</math></p> <p>(4) Method blank <math>&lt; 2 \times \text{RDL}</math>.</p> <p>(5) Method blank <math>&lt; 2 \times \text{RDL}</math></p> <p>(6) Method blank <math>&lt; 2 \times \text{RDL}</math></p>								





### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Maria Magdalena Florescu, Ph.D., P.Chem., QP, Inorganics Manager

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



**INVOICE TO:**

#11052 HATFIELD CONSULTANTS

Company Name: Zach Mueller

Attention: Suite A, 300 MacKenzie Blvd

Address: FORT MCMURRAY AB T9H 4C4

Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com

Email: zmueller@hatfieldgroup.com

**REPORT TO:**

Company Name: Zach Mueller

Attention: Suite A, 300 MacKenzie Blvd

Address: FORT MCMURRAY AB T9H 4C4

Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com

Email: zmueller@hatfieldgroup.com

**PROJECT INFORMATION:**

Citation #: C10909

P.O. #: Syncrude mesocosm experiment

Project Name: Syncrude mesocosm experiment

Site #: C170041

Sampled By: Ananda L'Hirondelle

**CHAIN OF CUSTODY RECORD**

**Regulatory Criteria**

☐ AT1

☐ CCOME

☐ Other

**Special Instructions**

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

**Turnaround Time (TAT) Required:**

Regular (Standard) TAT: ☒ (Will be applied if Rush TAT is not specified)

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details

Job Specific Rush TAT (if applies to entire submission): ☐

Date Required: \_\_\_\_\_

Rush Confirmation Number: \_\_\_\_\_ (call lab for #)

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	ANALYSIS REQUESTED (PLEASE BE SPECIFIC)		# Jars used and not submitted	Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
					ENV - 2021 Syncrude Mesocosm	Metals Field Filtered ? (Y / N)				
1	River water tank	21/09/19	14:50	W	X					
2	Mesocosm Table1	11:00			X					
3	Mesocosm Table2	10:50			X					
4	Mesocosm Table3	12:00			X					
5	Mesocosm Table4	11:30			X					
6	Mesocosm Table5	11:30			X					
7	Mesocosm Table6	12:10			X					
8	Mesocosm Table7	11:30			X					
9	Mesocosm Table8	12:10			X					
10	Treated OSPW tank	14:35			X					

**RELINQUISHED BY: (Signature/Print)**

MARGARET EDWARDS

Date: (YY/MM/DD) 21/09/19

Time 16:00

**RECEIVED BY: (Signature/Print)**

Regan Phillipos, BSc

Date: (YY/MM/DD) 22/10/19

Time 06:00

**Laboratory Use Only**


Temperature (°C) on Receipt: see ACTR

Custody Seal Intact on Cooler? ☐ Yes ☐ No

White: BV Labs Yellow: Client

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.  
 \* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.  
 \*\* ALL SAMPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.





Bureau Veritas Laboratories  
4000 19st N.E. Calgary, Alberta Canada T2E 6P6 Tel: (403) 291-3077 Toll-free 800-563-6266 Fax: (403) 291-9488 www.bv-labs.com

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CHAIN OF CUSTODY RECORD

**INVOICE TO:**

Company Name: #11052 HATFIELD CONSULTANTS  
 Attention: Zach Mueller  
 Address: Suite A, 300 MacKenzie Blvd  
 FORT MCMURRAY AB T9H 4C4  
 Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com  
 Email: zmueller@hatfieldgroup.com

**REPORT TO:**

Company Name: Zach Mueller  
 Attention: Suite A, 300 MacKenzie Blvd  
 Address: FORT MCMURRAY AB T9H 4C4  
 Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com  
 Email: zmueller@hatfieldgroup.com

**PROJECT INFORMATION:**

Quotation #: C10909  
 P.O. #: Syncrude mesocosm experiment  
 Project: Syncrude mesocosm experiment  
 Project Name: Syncrude mesocosm experiment  
 Site #: Syncrude mesocosm experiment  
 Sampled By: Amanda L'Honorelle

**LABORATORY USE ONLY:**

BV Labs Job #: C170041  
 Bottle Order #: 644187  
 COC #: Syncrude mesocosm experiment  
 Project Manager: Amanda L'Honorelle

**Regulatory Criteria:**

ATI ☐ CCME ☐ Other ☐

**Special Instructions:**

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix
1	DUPLICATE	21/09/19	10:45	W
2	FIELD BLANK	21/09/19	12:15	U
3				
4				
5				
6				
7				
8				
9				
10				

**ANALYSIS REQUESTED (PLEASE BE SPECIFIC)**

ENV - 2021 Syncrude Mesocosm

Metals Field Filtered? (Y/N)

X

X

**Turnaround Time (TAT) Required:**

Regular (Standard) TAT: ☒ (will be applied if Rush TAT is not specified)  
 Standard TAT = 5-7 Working days for most tests.  
 Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details

Job Specific Rush TAT (if applies to entire submission) ☐  
 Date Required: \_\_\_\_\_  
 Rush Confirmation Number: \_\_\_\_\_ (call lab for #)

**Comments:**

27

11

**\* RELINQUISHED BY: (Signature/Print)**

Audrey Edwards

Date: (YY/MM/DD) 21/09/19

Time 16:00

RECEIVED BY: (Signature/Print)

Reem Phillipos, Beech

Date: (YY/MM/DD) 2021/09/20

Time 06:00

**# Jars used and not submitted**

Time Sensitive ☐

Temperature (°C) on Receipt See ACTR

Custody Seal Intact on Cooler? ☐ Yes ☐ No

White: BV Labs Yellow: Client

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.  
 \*\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.  
 \*\*\* ALL SAMPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.





Your Project #: SYNCRUDE MESOCOSM EXPERIMENT  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/14**

Report #: R3084657

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C168465**

**Received: 2021/09/14, 15:23**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	12	N/A	2021/09/19	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	12	2021/09/16	2021/09/21	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	12	N/A	2021/09/26	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	12	N/A	2021/09/27		Auto Calc
Chloride/Sulphate by Auto Colourimetry	9	N/A	2021/09/28	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	3	N/A	2021/09/29	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
COD by Colorimeter	12	N/A	2021/09/17	AB SOP-00016	SM 23 5220D m
True Colour	6	N/A	2021/09/16	CAL SOP-00049	SM 23 2120 C m
True Colour	6	N/A	2021/09/17	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	12	N/A	2021/09/28		Auto Calc
Carbon (DOC) (3)	11	N/A	2021/09/26	AB SOP-00087	MMCW 119 1996 m
Carbon (DOC) (3)	1	N/A	2021/09/28	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	12	N/A	2021/09/19	AB SOP-00005	SM 23 2510 B m
Fluoride	12	N/A	2021/09/19	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (4)	5	2021/09/16	2021/09/17	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (4)	6	2021/09/16	2021/09/19	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (4)	1	2021/09/19	2021/09/20	AB SOP-00037	CCME PHC-CWS m
Hardness	12	N/A	2021/09/25		Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	10	N/A	2021/09/22	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (5)	2	N/A	2021/09/23	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	12	N/A	2021/09/25	BBY WI-00033	Auto Calc
Ultra Low Mercury - Diss, field filtered (1)	12	N/A	2021/09/27	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	12	2021/09/22	2021/09/24	BBY7SOP-00022	EPA 1631E m
Elements by ICP-Dissolved-Lab Filtered (6)	10	N/A	2021/09/24	AB SOP-00042	EPA 6010d R5 m
Elements by ICP-Dissolved-Lab Filtered (6)	2	N/A	2021/09/25	AB SOP-00042	EPA 6010d R5 m
Ion Balance	12	N/A	2021/09/29		Auto Calc
Sum of cations, anions	12	N/A	2021/09/25		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	12	N/A	2021/09/29	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (6)	10	N/A	2021/09/24	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Low Level (dissolved) (6)	2	N/A	2021/09/29	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	10	2021/09/21	2021/09/21	CAL SOP-00265	EPA 6020 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	10	N/A	2021/09/22	BBY WI-00033	Auto Calc





Your Project #: SYNCRUDE MESOCOSM EXPERIMENT  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/14**

Report #: R3084657

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C168465**

**Received: 2021/09/14, 15:23**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Na, K, Ca, Mg, S by CRC ICPMS (total)	2	N/A	2021/09/23	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	1	N/A	2021/09/19	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Low Level (total)	1	N/A	2021/09/22	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	2	2021/09/17	2021/09/21	AB SOP-00060	EPA 3510C R3 / FTIR
Naphthenic Acids by IR	10	2021/09/20	2021/09/22	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH3) as N @ 15C	1	2021/10/01	2021/10/05		Auto Calc
Un-Ionized Ammonia (NH3) as N	10	N/A	2021/10/01		Auto Calc
Un-Ionized Ammonia (NH3) as N	1	N/A	2021/10/05		Auto Calc
Ammonia-N (Total)	1	N/A	2021/09/17	AB SOP-00007	SM 23 4500 NH3 A G m
Ammonia-N (Total)	11	N/A	2021/09/27	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate and Nitrite	12	N/A	2021/09/17		Auto Calc
NO2 (N); NO2 (N) + NO3 (N) in Water	11	N/A	2021/09/16	AB SOP-00091	SM 23 4500 NO3m
NO2 (N); NO2 (N) + NO3 (N) in Water	1	N/A	2021/09/17	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	12	2021/09/15	2021/09/17		Auto Calc
Target & Alkylated PAH in Water by GC/MS (7)	7	2021/09/17	2021/09/21	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Target & Alkylated PAH in Water by GC/MS (7)	3	2021/09/20	2021/09/21	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Target & Alkylated PAH in Water by GC/MS (7)	2	2021/09/20	2021/09/22	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (8)	12	N/A	2021/09/28		Auto Calc
Filter and HNO3 Preserve for Metals (1)	12	N/A	2021/09/22	BBY7 WI-00004	SM 23 3030B m
pH measured @ 15 C (2, 9)	1	N/A	2021/10/05	EENV SOP-00159	SM 23 4500 H+ B m
pH @25°C (9)	12	N/A	2021/09/19	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	10	N/A	2021/10/01	Field Test	Field Test
pH (Field)	1	N/A	2021/10/05	Field Test	Field Test
Orthophosphate by Konelab (low level) (10)	12	N/A	2021/09/16	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	12	2021/09/27	2021/09/27	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	12	2021/09/21	2021/09/22	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	12	N/A	2021/09/29		Auto Calc
Temperature (Field)	11	N/A	2021/10/01		
Total Trihalomethanes Calculation	12	N/A	2021/09/27		Auto Calc





Your Project #: SYNCRUDE MESOCOSM EXPERIMENT  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/14**

Report #: R3084657

Version: 2 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C168465**

**Received: 2021/09/14, 15:23**

Sample Matrix: Water  
# Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbon (Inorganic)	12	N/A	2021/09/17	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	11	2021/09/17	2021/09/18	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	1	2021/09/17	2021/09/20	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (11)	10	N/A	2021/09/25	AB SOP-00087	MMCW 119 1996 m
Carbon (Total Organic) (11)	1	N/A	2021/09/27	AB SOP-00087	MMCW 119 1996 m
Carbon (Total Organic) (11)	1	N/A	2021/09/28	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (12)	10	2021/09/25	2021/09/27	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (12)	2	2021/09/27	2021/09/27	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	4	2021/09/24	2021/09/26	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	6	2021/09/25	2021/09/26	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/09/26	2021/09/28	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/09/27	2021/09/27	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	12	2021/09/21	2021/09/22	AB SOP-00061	SM 23 2540 D m
Turbidity	12	N/A	2021/09/16	CAL SOP-00081	SM 23 2130 B m
VOCs in Water by HS GC/MS (Std List)	12	N/A	2021/09/26	AB SOP-00056	EPA 5021a/8260d m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.





Your Project #: SYNCRUDE MESOCOSM EXPERIMENT  
Your C.O.C. #: 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/14**  
Report #: R3084657  
Version: 2 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C168465**

**Received: 2021/09/14, 15:23**

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Bureau Veritas Vancouver, 4606 Canada Way, Burnaby, BC, V5G 1K5

(2) This test was performed by Bureau Veritas Edmonton Environmental, 9331 - 48 St., Edmonton, AB, T6B 2R4

(3) DOC present in the sample should be considered as non-purgeable DOC. Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(4) Silica gel clean up employed.

(5) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(6) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(7) Alkylated PAH results are semiquantitative

(8) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

(9) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

(10) Orthophosphate > Total Phosphorus Imbalance: When applicable, Orthophosphate, Total Phosphorus and dissolved Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(11) TOC present in the sample should be considered as non-purgeable TOC.

(12) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Amanda L'Hirondelle  
Key Account Specialist  
14 Oct 2021 16:29:25

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Amanda L'Hirondelle, Key Account Specialist

Email: Amanda.lhirondelle@bureauveritas.com

Phone# (780)577-7117

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY382			AFY383			AFY384		
Sampling Date		2021/09/14 11:30			2021/09/14 11:20			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	QC Batch	TABLE 3	RDL	QC Batch

<b>Calculated Parameters</b>										
Anion Sum	meq/L	31	N/A	A353441	12	N/A	A353441	5.9	N/A	A353441
Cation Sum	meq/L	36	N/A	A353441	13	N/A	A353441	6.4	N/A	A353441
Filter and HNO3 Preservation	N/A	LAB		A361355	LAB		A361355	LAB		A361355
Hardness (CaCO3)	mg/L	91	0.50	A353474	130	0.50	A353474	140	0.50	A353474
Dissolved Hardness (CaCO3)	mg/L	91.0	0.50	A352808	131	0.50	A352808	141	0.50	A352808
Total Hardness (CaCO3)	mg/L	75.9	0.50	A353540	112	0.50	A352418	137	0.50	A352418
Ion Balance (% Difference)	%	6.2	N/A	A353500	3.2	N/A	A353500	4.2	N/A	A353500
Dissolved Nitrate (N)	mg/L	0.018	0.010	A353447	0.038	0.010	A353447	0.038	0.010	A353447
Dissolved Nitrate (NO3)	mg/L	0.079	0.044	A353445	0.17	0.044	A353445	0.17	0.044	A353445
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	A353445	<0.033	0.033	A353445	<0.033	0.033	A353445
Calculated Total Dissolved Solids	mg/L	2000	10	A353505	750	10	A353505	350	10	A353505
Un-Ionized Ammonia	mg/L	0.028	0.0063	A353542	0.016	0.0062	A353542	<0.0046	0.0046	A353542
<b>Demand Parameters</b>										
Biochemical Oxygen Demand	mg/L	4.8 (1)	2.0	A354089	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089
Chemical Oxygen Demand	mg/L	97	10	A356385	46	10	A355978	36	10	A355978
<b>Field Parameters</b>										
Field pH	pH	9.53	N/A	ONSITE	9.53	N/A	ONSITE	9.3	N/A	ONSITE
Field Temperature (Fd)	deg. C	11.8	N/A	ONSITE	11.6	N/A	ONSITE	12.2	N/A	ONSITE
<b>Misc. Inorganics</b>										
Conductivity	uS/cm	3100	2.0	A357870	1200	2.0	A357870	570	2.0	A357870
Dissolved Organic Carbon (C)	mg/L	19	0.50	A364859	13	0.50	A364859	9.1	0.50	A364859
pH	pH	9.17	N/A	A357871	8.85	N/A	A357871	8.45	N/A	A357871
Total Organic Carbon (C)	mg/L	20	0.50	A364746	9.5	0.50	A364749	7.3	0.50	A364749
Total Dissolved Solids	mg/L	1900	10	A359352	700	10	A359352	330	10	A359352
Total Suspended Solids	mg/L	9.1	1.0	A359364	13	1.0	A359364	13	1.0	A359364
<b>Anions</b>										
Alkalinity (PP as CaCO3)	mg/L	60	1.0	A357873	13	1.0	A357873	3.2	1.0	A357873
Alkalinity (Total as CaCO3)	mg/L	380	1.0	A357873	190	1.0	A357873	130	1.0	A357873
Bicarbonate (HCO3)	mg/L	320	1.0	A357873	200	1.0	A357873	160	1.0	A357873
Carbonate (CO3)	mg/L	72	1.0	A357873	16	1.0	A357873	3.9	1.0	A357873
RDL = Reportable Detection Limit										
N/A = Not Applicable										
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.										





### RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY382			AFY383			AFY384		
Sampling Date		2021/09/14 11:30			2021/09/14 11:20			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	QC Batch	TABLE 3	RDL	QC Batch
Dissolved Fluoride (F)	mg/L	2.2	0.050	A357872	0.77	0.050	A357872	0.30	0.050	A357872
Hydroxide (OH)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873
Orthophosphate (P)	mg/L	0.0070	0.0010	A354307	0.0026	0.0010	A354307	0.0015	0.0010	A354307
Dissolved Chloride (Cl)	mg/L	410	5.0	A369155	140	1.0	A369155	45	1.0	A369155
Dissolved Sulphate (SO4)	mg/L	590	5.0	A369155	210	5.0	A369155	92	1.0	A369155
<b>Nutrients</b>										
Total Ammonia (N)	mg/L	0.068	0.015	A367034	0.038	0.015	A367034	<0.015	0.015	A356227
Total Inorganic Carbon (C)	mg/L	87	1.0	A354395	47	1.0	A354395	35	1.0	A354395
Dissolved Phosphorus (P)	mg/L	0.0095	0.0010	A365824	0.0041	0.0010	A365824	<0.0010	0.0010	A366671
Total Phosphorus (P)	mg/L	0.067	0.0010	A364822	0.025	0.0010	A365830	0.022	0.0010	A365830
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A354888	<0.010	0.010	A354888	<0.010	0.010	A354888
Dissolved Nitrate plus Nitrite (N)	mg/L	0.018	0.010	A354888	0.038	0.010	A354888	0.038	0.010	A354888
Total Nitrogen (N)	mg/L	1.6	0.020	A356203	0.73	0.020	A356325	0.40	0.020	A356325
<b>Misc. Organics</b>										
Naphthenic Acids	mg/L	<2.0	2.0	A352869	<2.0	2.0	A352869	<2.0	2.0	A353626
<b>Physical Properties</b>										
True Colour	PtCo units	17	2.0	A354530	25	2.0	A354530	28	2.0	A354530
<b>Physical Properties</b>										
Turbidity	NTU	8.0	0.10	A354816	15	0.10	A354816	19	0.10	A354816
RDL = Reportable Detection Limit										





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY385			AFY386			AFY387		
Sampling Date		2021/09/14 10:20			2021/09/14 10:00			2021/09/14 09:32		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 4	RDL	QC Batch	TABLE 5	RDL	QC Batch	TABLE 6	RDL	QC Batch

Calculated Parameters										
Anion Sum	meq/L	3.9	N/A	A353441	3.4	N/A	A353441	3.1	N/A	A353441
Cation Sum	meq/L	4.3	N/A	A353441	3.7	N/A	A353441	3.5	N/A	A353441
Filter and HNO3 Preservation	N/A	LAB		A361355	LAB		A361355	LAB		A361355
Hardness (CaCO3)	mg/L	140	0.50	A353474	150	0.50	A353474	150	0.50	A353474
Dissolved Hardness (CaCO3)	mg/L	143	0.50	A352808	145	0.50	A352808	147	0.50	A352808
Total Hardness (CaCO3)	mg/L	134	0.50	A352418	128	0.50	A352418	127	0.50	A352418
Ion Balance (% Difference)	%	4.5	N/A	A353500	4.5	N/A	A353500	5.5	N/A	A353500
Dissolved Nitrate (N)	mg/L	0.028	0.010	A353447	0.031	0.010	A353447	0.027	0.010	A353447
Dissolved Nitrate (NO3)	mg/L	0.13	0.044	A353445	0.14	0.044	A353543	0.12	0.044	A353543
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	A353445	<0.033	0.033	A353543	<0.033	0.033	A353543
Calculated Total Dissolved Solids	mg/L	230	10	A353505	190	10	A353505	170	10	A353505
Un-Ionized Ammonia	mg/L	<0.0029	0.0029	A353542	<0.0038	0.0038	A353542	<0.0034	0.0034	A353542

Demand Parameters										
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089
Chemical Oxygen Demand	mg/L	24	10	A355978	32	10	A355978	20	10	A355978

Field Parameters										
Field pH	pH	9.03	N/A	ONSITE	9.18	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	12.3	N/A	ONSITE	12.4	N/A	ONSITE	12.8	N/A	ONSITE

Misc. Inorganics										
Conductivity	uS/cm	370	2.0	A357870	310	2.0	A357870	290	2.0	A357870
Dissolved Organic Carbon (C)	mg/L	7.2	0.50	A364859	7.3	0.50	A364859	7.6	0.50	A364859
pH	pH	8.25	N/A	A357871	8.19	N/A	A357871	8.17	N/A	A357871
Total Organic Carbon (C)	mg/L	6.2	0.50	A364746	5.8	0.50	A364746	6.0	0.50	A364758
Total Dissolved Solids	mg/L	180	10	A359352	160	10	A359352	150	10	A359352
Total Suspended Solids	mg/L	12	1.0	A359364	12	1.0	A359364	14	1.0	A359364

Anions										
Alkalinity (PP as CaCO3)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873
Alkalinity (Total as CaCO3)	mg/L	120	1.0	A357873	110	1.0	A357873	110	1.0	A357873
Bicarbonate (HCO3)	mg/L	140	1.0	A357873	140	1.0	A357873	130	1.0	A357873
Carbonate (CO3)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873

RDL = Reportable Detection Limit  
N/A = Not Applicable  
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY385			AFY386			AFY387		
Sampling Date		2021/09/14 10:20			2021/09/14 10:00			2021/09/14 09:32		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 4	RDL	QC Batch	TABLE 5	RDL	QC Batch	TABLE 6	RDL	QC Batch
Dissolved Fluoride (F)	mg/L	0.15	0.050	A357872	0.11	0.050	A357872	0.088	0.050	A357872
Hydroxide (OH)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873
Orthophosphate (P)	mg/L	0.0023	0.0010	A354307	0.0029	0.0010	A354307	0.0017	0.0010	A354307
Dissolved Chloride (Cl)	mg/L	17	1.0	A369155	8.4	1.0	A369155	5.0	1.0	A369155
Dissolved Sulphate (SO4)	mg/L	54	1.0	A369155	43	1.0	A369155	38	1.0	A369155
<b>Nutrients</b>										
Total Ammonia (N)	mg/L	<0.015	0.015	A367133	<0.015	0.015	A367034	<0.015	0.015	A367034
Total Inorganic Carbon (C)	mg/L	30	1.0	A356192	28	1.0	A354395	28	1.0	A356192
Dissolved Phosphorus (P)	mg/L	0.0023	0.0010	A365824	0.0012	0.0010	A365824	0.0015	0.0010	A365824
Total Phosphorus (P)	mg/L	0.019	0.0010	A364822	0.021	0.0010	A365830	0.020	0.0010	A365830
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A354886	<0.010	0.010	A354888	<0.010	0.010	A354886
Dissolved Nitrate plus Nitrite (N)	mg/L	0.028	0.010	A354886	0.031	0.010	A354888	0.027	0.010	A354886
Total Nitrogen (N)	mg/L	0.39	0.020	A356203	0.34	0.020	A356203	0.27	0.020	A356325
<b>Misc. Organics</b>										
Naphthenic Acids	mg/L	<2.0	2.0	A353626	<2.0	2.0	A353626	<2.0	2.0	A353626
<b>Physical Properties</b>										
True Colour	PtCo units	28	2.0	A354530	27	2.0	A354530	27	2.0	A354530
<b>Physical Properties</b>										
Turbidity	NTU	24	0.10	A354816	22	0.10	A354816	21	0.10	A354816
RDL = Reportable Detection Limit										





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY388			AFY389			AFY390		
Sampling Date		2021/09/14 10:50			2021/09/14 10:00			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 7	RDL	QC Batch	TABLE 8	RDL	QC Batch	DUPLICATE	RDL	QC Batch

Calculated Parameters										
Anion Sum	meq/L	3.0	N/A	A353441	3.0	N/A	A353441	3.0	N/A	A353441
Cation Sum	meq/L	3.4	N/A	A353441	3.4	N/A	A353441	3.4	N/A	A353441
Filter and HNO3 Preservation	N/A	LAB		A361355	LAB		A361355	LAB		A361355
Hardness (CaCO3)	mg/L	150	0.50	A353474	150	0.50	A353474	150	0.50	A353474
Dissolved Hardness (CaCO3)	mg/L	145	0.50	A352808	147	0.50	A352808	146	0.50	A352808
Total Hardness (CaCO3)	mg/L	141	0.50	A352418	125	0.50	A352418	126	0.50	A352418
Ion Balance (% Difference)	%	6.5	N/A	A353500	7.1	N/A	A353500	5.7	N/A	A353500
Dissolved Nitrate (N)	mg/L	0.083	0.010	A353447	0.027	0.010	A353447	0.026	0.010	A353447
Dissolved Nitrate (NO3)	mg/L	0.37	0.044	A353543	0.12	0.044	A353543	0.12	0.044	A353543
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	A353543	<0.033	0.033	A353543	<0.033	0.033	A353543
Calculated Total Dissolved Solids	mg/L	170	10	A353505	170	10	A353505	170	10	A353505
Un-Ionized Ammonia	mg/L	<0.0019	0.0019	A353542	<0.0023	0.0023	A353542	<0.0025	0.0025	A353542

Demand Parameters										
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089
Chemical Oxygen Demand	mg/L	31	10	A356385	35	10	A355978	24	10	A356385

Field Parameters										
Field pH	pH	8.82	N/A	ONSITE	8.91	N/A	ONSITE	8.97	N/A	ONSITE
Field Temperature (Fd)	deg. C	11.8	N/A	ONSITE	12.6	N/A	ONSITE	11.8	N/A	ONSITE

Misc. Inorganics										
Conductivity	uS/cm	280	2.0	A357870	280	2.0	A357870	280	2.0	A357870
Dissolved Organic Carbon (C)	mg/L	7.3	0.50	A364859	7.1	0.50	A367172	7.5	0.50	A364859
pH	pH	8.14	N/A	A357871	8.16	N/A	A357871	8.11	N/A	A357871
Total Organic Carbon (C)	mg/L	7.1	0.50	A364746	6.6	0.50	A367178	5.5	0.50	A364746
Total Dissolved Solids	mg/L	160	10	A359352	150	10	A359352	160	10	A359352
Total Suspended Solids	mg/L	45	1.0	A359364	11	1.0	A359364	13	1.0	A359364

Anions										
Alkalinity (PP as CaCO3)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873
Alkalinity (Total as CaCO3)	mg/L	110	1.0	A357873	110	1.0	A357873	110	1.0	A357873
Bicarbonate (HCO3)	mg/L	130	1.0	A357873	130	1.0	A357873	130	1.0	A357873
Carbonate (CO3)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873

RDL = Reportable Detection Limit  
N/A = Not Applicable  
(1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY388			AFY389			AFY390		
Sampling Date		2021/09/14 10:50			2021/09/14 10:00			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 7	RDL	QC Batch	TABLE 8	RDL	QC Batch	DUPLICATE	RDL	QC Batch
Dissolved Fluoride (F)	mg/L	0.085	0.050	A357872	0.085	0.050	A357872	0.083	0.050	A357872
Hydroxide (OH)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873	<1.0	1.0	A357873
Orthophosphate (P)	mg/L	0.0023	0.0010	A354307	0.0039	0.0010	A354307	0.0029	0.0010	A354307
Dissolved Chloride (Cl)	mg/L	3.7	1.0	A369155	2.6	1.0	A369155	3.4	1.0	A369700
Dissolved Sulphate (SO4)	mg/L	36	1.0	A369155	35	1.0	A369155	36	1.0	A369700
<b>Nutrients</b>										
Total Ammonia (N)	mg/L	<0.015	0.015	A367034	<0.015	0.015	A367133	<0.015	0.015	A367034
Total Inorganic Carbon (C)	mg/L	29	1.0	A356192	29	1.0	A356192	29	1.0	A356192
Dissolved Phosphorus (P)	mg/L	<0.0010	0.0010	A365824	0.0024	0.0010	A366671	0.0018	0.0010	A365824
Total Phosphorus (P)	mg/L	0.055	0.0010	A365830	0.021	0.0010	A364822	0.017	0.0010	A366458
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A354886	<0.010	0.010	A354886	<0.010	0.010	A354886
Dissolved Nitrate plus Nitrite (N)	mg/L	0.083	0.010	A354886	0.027	0.010	A354886	0.026	0.010	A354886
Total Nitrogen (N)	mg/L	0.38	0.020	A356325	0.31	0.020	A356203	0.29	0.020	A356325
<b>Misc. Organics</b>										
Naphthenic Acids	mg/L	<2.0	2.0	A353626	<2.0	2.0	A353626	<2.0	2.0	A353626
<b>Physical Properties</b>										
True Colour	PtCo units	30	2.0	A354530	28	2.0	A354530	26	2.0	A354530
<b>Physical Properties</b>										
Turbidity	NTU	44	0.10	A354816	20	0.10	A354816	22	0.10	A354816
RDL = Reportable Detection Limit										





## RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		AFY391			AFY434		
Sampling Date		2021/09/14 11:45			2021/09/14 13:45		
COC Number		644187-02-01			644187-02-01		
	UNITS	BLANK	RDL	QC Batch	RIVER WATER TANK	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	0.0000	N/A	A353441	3.0	N/A	A353441
Cation Sum	meq/L	0.018	N/A	A353441	3.4	N/A	A353441
Filter and HNO <sub>3</sub> Preservation	N/A	LAB		A361355	LAB		A361355
Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A353474	150	0.50	A353536
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A352808	146	0.50	A352808
Total Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A352418	131	0.50	A353538
Ion Balance (% Difference)	%	NC	N/A	A353500	6.4	N/A	A353500
Dissolved Nitrate (N)	mg/L	<0.010	0.010	A353447	0.023	0.010	A353447
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	<0.044	0.044	A353543	0.10	0.044	A353543
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A353543	<0.033	0.033	A353543
Calculated Total Dissolved Solids	mg/L	<10	10	A353505	170	10	A353505
Un-Ionized Ammonia	mg/L				<0.0028	0.0028	A353542
Un-Ionized Ammonia @ 15 °C	mg/L	<0.00050	0.00050	A372471			
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0 (1)	2.0	A354089	<2.0 (1)	2.0	A354089
Chemical Oxygen Demand	mg/L	<10	10	A355978	22	10	A355978
<b>Field Parameters</b>							
Field pH	pH				8.91	N/A	ONSITE
Field Temperature (Fd)	deg. C				15.5	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	<2.0	2.0	A357870	280	2.0	A357870
Dissolved Organic Carbon (C)	mg/L	<0.50	0.50	A364859	6.9	0.50	A364859
pH	pH	4.75	N/A	A357871	8.15	N/A	A357871
Total Organic Carbon (C)	mg/L	<0.50	0.50	A364746	5.5	0.50	A364746
Total Dissolved Solids	mg/L	<10	10	A359352	160	10	A359352
Total Suspended Solids	mg/L	<1.0	1.0	A359364	43	1.0	A359364
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A357873	110	1.0	A357873
Bicarbonate (HCO <sub>3</sub> )	mg/L	<1.0	1.0	A357873	130	1.0	A357873
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFY391			AFY434		
<b>Sampling Date</b>		2021/09/14 11:45			2021/09/14 13:45		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873
Dissolved Fluoride (F)	mg/L	<0.050	0.050	A357872	0.087	0.050	A357872
Hydroxide (OH)	mg/L	<1.0	1.0	A357873	<1.0	1.0	A357873
Orthophosphate (P)	mg/L	<0.0010	0.0010	A354307	0.0024	0.0010	A354307
Dissolved Chloride (Cl)	mg/L	<1.0	1.0	A369700	3.5	1.0	A369700
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	<1.0	1.0	A369700	37	1.0	A369700
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A367034	<0.015	0.015	A367133
Total Inorganic Carbon (C)	mg/L	<1.0	1.0	A354395	28	1.0	A356192
Dissolved Phosphorus (P)	mg/L	<0.0010	0.0010	A365824	0.0043	0.0010	A365824
Total Phosphorus (P)	mg/L	<0.0010	0.0010	A366941	0.044	0.0010	A364822
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A354888	<0.010	0.010	A354886
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	A354888	0.023	0.010	A354886
Total Nitrogen (N)	mg/L	<0.020	0.020	A358075	0.35	0.020	A355696
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A353626	<2.0	2.0	A353626
<b>Physical Properties</b>							
True Colour	PtCo units	<2.0	2.0	A354530	32	2.0	A354530
pH (15 C)	pH	6.01		A376917			
<b>Physical Properties</b>							
Turbidity	NTU	<0.10	0.10	A354816	41	0.10	A354826
RDL = Reportable Detection Limit							





## RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFY435		
<b>Sampling Date</b>		2021/09/14 12:00		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>				
Anion Sum	meq/L	32	N/A	A353441
Cation Sum	meq/L	36	N/A	A353441
Filter and HNO <sub>3</sub> Preservation	N/A	LAB		A361355
Hardness (CaCO <sub>3</sub> )	mg/L	94	0.50	A353536
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	94.0	0.50	A352808
Total Hardness (CaCO <sub>3</sub> )	mg/L	82.4	0.50	A353540
Ion Balance (% Difference)	%	6.6	N/A	A353500
Dissolved Nitrate (N)	mg/L	0.023	0.010	A353447
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.10	0.044	A353543
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A353543
Calculated Total Dissolved Solids	mg/L	2100	10	A353505
Un-Ionized Ammonia	mg/L	0.018	0.0066	A353542
<b>Demand Parameters</b>				
Biochemical Oxygen Demand	mg/L	5.8 (1)	2.0	A354089
Chemical Oxygen Demand	mg/L	94	10	A355978
<b>Field Parameters</b>				
Field pH	pH	9.53	N/A	ONSITE
Field Temperature (Fd)	deg. C	12.8	N/A	ONSITE
<b>Misc. Inorganics</b>				
Conductivity	uS/cm	3100	2.0	A357870
Dissolved Organic Carbon (C)	mg/L	20	0.50	A364859
pH	pH	9.18	N/A	A357871
Total Organic Carbon (C)	mg/L	19	0.50	A364746
Total Dissolved Solids	mg/L	1900	10	A359352
Total Suspended Solids	mg/L	14	1.0	A359364
<b>Anions</b>				
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	59	1.0	A357873
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	380	1.0	A357873
Bicarbonate (HCO <sub>3</sub> )	mg/L	310	1.0	A357873
Carbonate (CO <sub>3</sub> )	mg/L	71	1.0	A357873
RDL = Reportable Detection Limit N/A = Not Applicable (1) Method blank exceeds 0.2 mg/L stipulated in Reference Method. No other Quality Control measures affected.				





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>BV Labs ID</b>		AFY435		
<b>Sampling Date</b>		2021/09/14 12:00		
<b>COC Number</b>		644187-02-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	2.2	0.050	A357872
Hydroxide (OH)	mg/L	<1.0	1.0	A357873
Orthophosphate (P)	mg/L	0.0087	0.0010	A354307
Dissolved Chloride (Cl)	mg/L	410	5.0	A369155
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	600	5.0	A369155
<b>Nutrients</b>				
Total Ammonia (N)	mg/L	0.042	0.015	A367133
Total Inorganic Carbon (C)	mg/L	87	1.0	A356192
Dissolved Phosphorus (P)	mg/L	0.013	0.0010	A365824
Total Phosphorus (P)	mg/L	0.077	0.0010	A365830
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A354886
Dissolved Nitrate plus Nitrite (N)	mg/L	0.023	0.010	A354886
Total Nitrogen (N)	mg/L	1.7	0.020	A356325
<b>Misc. Organics</b>				
Naphthenic Acids	mg/L	<2.0	2.0	A353626
<b>Physical Properties</b>				
True Colour	PtCo units	15	2.0	A354530
<b>Physical Properties</b>				
Turbidity	NTU	13	0.10	A354826
RDL = Reportable Detection Limit				





### PETROLEUM HYDROCARBONS (CCME)

BV Labs ID		AFY382	AFY383	AFY384	AFY385	AFY386	AFY387		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20	2021/09/14 10:50	2021/09/14 10:20	2021/09/14 10:00	2021/09/14 09:32		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6	RDL	QC Batch

Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A353691
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A353691
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A353691
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	112	100	100	109	99	85		A353691
RDL = Reportable Detection Limit									

BV Labs ID		AFY388	AFY389	AFY390	AFY391	AFY434		
Sampling Date		2021/09/14 10:50	2021/09/14 10:00	2021/09/14 10:50	2021/09/14 11:45	2021/09/14 13:45		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 7	TABLE 8	DUPLICATE	BLANK	RIVER WATER TANK	RDL	QC Batch

Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A353632
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	A353632
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A353632
Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	101	106	113	98	94		A353632
RDL = Reportable Detection Limit								

BV Labs ID		AFY435		
Sampling Date		2021/09/14 12:00		
COC Number		644187-02-01		
	UNITS	TREATED OSPW TANK	RDL	QC Batch

Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	A353632
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	0.10	A353632
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	0.20	A353632
Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	123		A353632
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY382	AFY383	AFY384	AFY385		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20	2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	RDL	QC Batch
<b>Polycyclic Aromatics</b>							
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A352827
Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
Acridine	ug/L	<0.040	<0.040	<0.040	<0.040	0.040	A347786
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A347786
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A347786
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A347786
Fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A347786
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
Phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Perylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
Quinoline	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A347786
Retene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
Biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY382	AFY383	AFY384	AFY385		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20	2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C2-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C3-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C2-dibenzothiophene	ug/L	0.051	<0.020	<0.020	<0.020	0.020	A347786
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A347786
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A347786
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
C2 benzo(a)anthracene/chrysene	ug/L	0.0087	<0.0085	<0.0085	<0.0085	0.0085	A347786
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A347786
C1benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A347786
C2benzobkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A347786
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A347786
<b>Phenols</b>							
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
Cresols	mg/L	<0.00014	<0.00014	<0.00014	<0.00014	0.00014	A353534
Phenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY382	AFY383	AFY384	AFY385		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20	2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
<b>Surrogate Recovery (%)</b>							
D10-ANTHRACENE (sur.)	%	123	121	124	112		A347786
D8-ACENAPHTHYLENE (sur.)	%	104	93	105	103		A347786
D8-NAPHTHALENE (sur.)	%	90	79	89	89		A347786
TERPHENYL-D14 (sur.)	%	102	97	107	113		A347786
2,4,6-TRIBROMOPHENOL (sur.)	%	94	107	96	111		A366621
2,4-DIBROMOPHENOL (sur.)	%	86	99	93	104		A366621
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY386	AFY387	AFY388		AFY389		
Sampling Date		2021/09/14 10:00	2021/09/14 09:32	2021/09/14 10:50		2021/09/14 10:00		
COC Number		644187-02-01	644187-02-01	644187-02-01		644187-02-01		
	UNITS	TABLE 5	TABLE 6	TABLE 7	QC Batch	TABLE 8	RDL	QC Batch
<b>Polycyclic Aromatics</b>								
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	A353549	<0.010	0.010	A353549
Acenaphthene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
Acridine	ug/L	<0.040	<0.040	<0.040	A347786	<0.040	0.040	A355317
Anthracene	ug/L	<0.010	<0.010	<0.010	A347786	<0.010	0.010	A355317
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	A347786	<0.0075	0.0075	A355317
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	A347786	<0.0075	0.0075	A355317
Fluoranthene	ug/L	<0.010	<0.010	<0.010	A347786	<0.010	0.010	A355317
Fluorene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
Naphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
Phenanthrene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Perylene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Pyrene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
Quinoline	ug/L	<0.20	<0.20	<0.20	A347786	<0.20	0.20	A355317
Retene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
Biphenyl	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY386	AFY387	AFY388		AFY389		
Sampling Date		2021/09/14 10:00	2021/09/14 09:32	2021/09/14 10:50		2021/09/14 10:00		
COC Number		644187-02-01	644187-02-01	644187-02-01		644187-02-01		
	UNITS	TABLE 5	TABLE 6	TABLE 7	QC Batch	TABLE 8	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C2-fluorene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C3-fluorene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	A347786	<0.050	0.050	A355317
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	A347786	<0.020	0.020	A355317
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	A347786	<0.0085	0.0085	A355317
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	A347786	<0.0075	0.0075	A355317
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	A347786	<0.0075	0.0075	A355317
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	A347786	<0.10	0.10	A355317
<b>Phenols</b>								
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
Cresols	mg/L	<0.00014	<0.00014	<0.00014	A353534	<0.00014	0.00014	A353534
Phenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY386	AFY387	AFY388		AFY389		
Sampling Date		2021/09/14 10:00	2021/09/14 09:32	2021/09/14 10:50		2021/09/14 10:00		
COC Number		644187-02-01	644187-02-01	644187-02-01		644187-02-01		
	UNITS	TABLE 5	TABLE 6	TABLE 7	QC Batch	TABLE 8	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	A366621	<0.0010	0.0010	A366621
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	A366621	<0.0010	0.0010	A366621
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	A366621	<0.0010	0.0010	A366621
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	A366621	<0.0010	0.0010	A366621
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	A366621	<0.00010	0.00010	A366621
<b>Surrogate Recovery (%)</b>								
D10-ANTHRACENE (sur.)	%	124	127	119	A347786	92		A355317
D8-ACENAPHTHYLENE (sur.)	%	96	99	99	A347786	75		A355317
D8-NAPHTHALENE (sur.)	%	83	86	84	A347786	73		A355317
TERPHENYL-D14 (sur.)	%	102	106	100	A347786	90		A355317
2,4,6-TRIBROMOPHENOL (sur.)	%	100	117	104	A366621	96		A366621
2,4-DIBROMOPHENOL (sur.)	%	95	113	101	A366621	92		A366621
RDL = Reportable Detection Limit								





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY390	AFY391	AFY434	AFY435		
Sampling Date		2021/09/14 10:50	2021/09/14 11:45	2021/09/14 13:45	2021/09/14 12:00		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	DUPLICATE	BLANK	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
<b>Polycyclic Aromatics</b>							
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A353549
Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
Acridine	ug/L	<0.040	<0.040	<0.040	<0.040	0.040	A355317
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A355317
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A355317
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A355317
Fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	A355317
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
Phenanthrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Perylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
Quinoline	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A355317
Retene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
Biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY390	AFY391	AFY434	AFY435		
Sampling Date		2021/09/14 10:50	2021/09/14 11:45	2021/09/14 13:45	2021/09/14 12:00		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	DUPLICATE	BLANK	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C2-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C3-fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.035	0.020	A355317
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.062	0.020	A355317
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	A355317
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	A355317
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	<0.0085	0.0085	A355317
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A355317
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	<0.0075	0.0075	A355317
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	A355317
<b>Phenols</b>							
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
Cresols	mg/L	<0.00014	<0.00014	<0.00014	<0.00014	0.00014	A353534
Phenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
RDL = Reportable Detection Limit							





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY390	AFY391	AFY434	AFY435		
Sampling Date		2021/09/14 10:50	2021/09/14 11:45	2021/09/14 13:45	2021/09/14 12:00		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	DUPLICATE	BLANK	RIVER WATER TANK	TREATED OSPW TANK	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	0.00010	A366621
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	A366621
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	A366621
<b>Surrogate Recovery (%)</b>							
D10-ANTHRACENE (sur.)	%	109	103	100	102		A355317
D8-ACENAPHTHYLENE (sur.)	%	96	83	91	90		A355317
D8-NAPHTHALENE (sur.)	%	86	78	83	80		A355317
TERPHENYL-D14 (sur.)	%	109	103	99	101		A355317
2,4,6-TRIBROMOPHENOL (sur.)	%	84	97	97	118		A366621
2,4-DIBROMOPHENOL (sur.)	%	80	93	92	105		A366621
RDL = Reportable Detection Limit							





### MERCURY BY COLD VAPOR (WATER)

BV Labs ID		AFY382	AFY383	AFY384	AFY385	AFY386	AFY387		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20	2021/09/14 10:50	2021/09/14 10:20	2021/09/14 10:00	2021/09/14 09:32		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6	RDL	QC Batch

Elements									
Dissolved Mercury (Hg)	ug/L	0.00085	0.00134	0.00132	0.00141	0.00157	0.00154	0.00010	A367290
Total Mercury (Hg)	ug/L	0.00172	0.00270	0.00346	0.00310	0.00273	0.00314	0.00010	A362239
RDL = Reportable Detection Limit									

BV Labs ID		AFY388	AFY389	AFY390	AFY391	AFY434		
Sampling Date		2021/09/14 10:50	2021/09/14 10:00	2021/09/14 10:50	2021/09/14 11:45	2021/09/14 13:45		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 7	TABLE 8	DUPLICATE	BLANK	RIVER WATER TANK	RDL	QC Batch

Elements								
Dissolved Mercury (Hg)	ug/L	0.00140	0.00139	0.00191	<0.00010	0.00127	0.00010	A367290
Total Mercury (Hg)	ug/L	0.00383	0.00271	0.00290	0.00019	0.00397	0.00010	A362239
RDL = Reportable Detection Limit								

BV Labs ID		AFY435		
Sampling Date		2021/09/14 12:00		
COC Number		644187-02-01		
	UNITS	TREATED OSPW TANK	RDL	QC Batch

Elements				
Dissolved Mercury (Hg)	ug/L	0.00057	0.00010	A367290
Total Mercury (Hg)	ug/L	0.00148	0.00010	A362239
RDL = Reportable Detection Limit				





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY382			AFY383		AFY384	AFY385		
Sampling Date		2021/09/14 11:30			2021/09/14 11:20		2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01			644187-02-01		644187-02-01	644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	TABLE 3	TABLE 4	RDL	QC Batch

Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	18	0.30	A361530	34	0.30	38	39	0.30	A361530
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A361530	<0.060	0.060	<0.060	0.064	0.060	A361530
Dissolved Magnesium (Mg)	mg/L	11	0.20	A361530	11	0.20	11	11	0.20	A361530
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A361530	<0.0040	0.0040	<0.0040	<0.0040	0.0040	A361530
Dissolved Potassium (K)	mg/L	13	0.30	A361530	4.9	0.30	2.3	1.5	0.30	A361530
Dissolved Sodium (Na)	mg/L	770	2.5	A361530	240	0.50	81	33	0.50	A361530

Dissolved Metals by ICPMS										
Dissolved Aluminum (Al)	ug/L	104	2.5	A357284	37.3	0.50	15.3	10.9	0.50	A357284
Dissolved Antimony (Sb)	ug/L	0.90	0.10	A357284	0.321	0.020	0.142	0.095	0.020	A357284
Dissolved Arsenic (As)	ug/L	11.2	0.10	A357284	3.50	0.020	1.33	0.698	0.020	A357284
Dissolved Barium (Ba)	ug/L	49.5	0.10	A357284	44.7	0.020	41.0	42.5	0.020	A357284
Dissolved Beryllium (Be)	ug/L	<0.050	0.050	A357284	<0.010	0.010	<0.010	<0.010	0.010	A357284
Dissolved Bismuth (Bi)	ug/L	<0.025	0.025	A357284	<0.0050	0.0050	<0.0050	<0.0050	0.0050	A357284
Dissolved Boron (B)	ug/L	2240	50	A357284	964	10	303	122	10	A357284
Dissolved Cadmium (Cd)	ug/L	<0.025	0.025	A357284	<0.0050	0.0050	<0.0050	<0.0050	0.0050	A357284
Dissolved Chromium (Cr)	ug/L	0.72	0.50	A357284	0.22	0.10	0.16	0.20	0.10	A357284
Dissolved Cobalt (Co)	ug/L	0.236	0.025	A357284	0.115	0.0050	0.0785	0.0738	0.0050	A357284
Dissolved Copper (Cu)	ug/L	0.41	0.25	A357284	0.919	0.050	0.991	1.10	0.050	A357284
Dissolved Iron (Fe)	ug/L	51.5	5.0	A357284	45.4	1.0	29.1	29.7	1.0	A357284
Dissolved Lead (Pb)	ug/L	<0.025	0.025	A357284	0.0304	0.0050	0.0252	0.0519	0.0050	A357284
Dissolved Lithium (Li)	ug/L	108	2.5	A357284	39.8	0.50	16.2	8.38	0.50	A357284
Dissolved Manganese (Mn)	ug/L	5.15	0.25	A357284	2.36	0.050	1.00	1.00	0.050	A357284
Dissolved Molybdenum (Mo)	ug/L	683	0.25	A357284	199	0.050	59.4	20.1	0.050	A357284
Dissolved Nickel (Ni)	ug/L	3.83	0.10	A357284	1.72	0.020	1.08	1.02	0.020	A357284
Dissolved Selenium (Se)	ug/L	3.23	0.20	A357284	1.27	0.040	0.550	0.348	0.040	A357284
Dissolved Silicon (Si)	ug/L	1760	250	A357284	1810	50	1740	1570	50	A357284
Dissolved Silver (Ag)	ug/L	<0.025	0.025	A357284	<0.0050	0.0050	<0.0050	<0.0050	0.0050	A357284
Dissolved Strontium (Sr)	ug/L	421	0.25	A357284	266	0.050	213	208	0.050	A357284
Dissolved Thallium (Tl)	ug/L	<0.010	0.010	A357284	0.0045	0.0020	0.0051	0.0050	0.0020	A357284
Dissolved Tin (Sn)	ug/L	<1.0	1.0	A357284	<0.20	0.20	<0.20	<0.20	0.20	A357284
Dissolved Titanium (Ti)	ug/L	<2.5	2.5	A357284	<0.50	0.50	<0.50	<0.50	0.50	A357284
Dissolved Uranium (U)	ug/L	7.49	0.010	A357284	2.47	0.0020	1.03	0.618	0.0020	A357284

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY382			AFY383		AFY384	AFY385		
Sampling Date		2021/09/14 11:30			2021/09/14 11:20		2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01			644187-02-01		644187-02-01	644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	TABLE 3	TABLE 4	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	1790	1.0	A357284	722 (1)	1.0	158	53.1	0.20	A357284
Dissolved Zinc (Zn)	ug/L	1.49	0.50	A357284	2.06	0.10	9.61	1.62	0.10	A357284
Dissolved Zirconium (Zr)	ug/L	0.70	0.50	A357284	0.30	0.10	0.14	0.10	0.10	A357284
Dissolved Calcium (Ca)	mg/L	14.2	0.25	A352809	28.6	0.050	33.1	34.4	0.050	A352809
Dissolved Magnesium (Mg)	mg/L	9.16	0.25	A352809	8.33	0.050	8.21	8.39	0.050	A352809
Dissolved Potassium (K)	mg/L	10.5	0.25	A352809	3.75	0.050	1.79	1.27	0.050	A352809
Dissolved Sodium (Na)	mg/L	609	0.25	A352809	183	0.050	62.7	26.1	0.050	A352809
Dissolved Sulphur (S)	mg/L	183	15	A352809	45.4	3.0	17.5	12.8	3.0	A352809
<b>Total Metals by ICPMS</b>										
Total Aluminum (Al)	ug/L	161	0.50	A357290	445	3.0	1620	1170	3.0	A359510
Total Antimony (Sb)	ug/L	0.891	0.020	A357290	0.350	0.020	0.175	0.120	0.020	A359510
Total Arsenic (As)	ug/L	9.57	0.020	A357290	4.20	0.020	2.21	1.18	0.020	A359510
Total Barium (Ba)	ug/L	51.0	0.020	A357290	57.6	0.050	73.5	66.3	0.050	A359510
Total Beryllium (Be)	ug/L	<0.010	0.010	A357290	0.028	0.010	0.068	0.070	0.010	A359510
Total Bismuth (Bi)	ug/L	<0.0050	0.0050	A357290	<0.010	0.010	0.021	0.015	0.010	A359510
Total Boron (B)	ug/L	2290 (1)	50	A357290	707	10	241	90	10	A359510
Total Cadmium (Cd)	ug/L	<0.0050	0.0050	A357290	<0.0050	0.0050	0.0315	0.0252	0.0050	A359510
Total Chromium (Cr)	ug/L	0.15	0.10	A357290	0.71	0.10	2.51	1.72	0.10	A359510
Total Cobalt (Co)	ug/L	0.243	0.0050	A357290	0.364	0.010	1.09	0.720	0.010	A359510
Total Copper (Cu)	ug/L	0.360	0.050	A357290	1.44	0.10	2.99	2.34	0.10	A359510
Total Iron (Fe)	ug/L	369	1.0	A357290	644	5.0	2400	1590	5.0	A359510
Total Lead (Pb)	ug/L	0.0787	0.0050	A357290	0.325	0.020	1.21	0.814	0.020	A359510
Total Lithium (Li)	ug/L	123	0.50	A357290	40.4	0.50	17.9	10.3	0.50	A359510
Total Manganese (Mn)	ug/L	17.6	0.050	A357290	21.4	0.10	95.0	56.7	0.10	A359510
Total Molybdenum (Mo)	ug/L	659	0.050	A357290	244	0.050	75.6	24.3	0.050	A359510
Total Nickel (Ni)	ug/L	3.74	0.020	A357290	2.84	0.10	4.06	2.75	0.10	A359510
Total Phosphorus (P)	ug/L				42.2	5.0	80.7	57.9	5.0	A359510
Total Selenium (Se)	ug/L	2.85	0.040	A357290	1.09	0.040	0.513	0.333	0.040	A359510
Total Silicon (Si)	ug/L	1750	50	A357290	2660	50	4620	3900	50	A359510
Total Silver (Ag)	ug/L	<0.0050	0.0050	A357290	<0.010	0.010	0.013	0.011	0.010	A359510
Total Strontium (Sr)	ug/L	467	0.050	A357290	359	0.050	311	284	0.050	A359510
Total Thallium (Tl)	ug/L	0.0055	0.0020	A357290	0.0098	0.0020	0.0272	0.0202	0.0020	A359510

RDL = Reportable Detection Limit

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





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY382			AFY383		AFY384	AFY385		
Sampling Date		2021/09/14 11:30			2021/09/14 11:20		2021/09/14 10:50	2021/09/14 10:20		
COC Number		644187-02-01			644187-02-01		644187-02-01	644187-02-01		
	UNITS	TABLE 1	RDL	QC Batch	TABLE 2	RDL	TABLE 3	TABLE 4	RDL	QC Batch
Total Tin (Sn)	ug/L	<0.20	0.20	A357290	<0.20	0.20	<0.20	<0.20	0.20	A359510
Total Titanium (Ti)	ug/L	0.94	0.50	A357290	9.4	2.0	58.2	25.3	2.0	A359510
Total Uranium (U)	ug/L	6.73	0.0020	A357290	2.75	0.0050	1.26	0.747	0.0050	A359510
Total Vanadium (V)	ug/L	1840 (1)	1.0	A357290	639 (1)	1.0	215	70.5	0.20	A359510
Total Zinc (Zn)	ug/L	4.09	0.10	A357290	7.8	1.0	11.6	9.4	1.0	A359510
Total Zirconium (Zr)	ug/L	0.70	0.10	A357290	0.78	0.10	1.22	0.93	0.10	A359510
Total Calcium (Ca)	mg/L	15.2	0.050	A353541	28.5	0.25	37.1	36.6	0.25	A353541
Total Magnesium (Mg)	mg/L	9.18	0.050	A353541	9.94	0.25	10.8	10.4	0.25	A353541
Total Potassium (K)	mg/L	10.0	0.050	A353541	4.36	0.25	2.61	1.80	0.25	A353541
Total Sodium (Na)	mg/L	644	0.25	A353541	213	0.25	74.0	30.0	0.25	A353541
Total Sulphur (S)	mg/L	120	3.0	A353541	64.4	3.0	27.3	15.4	3.0	A353541

RDL = Reportable Detection Limit

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





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY386			AFY387			AFY388		
Sampling Date		2021/09/14 10:00			2021/09/14 09:32			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 5	RDL	QC Batch	TABLE 6	RDL	QC Batch	TABLE 7	RDL	QC Batch

#### Lab Filtered Elements

Dissolved Calcium (Ca)	mg/L	40	0.30	A361530	41	0.30	A361530	40	0.30	A361530
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A361530	<0.060	0.060	A361530	<0.060	0.060	A361530
Dissolved Magnesium (Mg)	mg/L	11	0.20	A361530	11	0.20	A361530	11	0.20	A361530
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A361530	<0.0040	0.0040	A361530	<0.0040	0.0040	A361530
Dissolved Potassium (K)	mg/L	1.3	0.30	A361530	1.2	0.30	A361530	1.2	0.30	A361530
Dissolved Sodium (Na)	mg/L	18	0.50	A361530	12	0.50	A361530	10	0.50	A361530

#### Dissolved Metals by ICPMS

Dissolved Aluminum (Al)	ug/L	7.10	0.50	A357284	6.19	0.50	A357284	13.4	0.50	A357284
Dissolved Antimony (Sb)	ug/L	0.079	0.020	A357284	0.066	0.020	A357284	0.065	0.020	A357284
Dissolved Arsenic (As)	ug/L	0.508	0.020	A357284	0.448	0.020	A357284	0.370	0.020	A357284
Dissolved Barium (Ba)	ug/L	40.6	0.020	A357284	40.6	0.020	A357284	39.0	0.020	A357284
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A357284	<0.010	0.010	A357284	<0.010	0.010	A357284
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284
Dissolved Boron (B)	ug/L	60	10	A357284	42	10	A357284	60	10	A357284
Dissolved Cadmium (Cd)	ug/L	0.0073	0.0050	A357284	0.0119	0.0050	A357284	0.0150	0.0050	A357284
Dissolved Chromium (Cr)	ug/L	0.17	0.10	A357284	0.18	0.10	A357284	0.15	0.10	A357284
Dissolved Cobalt (Co)	ug/L	0.0636	0.0050	A357284	0.0687	0.0050	A357284	0.0593	0.0050	A357284
Dissolved Copper (Cu)	ug/L	1.25	0.050	A357284	1.09	0.050	A357284	1.09	0.050	A357284
Dissolved Iron (Fe)	ug/L	31.3	1.0	A357284	35.7	1.0	A357284	29.6	1.0	A357284
Dissolved Lead (Pb)	ug/L	0.0216	0.0050	A357284	0.0250	0.0050	A357284	0.177	0.0050	A357284
Dissolved Lithium (Li)	ug/L	6.16	0.50	A357284	5.35	0.50	A357284	4.95	0.50	A357284
Dissolved Manganese (Mn)	ug/L	0.705	0.050	A357284	0.833	0.050	A357284	0.672	0.050	A357284
Dissolved Molybdenum (Mo)	ug/L	7.12	0.050	A357284	2.03	0.050	A357284	0.771	0.050	A357284
Dissolved Nickel (Ni)	ug/L	0.914	0.020	A357284	0.849	0.020	A357284	0.871	0.020	A357284
Dissolved Selenium (Se)	ug/L	0.268	0.040	A357284	0.250	0.040	A357284	0.245	0.040	A357284
Dissolved Silicon (Si)	ug/L	1230	50	A357284	1360	50	A357284	1140	50	A357284
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284
Dissolved Strontium (Sr)	ug/L	200	0.050	A357284	195	0.050	A357284	192	0.050	A357284
Dissolved Thallium (Tl)	ug/L	0.0044	0.0020	A357284	0.0044	0.0020	A357284	0.0033	0.0020	A357284
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A357284	<0.20	0.20	A357284	<0.20	0.20	A357284
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A357284	<0.50	0.50	A357284	<0.50	0.50	A357284
Dissolved Uranium (U)	ug/L	0.486	0.0020	A357284	0.431	0.0020	A357284	0.398	0.0020	A357284

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY386			AFY387			AFY388		
Sampling Date		2021/09/14 10:00			2021/09/14 09:32			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 5	RDL	QC Batch	TABLE 6	RDL	QC Batch	TABLE 7	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	18.1	0.20	A357284	3.76	0.20	A357284	0.25	0.20	A357284
Dissolved Zinc (Zn)	ug/L	0.83	0.10	A357284	1.89	0.10	A357284	1.68	0.10	A357284
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A357284	0.10	0.10	A357284	<0.10	0.10	A357284
Dissolved Calcium (Ca)	mg/L	34.3	0.050	A352809	34.9	0.050	A352809	34.3	0.050	A352809
Dissolved Magnesium (Mg)	mg/L	8.17	0.050	A352809	8.13	0.050	A352809	7.88	0.050	A352809
Dissolved Potassium (K)	mg/L	1.05	0.050	A352809	0.973	0.050	A352809	0.931	0.050	A352809
Dissolved Sodium (Na)	mg/L	13.9	0.050	A352809	9.09	0.050	A352809	7.74	0.050	A352809
Dissolved Sulphur (S)	mg/L	8.2	3.0	A352809	7.5	3.0	A352809	4.7	3.0	A352809
<b>Total Metals by ICPMS</b>										
Total Aluminum (Al)	ug/L	669	3.0	A359510	666	3.0	A359510	1840	3.0	A359510
Total Antimony (Sb)	ug/L	0.089	0.020	A359510	0.091	0.020	A359510	0.095	0.020	A359510
Total Arsenic (As)	ug/L	0.819	0.020	A359510	0.674	0.020	A359510	1.05	0.020	A359510
Total Barium (Ba)	ug/L	58.9	0.050	A359510	57.9	0.050	A359510	74.4	0.050	A359510
Total Beryllium (Be)	ug/L	0.034	0.010	A359510	0.036	0.010	A359510	0.077	0.010	A359510
Total Bismuth (Bi)	ug/L	<0.010	0.010	A359510	<0.010	0.010	A359510	0.019	0.010	A359510
Total Boron (B)	ug/L	45	10	A359510	27	10	A359510	49	10	A359510
Total Cadmium (Cd)	ug/L	0.0170	0.0050	A359510	0.0211	0.0050	A359510	0.0360	0.0050	A359510
Total Chromium (Cr)	ug/L	0.97	0.10	A359510	1.04	0.10	A359510	2.75	0.10	A359510
Total Cobalt (Co)	ug/L	0.382	0.010	A359510	0.392	0.010	A359510	1.04	0.010	A359510
Total Copper (Cu)	ug/L	1.84	0.10	A359510	1.85	0.10	A359510	3.04	0.10	A359510
Total Iron (Fe)	ug/L	819	5.0	A359510	824	5.0	A359510	2350	5.0	A359510
Total Lead (Pb)	ug/L	0.460	0.020	A359510	0.462	0.020	A359510	1.15	0.020	A359510
Total Lithium (Li)	ug/L	7.24	0.50	A359510	6.29	0.50	A359510	7.57	0.50	A359510
Total Manganese (Mn)	ug/L	26.4	0.10	A359510	26.8	0.10	A359510	88.1	0.10	A359510
Total Molybdenum (Mo)	ug/L	8.85	0.050	A359510	2.41	0.050	A371010	1.04	0.050	A359510
Total Nickel (Ni)	ug/L	1.85	0.10	A359510	1.92	0.10	A359510	3.56	0.10	A359510
Total Phosphorus (P)	ug/L	34.3	5.0	A359510	32.2	5.0	A359510	70.7	5.0	A359510
Total Selenium (Se)	ug/L	0.267	0.040	A359510	0.246	0.040	A359510	0.326	0.040	A359510
Total Silicon (Si)	ug/L	2980	50	A359510	2990	50	A359510	5130	50	A359510
Total Silver (Ag)	ug/L	<0.010	0.010	A359510	<0.010	0.010	A359510	0.011	0.010	A359510
Total Strontium (Sr)	ug/L	275	0.050	A359510	266	0.050	A359510	278	0.050	A359510
Total Thallium (Tl)	ug/L	0.0129	0.0020	A359510	0.0115	0.0020	A359510	0.0311	0.0020	A359510
Total Tin (Sn)	ug/L	<0.20	0.20	A359510	<0.20	0.20	A359510	<0.20	0.20	A359510
RDL = Reportable Detection Limit										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY386			AFY387			AFY388		
Sampling Date		2021/09/14 10:00			2021/09/14 09:32			2021/09/14 10:50		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 5	RDL	QC Batch	TABLE 6	RDL	QC Batch	TABLE 7	RDL	QC Batch
Total Titanium (Ti)	ug/L	26.0	2.0	A359510	19.7	2.0	A359510	48.2	2.0	A359510
Total Uranium (U)	ug/L	0.580	0.0050	A359510	0.514	0.0050	A359510	0.551	0.0050	A359510
Total Vanadium (V)	ug/L	23.8	0.20	A359510	5.53	0.20	A371010	4.59	0.20	A359510
Total Zinc (Zn)	ug/L	4.1	1.0	A359510	7.1	1.5	A371010	8.3	1.0	A359510
Total Zirconium (Zr)	ug/L	0.63	0.10	A359510	0.65	0.10	A359510	1.38	0.10	A359510
Total Calcium (Ca)	mg/L	34.5	0.25	A353541	34.3	0.25	A353541	38.6	0.25	A353541
Total Magnesium (Mg)	mg/L	10.1	0.25	A353541	9.93	0.25	A353541	10.9	0.25	A353541
Total Potassium (K)	mg/L	1.46	0.25	A353541	1.33	0.25	A353541	1.72	0.25	A353541
Total Sodium (Na)	mg/L	16.6	0.25	A353541	10.9	0.25	A353541	9.57	0.25	A353541
Total Sulphur (S)	mg/L	11.8	3.0	A353541	10.2	3.0	A353541	10.2	3.0	A353541
RDL = Reportable Detection Limit										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY389			AFY390			AFY391		
Sampling Date		2021/09/14 10:00			2021/09/14 10:50			2021/09/14 11:45		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 8	RDL	QC Batch	DUPLICATE	RDL	QC Batch	BLANK	RDL	QC Batch

#### Lab Filtered Elements

Dissolved Calcium (Ca)	mg/L	41	0.30	A361530	40	0.30	A361530	<0.30	0.30	A361530
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A361530	<0.060	0.060	A361530	<0.060	0.060	A361530
Dissolved Magnesium (Mg)	mg/L	11	0.20	A361530	11	0.20	A361530	<0.20	0.20	A361530
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A361530	<0.0040	0.0040	A361530	<0.0040	0.0040	A361530
Dissolved Potassium (K)	mg/L	1.3	0.30	A361530	1.2	0.30	A361530	<0.30	0.30	A361530
Dissolved Sodium (Na)	mg/L	10	0.50	A361530	10	0.50	A361530	<0.50	0.50	A361530

#### Dissolved Metals by ICPMS

Dissolved Aluminum (Al)	ug/L	7.57	0.50	A357284	9.47	0.50	A357284	5.33	0.50	A357284
Dissolved Antimony (Sb)	ug/L	0.065	0.020	A357284	0.063	0.020	A357284	<0.020	0.020	A357284
Dissolved Arsenic (As)	ug/L	0.375	0.020	A357284	0.391	0.020	A357284	<0.020	0.020	A357284
Dissolved Barium (Ba)	ug/L	40.3	0.020	A357284	39.3	0.020	A357284	0.166	0.020	A357284
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A357284	<0.010	0.010	A357284	<0.010	0.010	A357284
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284
Dissolved Boron (B)	ug/L	35	10	A357284	40	10	A357284	20	10	A357284
Dissolved Cadmium (Cd)	ug/L	0.0143	0.0050	A357284	0.0125	0.0050	A357284	<0.0050	0.0050	A357284
Dissolved Chromium (Cr)	ug/L	0.16	0.10	A357284	0.15	0.10	A357284	0.13	0.10	A357284
Dissolved Cobalt (Co)	ug/L	0.0694	0.0050	A357284	0.0673	0.0050	A357284	0.0082	0.0050	A357284
Dissolved Copper (Cu)	ug/L	1.09	0.050	A357284	1.17	0.050	A357284	0.903	0.050	A357284
Dissolved Iron (Fe)	ug/L	42.1	1.0	A357284	41.7	1.0	A357284	24.0	1.0	A357284
Dissolved Lead (Pb)	ug/L	0.0323	0.0050	A357284	0.0335	0.0050	A357284	0.711	0.0050	A357284
Dissolved Lithium (Li)	ug/L	4.96	0.50	A357284	5.05	0.50	A357284	<0.50	0.50	A357284
Dissolved Manganese (Mn)	ug/L	1.32	0.050	A357284	1.32	0.050	A357284	0.822	0.050	A357284
Dissolved Molybdenum (Mo)	ug/L	0.709	0.050	A357284	0.726	0.050	A357284	0.168	0.050	A357284
Dissolved Nickel (Ni)	ug/L	0.859	0.020	A357284	0.851	0.020	A357284	0.024	0.020	A357284
Dissolved Selenium (Se)	ug/L	0.249	0.040	A357284	0.232	0.040	A357284	<0.040	0.040	A357284
Dissolved Silicon (Si)	ug/L	1400	50	A357284	1160	50	A357284	<50	50	A357284
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284	<0.0050	0.0050	A357284
Dissolved Strontium (Sr)	ug/L	193	0.050	A357284	194	0.050	A357284	0.668	0.050	A357284
Dissolved Thallium (Tl)	ug/L	0.0048	0.0020	A357284	0.0043	0.0020	A357284	<0.0020	0.0020	A357284
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A357284	<0.20	0.20	A357284	<0.20	0.20	A357284
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A357284	<0.50	0.50	A357284	<0.50	0.50	A357284
Dissolved Uranium (U)	ug/L	0.397	0.0020	A357284	0.414	0.0020	A357284	0.0033	0.0020	A357284

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY389			AFY390			AFY391		
Sampling Date		2021/09/14 10:00			2021/09/14 10:50			2021/09/14 11:45		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 8	RDL	QC Batch	DUPLICATE	RDL	QC Batch	BLANK	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	0.23	0.20	A357284	0.25	0.20	A357284	0.44	0.20	A357284
Dissolved Zinc (Zn)	ug/L	0.78	0.10	A357284	1.25	0.10	A357284	1.15	0.10	A357284
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A357284	<0.10	0.10	A357284	<0.10	0.10	A357284
Dissolved Calcium (Ca)	mg/L	34.8	0.050	A352809	34.6	0.050	A352809	0.665	0.050	A352809
Dissolved Magnesium (Mg)	mg/L	7.89	0.050	A352809	8.01	0.050	A352809	<0.050	0.050	A352809
Dissolved Potassium (K)	mg/L	0.931	0.050	A352809	0.940	0.050	A352809	<0.050	0.050	A352809
Dissolved Sodium (Na)	mg/L	7.73	0.050	A352809	7.93	0.050	A352809	0.179	0.050	A352809
Dissolved Sulphur (S)	mg/L	6.9	3.0	A352809	5.2	3.0	A352809	<3.0	3.0	A352809
<b>Total Metals by ICPMS</b>										
Total Aluminum (Al)	ug/L	645	3.0	A359510	709	3.0	A359510	0.99	0.50	A357290
Total Antimony (Sb)	ug/L	0.080	0.020	A359510	0.098	0.020	A359510	<0.020	0.020	A357290
Total Arsenic (As)	ug/L	0.634	0.020	A359510	0.647	0.020	A359510	<0.020	0.020	A357290
Total Barium (Ba)	ug/L	57.0	0.050	A359510	60.6	0.050	A359510	<0.020	0.020	A357290
Total Beryllium (Be)	ug/L	0.031	0.010	A359510	0.043	0.010	A359510	<0.010	0.010	A357290
Total Bismuth (Bi)	ug/L	<0.010	0.010	A359510	<0.010	0.010	A359510	<0.0050	0.0050	A357290
Total Boron (B)	ug/L	26	10	A359510	24	10	A359510	<10	10	A357290
Total Cadmium (Cd)	ug/L	0.0234	0.0050	A359510	0.0207	0.0050	A359510	<0.0050	0.0050	A357290
Total Chromium (Cr)	ug/L	0.95	0.10	A359510	1.08	0.10	A359510	<0.10	0.10	A357290
Total Cobalt (Co)	ug/L	0.365	0.010	A359510	0.394	0.010	A359510	<0.0050	0.0050	A357290
Total Copper (Cu)	ug/L	1.86	0.10	A359510	1.88	0.10	A359510	<0.050	0.050	A357290
Total Iron (Fe)	ug/L	798	5.0	A359510	824	5.0	A359510	<1.0	1.0	A357290
Total Lead (Pb)	ug/L	0.465	0.020	A359510	0.489	0.020	A359510	<0.0050	0.0050	A357290
Total Lithium (Li)	ug/L	6.07	0.50	A359510	6.36	0.50	A359510	<0.50	0.50	A357290
Total Manganese (Mn)	ug/L	26.1	0.10	A359510	26.3	0.10	A359510	<0.050	0.050	A357290
Total Molybdenum (Mo)	ug/L	0.921	0.050	A359510	0.861	0.050	A371010	<0.050	0.050	A357290
Total Nickel (Ni)	ug/L	1.96	0.10	A359510	2.19	0.10	A359510	<0.020	0.020	A357290
Total Phosphorus (P)	ug/L	33.2	5.0	A359510	34.0	5.0	A359510			
Total Selenium (Se)	ug/L	0.221	0.040	A359510	0.220	0.040	A359510	<0.040	0.040	A357290
Total Silicon (Si)	ug/L	2900	50	A359510	2980	50	A359510	<50	50	A357290
Total Silver (Ag)	ug/L	<0.010	0.010	A359510	<0.010	0.010	A359510	<0.0050	0.0050	A357290
Total Strontium (Sr)	ug/L	264	0.050	A359510	263	0.050	A359510	<0.050	0.050	A357290
Total Thallium (Tl)	ug/L	0.0141	0.0020	A359510	0.0177	0.0020	A359510	<0.0020	0.0020	A357290
Total Tin (Sn)	ug/L	<0.20	0.20	A359510	<0.20	0.20	A359510	<0.20	0.20	A357290
RDL = Reportable Detection Limit										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY389			AFY390			AFY391		
Sampling Date		2021/09/14 10:00			2021/09/14 10:50			2021/09/14 11:45		
COC Number		644187-02-01			644187-02-01			644187-02-01		
	UNITS	TABLE 8	RDL	QC Batch	DUPLICATE	RDL	QC Batch	BLANK	RDL	QC Batch
Total Titanium (Ti)	ug/L	26.6	2.0	A359510	18.7	2.0	A359510	<0.50	0.50	A357290
Total Uranium (U)	ug/L	0.480	0.0050	A359510	0.516	0.0050	A359510	0.0032	0.0020	A357290
Total Vanadium (V)	ug/L	1.83	0.20	A359510	1.26	0.20	A371010	<0.20	0.20	A357290
Total Zinc (Zn)	ug/L	6.2	1.0	A359510	5.1	1.5	A371010	0.19	0.10	A357290
Total Zirconium (Zr)	ug/L	0.60	0.10	A359510	0.61	0.10	A359510	<0.10	0.10	A357290
Total Calcium (Ca)	mg/L	33.9	0.25	A353541	34.3	0.25	A353541	<0.050	0.050	A353541
Total Magnesium (Mg)	mg/L	9.91	0.25	A353541	9.74	0.25	A353541	<0.050	0.050	A353541
Total Potassium (K)	mg/L	1.31	0.25	A353541	1.32	0.25	A353541	<0.050	0.050	A353541
Total Sodium (Na)	mg/L	9.37	0.25	A353541	9.37	0.25	A353541	<0.050	0.050	A353541
Total Sulphur (S)	mg/L	9.8	3.0	A353541	10.2	3.0	A353541	<3.0	3.0	A353541
RDL = Reportable Detection Limit										





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>BV Labs ID</b>		AFY434			AFY435		
<b>Sampling Date</b>		2021/09/14 13:45			2021/09/14 12:00		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Lab Filtered Elements</b>							
Dissolved Calcium (Ca)	mg/L	40	0.30	A361530	18	0.30	A361530
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A361530	<0.060	0.060	A361530
Dissolved Magnesium (Mg)	mg/L	11	0.20	A361530	12	0.20	A361530
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A361530	0.0056	0.0040	A361530
Dissolved Potassium (K)	mg/L	1.2	0.30	A361530	13	0.30	A361530
Dissolved Sodium (Na)	mg/L	10	0.50	A361530	780	2.5	A361530
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	15.3	0.50	A357284	107	2.5	A357284
Dissolved Antimony (Sb)	ug/L	0.056	0.020	A357284	0.97	0.10	A357284
Dissolved Arsenic (As)	ug/L	0.378	0.020	A357284	11.5	0.10	A357284
Dissolved Barium (Ba)	ug/L	41.5	0.020	A357284	51.8	0.10	A357284
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A357284	<0.050	0.050	A357284
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A357284	<0.025	0.025	A357284
Dissolved Boron (B)	ug/L	36	10	A384717	2260	50	A357284
Dissolved Cadmium (Cd)	ug/L	0.0165	0.0050	A357284	<0.025	0.025	A357284
Dissolved Chromium (Cr)	ug/L	0.15	0.10	A357284	0.63	0.50	A357284
Dissolved Cobalt (Co)	ug/L	0.0842	0.0050	A357284	0.247	0.025	A357284
Dissolved Copper (Cu)	ug/L	1.00	0.050	A357284	0.47	0.25	A357284
Dissolved Iron (Fe)	ug/L	64.2	1.0	A357284	47.6	5.0	A357284
Dissolved Lead (Pb)	ug/L	0.0491	0.0050	A357284	0.028	0.025	A357284
Dissolved Lithium (Li)	ug/L	4.85	0.50	A357284	106	2.5	A357284
Dissolved Manganese (Mn)	ug/L	3.89	0.050	A357284	5.31	0.25	A357284
Dissolved Molybdenum (Mo)	ug/L	4.06	0.050	A384717	699	0.25	A357284
Dissolved Nickel (Ni)	ug/L	0.895	0.020	A357284	4.23	0.10	A357284
Dissolved Selenium (Se)	ug/L	0.221	0.040	A357284	3.15	0.20	A357284
Dissolved Silicon (Si)	ug/L	1850	50	A357284	1780	250	A357284
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A357284	<0.025	0.025	A357284
Dissolved Strontium (Sr)	ug/L	192	0.050	A357284	434	0.25	A357284
Dissolved Thallium (Tl)	ug/L	0.0046	0.0020	A357284	<0.010	0.010	A357284
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A357284	<1.0	1.0	A357284
Dissolved Titanium (Ti)	ug/L	0.53	0.50	A357284	<2.5	2.5	A357284
Dissolved Uranium (U)	ug/L	0.390	0.0020	A357284	7.72	0.010	A357284
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		AFY434			AFY435		
Sampling Date		2021/09/14 13:45			2021/09/14 12:00		
COC Number		644187-02-01			644187-02-01		
	UNITS	RIVER WATER TANK	RDL	QC Batch	TREATED OSPW TANK	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	8.25	0.20	A384717	1830	1.0	A357284
Dissolved Zinc (Zn)	ug/L	2.49	0.10	A384717	3.53	0.50	A357284
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A357284	0.64	0.50	A357284
Dissolved Calcium (Ca)	mg/L	47.7	0.050	A352809	15.1	0.25	A352809
Dissolved Magnesium (Mg)	mg/L	12.1	0.050	A352809	9.30	0.25	A352809
Dissolved Potassium (K)	mg/L	1.43	0.050	A352809	10.7	0.25	A352809
Dissolved Sodium (Na)	mg/L	14.2	0.050	A352809	620	0.25	A352809
Dissolved Sulphur (S)	mg/L	9.3	3.0	A352809	184	15	A352809
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	1030	3.0	A359510	205	15	A359510
Total Antimony (Sb)	ug/L	0.099	0.020	A359510	0.99	0.10	A359510
Total Arsenic (As)	ug/L	0.775	0.020	A359510	12.8	0.10	A359510
Total Barium (Ba)	ug/L	63.2	0.050	A359510	61.9	0.25	A359510
Total Beryllium (Be)	ug/L	0.059	0.010	A359510	<0.050	0.050	A359510
Total Bismuth (Bi)	ug/L	0.014	0.010	A359510	<0.050	0.050	A359510
Total Boron (B)	ug/L	22	10	A359510	2290	50	A359510
Total Cadmium (Cd)	ug/L	0.0255	0.0050	A359510	<0.025	0.025	A359510
Total Chromium (Cr)	ug/L	1.53	0.10	A359510	0.72	0.50	A359510
Total Cobalt (Co)	ug/L	0.628	0.010	A359510	0.421	0.050	A359510
Total Copper (Cu)	ug/L	2.27	0.10	A359510	0.91	0.50	A359510
Total Iron (Fe)	ug/L	1360	5.0	A359510	641	25	A359510
Total Lead (Pb)	ug/L	0.728	0.020	A359510	0.13	0.10	A359510
Total Lithium (Li)	ug/L	6.38	0.50	A359510	120	2.5	A359510
Total Manganese (Mn)	ug/L	53.4	0.10	A359510	26.0	0.50	A359510
Total Molybdenum (Mo)	ug/L	0.907	0.050	A359510	806	0.25	A359510
Total Nickel (Ni)	ug/L	2.54	0.10	A359510	5.91	0.50	A359510
Total Phosphorus (P)	ug/L	49.0	5.0	A359510	111	25	A359510
Total Selenium (Se)	ug/L	0.231	0.040	A359510	3.13	0.20	A359510
Total Silicon (Si)	ug/L	3550	50	A359510	2220	250	A359510
Total Silver (Ag)	ug/L	<0.010	0.010	A359510	<0.050	0.050	A359510
Total Strontium (Sr)	ug/L	267	0.050	A359510	545	0.25	A359510
Total Thallium (Tl)	ug/L	0.0198	0.0020	A359510	<0.010	0.010	A359510
Total Tin (Sn)	ug/L	<0.20	0.20	A359510	<1.0	1.0	A359510
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>BV Labs ID</b>		AFY434			AFY435		
<b>Sampling Date</b>		2021/09/14 13:45			2021/09/14 12:00		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Total Titanium (Ti)	ug/L	23.3	2.0	A359510	<10	10	A359510
Total Uranium (U)	ug/L	0.492	0.0050	A359510	7.83	0.025	A359510
Total Vanadium (V)	ug/L	2.75	0.20	A359510	2170	0.20	A359510
Total Zinc (Zn)	ug/L	11.5	1.0	A359510	19.2	5.0	A359510
Total Zirconium (Zr)	ug/L	0.89	0.10	A359510	1.07	0.50	A359510
Total Calcium (Ca)	mg/L	35.7	0.25	A353541	15.3	1.3	A353541
Total Magnesium (Mg)	mg/L	10.1	0.25	A353541	10.7	1.3	A353541
Total Potassium (K)	mg/L	1.42	0.25	A353541	11.8	1.3	A353541
Total Sodium (Na)	mg/L	9.09	0.25	A353541	693	1.3	A353541
Total Sulphur (S)	mg/L	10.0	3.0	A353541	197	15	A353541
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY382	AFY383		AFY384	AFY385	AFY386		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20		2021/09/14 10:50	2021/09/14 10:20	2021/09/14 10:00		
COC Number		644187-02-01	644187-02-01		644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	QC Batch	TABLE 3	TABLE 4	TABLE 5	RDL	QC Batch
<b>Volatiles</b>									
Total Trihalomethanes	ug/L	<1.3	<1.3	A352638	<1.3	<1.3	<1.3	1.3	A352638
Benzene	ug/L	<0.40	<0.40	A354607	<0.40	<0.40	<0.40	0.40	A354607
Bromodichloromethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Toluene	ug/L	<0.40	<0.40	A354607	<0.40	<0.40	<0.40	0.40	A354607
Bromoform	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Ethylbenzene	ug/L	<0.40	<0.40	A354607	<0.40	<0.40	<0.40	0.40	A354607
Bromomethane	ug/L	<2.0	<2.0	A365270	<2.0	<2.0	<2.0	2.0	A365270
m & p-Xylene	ug/L	<0.80	<0.80	A354607	<0.80	<0.80	<0.80	0.80	A354607
Carbon tetrachloride	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
o-Xylene	ug/L	<0.40	<0.40	A354607	<0.40	<0.40	<0.40	0.40	A354607
Chlorobenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Dibromochloromethane	ug/L	<1.0	<1.0	A365270	<1.0	<1.0	<1.0	1.0	A365270
Xylenes (Total)	ug/L	<0.89	<0.89	A353214	<0.89	<0.89	<0.89	0.89	A353533
Chloroethane	ug/L	<1.0	<1.0	A365270	<1.0	<1.0	<1.0	1.0	A365270
F1 (C6-C10) - BTEX	ug/L	<100	<100	A353214	<100	<100	<100	100	A353533
Chloroform	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Chloromethane	ug/L	<2.0	<2.0	A365270	<2.0	<2.0	<2.0	2.0	A365270
F1 (C6-C10)	ug/L	<100	<100	A354607	<100	<100	<100	100	A354607
1,2-dibromoethane	ug/L	<0.20	<0.20	A365270	<0.20	<0.20	<0.20	0.20	A365270
1,2-dichlorobenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,3-dichlorobenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,4-dichlorobenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,1-dichloroethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,2-dichloroethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,1-dichloroethene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Dichloromethane	ug/L	<2.0	<2.0	A365270	<2.0	<2.0	<2.0	2.0	A365270
1,2-dichloropropane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Methyl methacrylate	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
RDL = Reportable Detection Limit									





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY382	AFY383		AFY384	AFY385	AFY386		
Sampling Date		2021/09/14 11:30	2021/09/14 11:20		2021/09/14 10:50	2021/09/14 10:20	2021/09/14 10:00		
COC Number		644187-02-01	644187-02-01		644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 1	TABLE 2	QC Batch	TABLE 3	TABLE 4	TABLE 5	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Styrene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	A365270	<1.0	<1.0	<1.0	1.0	A365270
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	A365270	<2.0	<2.0	<2.0	2.0	A365270
Tetrachloroethene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	A365270	<1.0	<1.0	<1.0	1.0	A365270
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	A365270	<1.0	<1.0	<1.0	1.0	A365270
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,1,1-trichloroethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,1,2-trichloroethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Trichloroethene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Trichlorofluoromethane	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
Vinyl chloride	ug/L	<0.50	<0.50	A365270	<0.50	<0.50	<0.50	0.50	A365270
<b>Surrogate Recovery (%)</b>									
1,4-Difluorobenzene (sur.)	%	105	100	A354607	101	106	105		A354607
4-Bromofluorobenzene (sur.)	%	97	101	A354607	96	102	100		A354607
D4-1,2-Dichloroethane (sur.)	%	103	98	A354607	98	103	105		A354607
1,4-Difluorobenzene (sur.)	%	103	103	A365270	104	102	102		A365270
4-Bromofluorobenzene (sur.)	%	97	97	A365270	96	97	98		A365270
D4-1,2-Dichloroethane (sur.)	%	100	112	A365270	99	108	106		A365270
RDL = Reportable Detection Limit									





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY387	AFY388	AFY389	AFY390	AFY391		
Sampling Date		2021/09/14 09:32	2021/09/14 10:50	2021/09/14 10:00	2021/09/14 10:50	2021/09/14 11:45		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 6	TABLE 7	TABLE 8	DUPLICATE	BLANK	RDL	QC Batch
<b>Volatiles</b>								
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	<1.3	1.3	A352638
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A354607
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A354607
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A354607
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A365270
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	A354607
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	A354607
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A365270
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	<0.89	0.89	A353533
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A365270
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	100	A353533
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A365270
F1 (C6-C10)	ug/L	<100	<100	<100	<100	<100	100	A354607
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	A365270
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A365270
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY387	AFY388	AFY389	AFY390	AFY391		
Sampling Date		2021/09/14 09:32	2021/09/14 10:50	2021/09/14 10:00	2021/09/14 10:50	2021/09/14 11:45		
COC Number		644187-02-01	644187-02-01	644187-02-01	644187-02-01	644187-02-01		
	UNITS	TABLE 6	TABLE 7	TABLE 8	DUPLICATE	BLANK	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A365270
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	A365270
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A365270
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	A365270
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	A365270
<b>Surrogate Recovery (%)</b>								
1,4-Difluorobenzene (sur.)	%	105	107	103	103	101		A354607
4-Bromofluorobenzene (sur.)	%	100	99	95	98	95		A354607
D4-1,2-Dichloroethane (sur.)	%	101	108	102	97	101		A354607
1,4-Difluorobenzene (sur.)	%	103	102	103	102	102		A365270
4-Bromofluorobenzene (sur.)	%	97	96	95	95	98		A365270
D4-1,2-Dichloroethane (sur.)	%	103	102	98	99	99		A365270
RDL = Reportable Detection Limit								





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY434		AFY435		
Sampling Date		2021/09/14 13:45		2021/09/14 12:00		
COC Number		644187-02-01		644187-02-01		
	UNITS	RIVER WATER TANK	QC Batch	TREATED OSPW TANK	RDL	QC Batch
<b>Volatiles</b>						
Total Trihalomethanes	ug/L	<1.3	A352638	<1.3	1.3	A353554
Benzene	ug/L	<0.40	A354607	<0.40	0.40	A354607
Bromodichloromethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
Toluene	ug/L	<0.40	A354607	<0.40	0.40	A354607
Bromoform	ug/L	<0.50	A365270	<0.50	0.50	A365270
Ethylbenzene	ug/L	<0.40	A354607	<0.40	0.40	A354607
Bromomethane	ug/L	<2.0	A365270	<2.0	2.0	A365270
m & p-Xylene	ug/L	<0.80	A354607	<0.80	0.80	A354607
Carbon tetrachloride	ug/L	<0.50	A365270	<0.50	0.50	A365270
o-Xylene	ug/L	<0.40	A354607	<0.40	0.40	A354607
Chlorobenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
Dibromochloromethane	ug/L	<1.0	A365270	<1.0	1.0	A365270
Xylenes (Total)	ug/L	<0.89	A353533	<0.89	0.89	A353533
Chloroethane	ug/L	<1.0	A365270	<1.0	1.0	A365270
F1 (C6-C10) - BTEX	ug/L	<100	A353533	<100	100	A353533
Chloroform	ug/L	<0.50	A365270	<0.50	0.50	A365270
Chloromethane	ug/L	<2.0	A365270	<2.0	2.0	A365270
F1 (C6-C10)	ug/L	<100	A354607	<100	100	A354607
1,2-dibromoethane	ug/L	<0.20	A365270	<0.20	0.20	A365270
1,2-dichlorobenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,3-dichlorobenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,4-dichlorobenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,1-dichloroethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,2-dichloroethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,1-dichloroethene	ug/L	<0.50	A365270	<0.50	0.50	A365270
cis-1,2-dichloroethene	ug/L	<0.50	A365270	<0.50	0.50	A365270
trans-1,2-dichloroethene	ug/L	<0.50	A365270	<0.50	0.50	A365270
Dichloromethane	ug/L	<2.0	A365270	<2.0	2.0	A365270
1,2-dichloropropane	ug/L	<0.50	A365270	<0.50	0.50	A365270
cis-1,3-dichloropropene	ug/L	<0.50	A365270	<0.50	0.50	A365270
trans-1,3-dichloropropene	ug/L	<0.50	A365270	<0.50	0.50	A365270
Methyl methacrylate	ug/L	<0.50	A365270	<0.50	0.50	A365270
RDL = Reportable Detection Limit						





### VOLATILE ORGANICS BY GC-MS (WATER)

BV Labs ID		AFY434		AFY435		
Sampling Date		2021/09/14 13:45		2021/09/14 12:00		
COC Number		644187-02-01		644187-02-01		
	UNITS	RIVER WATER TANK	QC Batch	TREATED OSPW TANK	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	A365270	<0.50	0.50	A365270
Styrene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,1,1,2-tetrachloroethane	ug/L	<1.0	A365270	<1.0	1.0	A365270
1,1,2,2-tetrachloroethane	ug/L	<2.0	A365270	<2.0	2.0	A365270
Tetrachloroethene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,2,3-trichlorobenzene	ug/L	<1.0	A365270	<1.0	1.0	A365270
1,2,4-trichlorobenzene	ug/L	<1.0	A365270	<1.0	1.0	A365270
1,3,5-trichlorobenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,1,1-trichloroethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,1,2-trichloroethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
Trichloroethene	ug/L	<0.50	A365270	<0.50	0.50	A365270
Trichlorofluoromethane	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,2,4-trimethylbenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
1,3,5-trimethylbenzene	ug/L	<0.50	A365270	<0.50	0.50	A365270
Vinyl chloride	ug/L	<0.50	A365270	<0.50	0.50	A365270
<b>Surrogate Recovery (%)</b>						
1,4-Difluorobenzene (sur.)	%	104	A354607	103		A354607
4-Bromofluorobenzene (sur.)	%	99	A354607	97		A354607
D4-1,2-Dichloroethane (sur.)	%	98	A354607	105		A354607
1,4-Difluorobenzene (sur.)	%	103	A365270	103		A365270
4-Bromofluorobenzene (sur.)	%	95	A365270	98		A365270
D4-1,2-Dichloroethane (sur.)	%	103	A365270	102		A365270
RDL = Reportable Detection Limit						





## GENERAL COMMENTS

Sample AFY382 [TABLE 1] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY383 [TABLE 2] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY384 [TABLE 3] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY385 [TABLE 4] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY386 [TABLE 5] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY387 [TABLE 6] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY388 [TABLE 7] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY389 [TABLE 8] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY390 [DUPLICATE] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY391 [BLANK] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY434 [RIVER WATER TANK] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

Sample AFY435 [TREATED OSPW TANK] : The sample for dissolved metals was filtered and preserved at the lab. Values may not reflect concentrations at the time of sampling.

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample AFY382 [TABLE 1] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

Sample AFY435 [TREATED OSPW TANK] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

Sample AFY435 [TREATED OSPW TANK] Elements by ICPMS Digested LL (total): Detection limits raised due to sample matrix.

Sample AFY387, Elements by ICPMS Digested LL (total): Test repeated.

Sample AFY390, Elements by ICPMS Digested LL (total): Test repeated.

Sample AFY434, Elements by ICPMS Low Level (dissolved): Test repeated.

**Results relate only to the items tested.**





### QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A347786	DM	Matrix Spike		D10-ANTHRACENE (sur.)	2021/09/21		122	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/21		97	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/21		82	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/21		111	%	50 - 130
				Acenaphthene	2021/09/21		89	%	50 - 130
				Acenaphthylene	2021/09/21		91	%	50 - 130
				Acridine	2021/09/21		88	%	50 - 130
				Anthracene	2021/09/21		83	%	50 - 130
				Benzo(a)anthracene	2021/09/21		90	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/21		86	%	50 - 130
				Benzo(k)fluoranthene	2021/09/21		84	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/21		81	%	50 - 130
				Benzo(c)phenanthrene	2021/09/21		97	%	50 - 130
				Benzo(a)pyrene	2021/09/21		79	%	50 - 130
				Benzo(e)pyrene	2021/09/21		87	%	50 - 130
				Chrysene	2021/09/21		88	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/21		81	%	50 - 130
				Fluoranthene	2021/09/21		104	%	50 - 130
				Fluorene	2021/09/21		92	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/21		79	%	50 - 130
				2-Methylnaphthalene	2021/09/21		81	%	50 - 130
				Naphthalene	2021/09/21		83	%	50 - 130
				Phenanthrene	2021/09/21		101	%	50 - 130
				Perylene	2021/09/21		84	%	50 - 130
				Pyrene	2021/09/21		102	%	50 - 130
				Quinoline	2021/09/21		104	%	50 - 130
				C1-Naphthalene	2021/09/21		80	%	50 - 130
				C3-Naphthalene	2021/09/21		82	%	50 - 130
				C2-Naphthalene	2021/09/21		79	%	50 - 130
				C1-biphenyl	2021/09/21		73	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/21		115	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/21		102	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/21		94	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/21		81	%	30 - 130
				1-Methylnaphthalene	2021/09/21		80	%	50 - 130
A347786	DM	Spiked Blank		D10-ANTHRACENE (sur.)	2021/09/21		119	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/21		86	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/21		67	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/21		100	%	50 - 130
				Acenaphthene	2021/09/21		83	%	50 - 130
				Acenaphthylene	2021/09/21		83	%	50 - 130
				Acridine	2021/09/21		80	%	50 - 130
				Anthracene	2021/09/21		79	%	50 - 130
				Benzo(a)anthracene	2021/09/21		103	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/21		102	%	50 - 130
				Benzo(k)fluoranthene	2021/09/21		100	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/21		100	%	50 - 130
				Benzo(c)phenanthrene	2021/09/21		102	%	50 - 130
				Benzo(a)pyrene	2021/09/21		96	%	50 - 130
				Benzo(e)pyrene	2021/09/21		104	%	50 - 130
				Chrysene	2021/09/21		105	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/21		101	%	50 - 130
				Fluoranthene	2021/09/21		105	%	50 - 130
				Fluorene	2021/09/21		86	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/21		98	%	50 - 130





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A347786	DM	Method Blank	2-Methylnaphthalene	2021/09/21		72	%	50 - 130
			Naphthalene	2021/09/21		75	%	50 - 130
			Phenanthrene	2021/09/21		96	%	50 - 130
			Perylene	2021/09/21		106	%	50 - 130
			Pyrene	2021/09/21		105	%	50 - 130
			Quinoline	2021/09/21		101	%	50 - 130
			C1-Naphthalene	2021/09/21		72	%	50 - 130
			C3-Naphthalene	2021/09/21		77	%	50 - 130
			C2-Naphthalene	2021/09/21		73	%	50 - 130
			C1-biphenyl	2021/09/21		66	%	50 - 130
			C1 phenanthrene/anthracene	2021/09/21		106	%	50 - 130
			C2 phenanthrene/anthracene	2021/09/21		107	%	50 - 130
			C1 fluoranthene/pyrene	2021/09/21		104	%	50 - 130
			C2 benzo(a)anthracene/chrysene	2021/09/21		69	%	30 - 130
			1-Methylnaphthalene	2021/09/21		72	%	50 - 130
			D10-ANTHRACENE (sur.)	2021/09/21		123	%	50 - 130
			D8-ACENAPHTHYLENE (sur.)	2021/09/21		84	%	50 - 130
			D8-NAPHTHALENE (sur.)	2021/09/21		63	%	50 - 130
			TERPHENYL-D14 (sur.)	2021/09/21		103	%	50 - 130
			Acenaphthene	2021/09/21	<0.10		ug/L	
			Acenaphthylene	2021/09/21	<0.10		ug/L	
			Acridine	2021/09/21	<0.040		ug/L	
			Anthracene	2021/09/21	<0.010		ug/L	
			Benzo(a)anthracene	2021/09/21	<0.0085		ug/L	
			Benzo(b&j)fluoranthene	2021/09/21	<0.0085		ug/L	
			Benzo(k)fluoranthene	2021/09/21	<0.0085		ug/L	
			Benzo(g,h,i)perylene	2021/09/21	<0.0085		ug/L	
			Benzo(c)phenanthrene	2021/09/21	<0.050		ug/L	
			Benzo(a)pyrene	2021/09/21	<0.0075		ug/L	
			Benzo(e)pyrene	2021/09/21	<0.050		ug/L	
			Chrysene	2021/09/21	<0.0085		ug/L	
			Dibenz(a,h)anthracene	2021/09/21	<0.0075		ug/L	
			Fluoranthene	2021/09/21	<0.010		ug/L	
			Fluorene	2021/09/21	<0.050		ug/L	
			Indeno(1,2,3-cd)pyrene	2021/09/21	<0.0085		ug/L	
			Indeno(1,2,3-cd)fluoranthene	2021/09/21	<0.0085		ug/L	
			2-Methylnaphthalene	2021/09/21	<0.10		ug/L	
			Naphthalene	2021/09/21	<0.10		ug/L	
			Phenanthrene	2021/09/21	<0.050		ug/L	
			Perylene	2021/09/21	<0.050		ug/L	
			Pyrene	2021/09/21	<0.020		ug/L	
			Quinoline	2021/09/21	<0.20		ug/L	
			Retene	2021/09/21	<0.050		ug/L	
			C1-Naphthalene	2021/09/21	<0.10		ug/L	
			C3-Naphthalene	2021/09/21	<0.10		ug/L	
			C4-Naphthalene	2021/09/21	<0.10		ug/L	
			C2-Naphthalene	2021/09/21	<0.10		ug/L	
			Biphenyl	2021/09/21	<0.020		ug/L	
			C1-biphenyl	2021/09/21	<0.020		ug/L	
			C2-biphenyl	2021/09/21	<0.020		ug/L	
			C1-fluorene	2021/09/21	<0.050		ug/L	
			C2-fluorene	2021/09/21	<0.050		ug/L	
			C3-fluorene	2021/09/21	<0.050		ug/L	
			Dibenzothiophene	2021/09/21	<0.020		ug/L	
			C1-dibenzothiophene	2021/09/21	<0.020		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
A347786	DM	RPD	C2-dibenzothiophene	2021/09/21	<0.020		ug/L	
			C3-dibenzothiophene	2021/09/21	<0.020		ug/L	
			C4-dibenzothiophene	2021/09/21	<0.020		ug/L	
			C1 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
			C2 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
			C3 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
			C4 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
			C1 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
			C2 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
			C3 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
			C4 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
			C1 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
			C2 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
			C3 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
			C4 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
			C1benzobkfluoranthene/benzoapyrene	2021/09/21	<0.0075		ug/L	
			C2benzobkfluoranthene/benzoapyrene	2021/09/21	<0.0075		ug/L	
			C1-Acenaphthene	2021/09/21	<0.10		ug/L	
			1-Methylnaphthalene	2021/09/21	<0.10		ug/L	
			Acenaphthene	2021/09/21	NC		%	30
			Acenaphthylene	2021/09/21	NC		%	30
			Acridine	2021/09/21	NC		%	30
			Anthracene	2021/09/21	NC		%	30
			Benzo(a)anthracene	2021/09/21	NC		%	30
			Benzo(b&j)fluoranthene	2021/09/21	NC		%	30
			Benzo(k)fluoranthene	2021/09/21	NC		%	30
			Benzo(g,h,i)perylene	2021/09/21	NC		%	30
			Benzo(c)phenanthrene	2021/09/21	NC		%	30
			Benzo(a)pyrene	2021/09/21	NC		%	30
			Benzo(e)pyrene	2021/09/21	NC		%	30
			Chrysene	2021/09/21	NC		%	30
			Dibenz(a,h)anthracene	2021/09/21	NC		%	30
			Fluoranthene	2021/09/21	NC		%	30
			Fluorene	2021/09/21	NC		%	30
			Indeno(1,2,3-cd)pyrene	2021/09/21	NC		%	30
			Indeno(1,2,3-cd)fluoranthene	2021/09/21	NC		%	30
			2-Methylnaphthalene	2021/09/21	NC		%	30
			Naphthalene	2021/09/21	NC		%	30
			Phenanthrene	2021/09/21	NC		%	30
			Perylene	2021/09/21	NC		%	30
			Pyrene	2021/09/21	NC		%	30
			Quinoline	2021/09/21	NC		%	30
			Retene	2021/09/21	NC		%	30
			C1-Naphthalene	2021/09/21	NC		%	30
			C3-Naphthalene	2021/09/21	NC		%	30
			C4-Naphthalene	2021/09/21	NC		%	30
			C2-Naphthalene	2021/09/21	NC		%	30
			Biphenyl	2021/09/21	NC		%	30
			C1-biphenyl	2021/09/21	NC		%	30
			C2-biphenyl	2021/09/21	NC		%	30
			C1-fluorene	2021/09/21	NC		%	30
			C2-fluorene	2021/09/21	NC		%	30
			C3-fluorene	2021/09/21	NC		%	30
			Dibenzothiophene	2021/09/21	NC		%	30
			C1-dibenzothiophene	2021/09/21	NC		%	30





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			C2-dibenzothiophene	2021/09/21	8.6		%	30
			C3-dibenzothiophene	2021/09/21	NC		%	30
			C4-dibenzothiophene	2021/09/21	NC		%	30
			C1 phenanthrene/anthracene	2021/09/21	NC		%	30
			C2 phenanthrene/anthracene	2021/09/21	NC		%	30
			C3 phenanthrene/anthracene	2021/09/21	NC		%	30
			C4 phenanthrene/anthracene	2021/09/21	NC		%	30
			C1 fluoranthene/pyrene	2021/09/21	NC		%	30
			C2 fluoranthene/pyrene	2021/09/21	NC		%	30
			C3 fluoranthene/pyrene	2021/09/21	NC		%	30
			C4 fluoranthene/pyrene	2021/09/21	NC		%	30
			C1 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
			C2 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
			C3 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
			C4 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
			C1benzobkfluoranthene/benzoapyrene	2021/09/21	NC		%	30
			C2benzobkfluoranthene/benzoapyrene	2021/09/21	NC		%	30
			C1-Acenaphthene	2021/09/21	NC		%	30
			1-Methylnaphthalene	2021/09/21	NC		%	30
A352869	CAU	Matrix Spike	Naphthenic Acids	2021/09/20		78	%	70 - 130
A352869	CAU	Spiked Blank	Naphthenic Acids	2021/09/20		83	%	70 - 130
A352869	CAU	Method Blank	Naphthenic Acids	2021/09/20	<2.0		mg/L	
A352869	CAU	RPD	Naphthenic Acids	2021/09/20	NC		%	30
A353626	CAU	Matrix Spike [AFY384-05]	Naphthenic Acids	2021/09/22		79	%	70 - 130
A353626	CAU	Spiked Blank	Naphthenic Acids	2021/09/22		83	%	70 - 130
A353626	CAU	Method Blank	Naphthenic Acids	2021/09/22	<2.0		mg/L	
A353626	CAU	RPD [AFY435-05]	Naphthenic Acids	2021/09/22	NC		%	30
A353632	SEH	Matrix Spike	O-TERPHENYL (sur.)	2021/09/19		101	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/19		99	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/09/19		104	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/19		98	%	60 - 140
A353632	SEH	Spiked Blank	O-TERPHENYL (sur.)	2021/09/19		114	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/19		109	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/09/19		114	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/19		109	%	60 - 140
A353632	SEH	Method Blank	O-TERPHENYL (sur.)	2021/09/19		106	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/19	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2021/09/19	<0.10		mg/L	
			F4 (C34-C50 Hydrocarbons)	2021/09/19	<0.20		mg/L	
A353632	SEH	RPD	F2 (C10-C16 Hydrocarbons)	2021/09/19	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2021/09/19	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2021/09/19	NC		%	30
A353691	GG3	Matrix Spike [AFY382-14]	O-TERPHENYL (sur.)	2021/09/17		103	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/17		100	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/09/17		104	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/17		105	%	60 - 140
A353691	GG3	Spiked Blank	O-TERPHENYL (sur.)	2021/09/17		106	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/17		100	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/09/17		105	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/09/17		110	%	60 - 140
A353691	GG3	Method Blank	O-TERPHENYL (sur.)	2021/09/17		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/09/17	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2021/09/17	<0.10		mg/L	
			F4 (C34-C50 Hydrocarbons)	2021/09/17	<0.20		mg/L	
A353691	GG3	RPD	F2 (C10-C16 Hydrocarbons)	2021/09/17	NC		%	30





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			F3 (C16-C34 Hydrocarbons)	2021/09/17	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2021/09/17	NC		%	30
A354089	PK8	Spiked Blank	Biochemical Oxygen Demand	2021/09/21		89	%	85 - 115
A354089	PK8	Method Blank	Biochemical Oxygen Demand	2021/09/21	<2.0		mg/L	
A354089	PK8	RPD [AFY387-02]	Biochemical Oxygen Demand	2021/09/21	NC		%	20
A354307	FM0	Matrix Spike	Orthophosphate (P)	2021/09/16		104	%	80 - 120
A354307	FM0	Spiked Blank	Orthophosphate (P)	2021/09/16		105	%	80 - 120
A354307	FM0	Method Blank	Orthophosphate (P)	2021/09/16	<0.0010		mg/L	
A354307	FM0	RPD	Orthophosphate (P)	2021/09/16	NC		%	20
A354395	TMU	Matrix Spike	Total Inorganic Carbon (C)	2021/09/17		104	%	80 - 120
A354395	TMU	Spiked Blank	Total Inorganic Carbon (C)	2021/09/17		109	%	80 - 120
A354395	TMU	Method Blank	Total Inorganic Carbon (C)	2021/09/17	<1.0		mg/L	
A354395	TMU	RPD	Total Inorganic Carbon (C)	2021/09/17	2.5		%	20
A354530	STI	Matrix Spike [AFY435-02]	True Colour	2021/09/17		93	%	80 - 120
A354530	STI	Spiked Blank	True Colour	2021/09/16		97	%	80 - 120
A354530	STI	Method Blank	True Colour	2021/09/16	<2.0		PtCo units	
A354530	STI	RPD [AFY435-02]	True Colour	2021/09/17	5.7		%	20
A354607	DO1	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/09/26		112	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/26		103	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/26		116	%	50 - 140
			Benzene	2021/09/26		102	%	50 - 140
			Toluene	2021/09/26		95	%	50 - 140
			Ethylbenzene	2021/09/26		99	%	50 - 140
			m & p-Xylene	2021/09/26		99	%	50 - 140
			o-Xylene	2021/09/26		98	%	50 - 140
			F1 (C6-C10)	2021/09/26		74	%	60 - 140
A354607	DO1	Spiked Blank	1,4-Difluorobenzene (sur.)	2021/09/26		98	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/26		104	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/26		103	%	50 - 140
			Benzene	2021/09/26		97	%	60 - 130
			Toluene	2021/09/26		97	%	60 - 130
			Ethylbenzene	2021/09/26		101	%	60 - 130
			m & p-Xylene	2021/09/26		99	%	60 - 130
			o-Xylene	2021/09/26		99	%	60 - 130
			F1 (C6-C10)	2021/09/26		102	%	60 - 140
A354607	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2021/09/26		104	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/26		102	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/26		104	%	50 - 140
			Benzene	2021/09/26	<0.40		ug/L	
			Toluene	2021/09/26	<0.40		ug/L	
			Ethylbenzene	2021/09/26	<0.40		ug/L	
			m & p-Xylene	2021/09/26	<0.80		ug/L	
			o-Xylene	2021/09/26	<0.40		ug/L	
			F1 (C6-C10)	2021/09/26	<100		ug/L	
A354607	DO1	RPD	Benzene	2021/09/26	NC		%	30
			Toluene	2021/09/26	NC		%	30
			Ethylbenzene	2021/09/26	NC		%	30
			m & p-Xylene	2021/09/26	NC		%	30
			o-Xylene	2021/09/26	NC		%	30
			F1 (C6-C10)	2021/09/26	NC		%	30
A354816	KGA	Spiked Blank	Turbidity	2021/09/16		103	%	80 - 120
A354816	KGA	Method Blank	Turbidity	2021/09/16	<0.10		NTU	
A354816	KGA	RPD	Turbidity	2021/09/16	5.7		%	20
A354826	KGA	Spiked Blank	Turbidity	2021/09/16		103	%	80 - 120
A354826	KGA	Method Blank	Turbidity	2021/09/16	<0.10		NTU	





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A354826	KGA	RPD	[AFY434-01]	Turbidity	2021/09/16	8.6		%	20
A354886	SKM	Matrix Spike		Dissolved Nitrite (N)	2021/09/16		102	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/09/16		111	%	80 - 120
A354886	SKM	Spiked Blank		Dissolved Nitrite (N)	2021/09/16		103	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/09/16		102	%	80 - 120
A354886	SKM	Method Blank		Dissolved Nitrite (N)	2021/09/16	<0.010		mg/L	
				Dissolved Nitrate plus Nitrite (N)	2021/09/16	<0.010		mg/L	
A354886	SKM	RPD		Dissolved Nitrite (N)	2021/09/16	NC		%	20
				Dissolved Nitrate plus Nitrite (N)	2021/09/16	2.4		%	20
A354888	SKM	Matrix Spike		Dissolved Nitrite (N)	2021/09/16		101	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/09/16		112	%	80 - 120
A354888	SKM	Spiked Blank		Dissolved Nitrite (N)	2021/09/16		103	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/09/16		104	%	80 - 120
A354888	SKM	Method Blank		Dissolved Nitrite (N)	2021/09/17	<0.010		mg/L	
				Dissolved Nitrate plus Nitrite (N)	2021/09/17	<0.010		mg/L	
A354888	SKM	RPD		Dissolved Nitrite (N)	2021/09/16	NC		%	20
				Dissolved Nitrate plus Nitrite (N)	2021/09/16	1.9		%	20
A355317	JU2	Matrix Spike	[AFY389-04]	D10-ANTHRACENE (sur.)	2021/09/21		109	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/21		95	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/21		83	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/21		109	%	50 - 130
				Acenaphthene	2021/09/21		102	%	50 - 130
				Acenaphthylene	2021/09/21		101	%	50 - 130
				Acridine	2021/09/21		88	%	50 - 130
				Anthracene	2021/09/21		86	%	50 - 130
				Benzo(a)anthracene	2021/09/21		105	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/21		102	%	50 - 130
				Benzo(k)fluoranthene	2021/09/21		114	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/21		101	%	50 - 130
				Benzo(c)phenanthrene	2021/09/21		107	%	50 - 130
				Benzo(a)pyrene	2021/09/21		97	%	50 - 130
				Benzo(e)pyrene	2021/09/21		104	%	50 - 130
				Chrysene	2021/09/21		106	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/21		101	%	50 - 130
				Fluoranthene	2021/09/21		112	%	50 - 130
				Fluorene	2021/09/21		104	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/21		95	%	50 - 130
				2-Methylnaphthalene	2021/09/21		90	%	50 - 130
				Naphthalene	2021/09/21		92	%	50 - 130
				Phenanthrene	2021/09/21		104	%	50 - 130
				Perylene	2021/09/21		106	%	50 - 130
				Pyrene	2021/09/21		111	%	50 - 130
				Quinoline	2021/09/21		117	%	50 - 130
				C1-Naphthalene	2021/09/21		90	%	50 - 130
				C3-Naphthalene	2021/09/21		98	%	50 - 130
				C2-Naphthalene	2021/09/21		92	%	50 - 130
				C1-biphenyl	2021/09/21		86	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/21		126	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/21		112	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/21		108	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/21		48	%	30 - 130
				1-Methylnaphthalene	2021/09/21		90	%	50 - 130
A355317	JU2	Spiked Blank		D10-ANTHRACENE (sur.)	2021/09/21		99	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/21		81	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/21		72	%	50 - 130





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				TERPHENYL-D14 (sur.)	2021/09/21		101	%	50 - 130
				Acenaphthene	2021/09/21		91	%	50 - 130
				Acenaphthylene	2021/09/21		86	%	50 - 130
				Acridine	2021/09/21		81	%	50 - 130
				Anthracene	2021/09/21		82	%	50 - 130
				Benzo(a)anthracene	2021/09/21		103	%	50 - 130
				Benzo(b&j)fluoranthene	2021/09/21		104	%	50 - 130
				Benzo(k)fluoranthene	2021/09/21		108	%	50 - 130
				Benzo(g,h,i)perylene	2021/09/21		101	%	50 - 130
				Benzo(c)phenanthrene	2021/09/21		103	%	50 - 130
				Benzo(a)pyrene	2021/09/21		97	%	50 - 130
				Benzo(e)pyrene	2021/09/21		104	%	50 - 130
				Chrysene	2021/09/21		105	%	50 - 130
				Dibenz(a,h)anthracene	2021/09/21		101	%	50 - 130
				Fluoranthene	2021/09/21		108	%	50 - 130
				Fluorene	2021/09/21		90	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/09/21		98	%	50 - 130
				2-Methylnaphthalene	2021/09/21		84	%	50 - 130
				Naphthalene	2021/09/21		79	%	50 - 130
				Phenanthrene	2021/09/21		99	%	50 - 130
				Perylene	2021/09/21		108	%	50 - 130
				Pyrene	2021/09/21		107	%	50 - 130
				Quinoline	2021/09/21		113	%	50 - 130
				C1-Naphthalene	2021/09/21		77	%	50 - 130
				C3-Naphthalene	2021/09/21		85	%	50 - 130
				C2-Naphthalene	2021/09/21		80	%	50 - 130
				C1-biphenyl	2021/09/21		75	%	50 - 130
				C1 phenanthrene/anthracene	2021/09/21		109	%	50 - 130
				C2 phenanthrene/anthracene	2021/09/21		110	%	50 - 130
				C1 fluoranthene/pyrene	2021/09/21		105	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/09/21		56	%	30 - 130
				1-Methylnaphthalene	2021/09/21		77	%	50 - 130
A355317	JU2		Method Blank	D10-ANTHRACENE (sur.)	2021/09/21		100	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/09/21		85	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/09/21		72	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/09/21		99	%	50 - 130
				Acenaphthene	2021/09/21	<0.10		ug/L	
				Acenaphthylene	2021/09/21	<0.10		ug/L	
				Acridine	2021/09/21	<0.040		ug/L	
				Anthracene	2021/09/21	<0.010		ug/L	
				Benzo(a)anthracene	2021/09/21	<0.0085		ug/L	
				Benzo(b&j)fluoranthene	2021/09/21	<0.0085		ug/L	
				Benzo(k)fluoranthene	2021/09/21	<0.0085		ug/L	
				Benzo(g,h,i)perylene	2021/09/21	<0.0085		ug/L	
				Benzo(c)phenanthrene	2021/09/21	<0.050		ug/L	
				Benzo(a)pyrene	2021/09/21	<0.0075		ug/L	
				Benzo(e)pyrene	2021/09/21	<0.050		ug/L	
				Chrysene	2021/09/21	<0.0085		ug/L	
				Dibenz(a,h)anthracene	2021/09/21	<0.0075		ug/L	
				Fluoranthene	2021/09/21	<0.010		ug/L	
				Fluorene	2021/09/21	<0.050		ug/L	
				Indeno(1,2,3-cd)pyrene	2021/09/21	<0.0085		ug/L	
				Indeno(1,2,3-cd)fluoranthene	2021/09/21	<0.0085		ug/L	
				2-Methylnaphthalene	2021/09/21	<0.10		ug/L	
				Naphthalene	2021/09/21	<0.10		ug/L	





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HATFIELD CONSULTANTS  
Client Project #: SYNCRUDE MESOCOSM EXPERIMENT

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A355317	JU2	RPD		Phenanthrene	2021/09/21	<0.050		ug/L	
				Perylene	2021/09/21	<0.050		ug/L	
				Pyrene	2021/09/21	<0.020		ug/L	
				Quinoline	2021/09/21	<0.20		ug/L	
				Retene	2021/09/21	<0.050		ug/L	
				C1-Naphthalene	2021/09/21	<0.10		ug/L	
				C3-Naphthalene	2021/09/21	<0.10		ug/L	
				C4-Naphthalene	2021/09/21	<0.10		ug/L	
				C2-Naphthalene	2021/09/21	<0.10		ug/L	
				Biphenyl	2021/09/21	<0.020		ug/L	
				C1-biphenyl	2021/09/21	<0.020		ug/L	
				C2-biphenyl	2021/09/21	<0.020		ug/L	
				C1-fluorene	2021/09/21	<0.050		ug/L	
				C2-fluorene	2021/09/21	<0.050		ug/L	
				C3-fluorene	2021/09/21	<0.050		ug/L	
				Dibenzothiophene	2021/09/21	<0.020		ug/L	
				C1-dibenzothiophene	2021/09/21	<0.020		ug/L	
				C2-dibenzothiophene	2021/09/21	<0.020		ug/L	
				C3-dibenzothiophene	2021/09/21	<0.020		ug/L	
				C4-dibenzothiophene	2021/09/21	<0.020		ug/L	
				C1 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
				C2 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
				C3 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
				C4 phenanthrene/anthracene	2021/09/21	<0.050		ug/L	
				C1 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
				C2 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
				C3 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
				C4 fluoranthene/pyrene	2021/09/21	<0.020		ug/L	
				C1 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
				C2 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
				C3 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
				C4 benzo(a)anthracene/chrysene	2021/09/21	<0.0085		ug/L	
				C1benzobjkfluoranthene/benzoapyrene	2021/09/21	<0.0075		ug/L	
				C2benzobjkfluoranthene/benzoapyrene	2021/09/21	<0.0075		ug/L	
				C1-Acenaphthene	2021/09/21	<0.10		ug/L	
				1-Methylnaphthalene	2021/09/21	<0.10		ug/L	
				Acenaphthene	2021/09/21	NC		%	30
				Acenaphthylene	2021/09/21	NC		%	30
				Acridine	2021/09/21	NC		%	30
				Anthracene	2021/09/21	NC		%	30
				Benzo(a)anthracene	2021/09/21	NC		%	30
				Benzo(b&j)fluoranthene	2021/09/21	3.5		%	30
				Benzo(k)fluoranthene	2021/09/21	NC		%	30
				Benzo(g,h,i)perylene	2021/09/21	NC		%	30
				Benzo(c)phenanthrene	2021/09/21	NC		%	30
				Benzo(a)pyrene	2021/09/21	NC		%	30
				Benzo(e)pyrene	2021/09/21	NC		%	30
				Chrysene	2021/09/21	NC		%	30
				Dibenz(a,h)anthracene	2021/09/21	NC		%	30
				Fluoranthene	2021/09/21	NC		%	30
				Fluorene	2021/09/21	NC		%	30
				Indeno(1,2,3-cd)pyrene	2021/09/21	NC		%	30
				Indeno(1,2,3-cd)fluoranthene	2021/09/21	NC		%	30
				2-Methylnaphthalene	2021/09/21	NC		%	30
				Naphthalene	2021/09/21	NC		%	30





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Phenanthrene	2021/09/21	NC		%	30
				Perylene	2021/09/21	NC		%	30
				Pyrene	2021/09/21	NC		%	30
				Quinoline	2021/09/21	NC		%	30
				Retene	2021/09/21	NC		%	30
				C1-Naphthalene	2021/09/21	NC		%	30
				C3-Naphthalene	2021/09/21	2.7		%	30
				C4-Naphthalene	2021/09/21	NC		%	30
				C2-Naphthalene	2021/09/21	NC		%	30
				Biphenyl	2021/09/21	NC		%	30
				C1-biphenyl	2021/09/21	NC		%	30
				C2-biphenyl	2021/09/21	NC		%	30
				C1-fluorene	2021/09/21	NC		%	30
				C2-fluorene	2021/09/21	NC		%	30
				C3-fluorene	2021/09/21	2.5		%	30
				Dibenzothiophene	2021/09/21	NC		%	30
				C1-dibenzothiophene	2021/09/21	14		%	30
				C2-dibenzothiophene	2021/09/21	6.9		%	30
				C3-dibenzothiophene	2021/09/21	7.4		%	30
				C4-dibenzothiophene	2021/09/21	NC		%	30
				C1 phenanthrene/anthracene	2021/09/21	0.90		%	30
				C2 phenanthrene/anthracene	2021/09/21	NC		%	30
				C3 phenanthrene/anthracene	2021/09/21	NC		%	30
				C4 phenanthrene/anthracene	2021/09/21	NC		%	30
				C1 fluoranthene/pyrene	2021/09/21	NC		%	30
				C2 fluoranthene/pyrene	2021/09/21	NC		%	30
				C3 fluoranthene/pyrene	2021/09/21	NC		%	30
				C4 fluoranthene/pyrene	2021/09/21	NC		%	30
				C1 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
				C2 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
				C3 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
				C4 benzo(a)anthracene/chrysene	2021/09/21	NC		%	30
				C1benzobjkfluoranthene/benzoapyrene	2021/09/21	NC		%	30
				C2benzobjkfluoranthene/benzoapyrene	2021/09/21	NC		%	30
				C1-Acenaphthene	2021/09/21	NC		%	30
				1-Methylnaphthalene	2021/09/21	NC		%	30
A355696	FM0		Matrix Spike	Total Nitrogen (N)	2021/09/18		NC	%	80 - 120
A355696	FM0		QC Standard	Total Nitrogen (N)	2021/09/18		99	%	80 - 120
A355696	FM0		Spiked Blank	Total Nitrogen (N)	2021/09/18		113	%	80 - 120
A355696	FM0		Method Blank	Total Nitrogen (N)	2021/09/18	<0.020		mg/L	
A355696	FM0		RPD	Total Nitrogen (N)	2021/09/18	0.54		%	20
A355978	BYM		Matrix Spike	Chemical Oxygen Demand	2021/09/17		101	%	80 - 120
A355978	BYM		Spiked Blank	Chemical Oxygen Demand	2021/09/17		101	%	80 - 120
A355978	BYM		Method Blank	Chemical Oxygen Demand	2021/09/17	<10		mg/L	
A355978	BYM		RPD	Chemical Oxygen Demand	2021/09/17	3.0		%	20
A356192	TMU		Matrix Spike [AFY387-02]	Total Inorganic Carbon (C)	2021/09/17		98	%	80 - 120
A356192	TMU		Spiked Blank	Total Inorganic Carbon (C)	2021/09/17		103	%	80 - 120
A356192	TMU		Method Blank	Total Inorganic Carbon (C)	2021/09/17	<1.0		mg/L	
A356192	TMU		RPD [AFY387-02]	Total Inorganic Carbon (C)	2021/09/17	1.8		%	20
A356203	FM0		Matrix Spike [AFY382-06]	Total Nitrogen (N)	2021/09/18		NC	%	80 - 120
A356203	FM0		QC Standard	Total Nitrogen (N)	2021/09/18		98	%	80 - 120
A356203	FM0		Spiked Blank	Total Nitrogen (N)	2021/09/18		112	%	80 - 120
A356203	FM0		Method Blank	Total Nitrogen (N)	2021/09/18	<0.020		mg/L	
A356203	FM0		RPD [AFY382-06]	Total Nitrogen (N)	2021/09/18	0.12		%	20
A356227	JFH		Matrix Spike	Total Ammonia (N)	2021/09/17		93	%	80 - 120





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### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
	A356227	JFH	Spiked Blank	Total Ammonia (N)	2021/09/17		101	%	80 - 120
	A356227	JFH	Method Blank	Total Ammonia (N)	2021/09/17	<0.015		mg/L	
	A356227	JFH	RPD	Total Ammonia (N)	2021/09/17	3.3		%	20
	A356325	FM0	Matrix Spike	Total Nitrogen (N)	2021/09/18		101	%	80 - 120
	A356325	FM0	QC Standard	Total Nitrogen (N)	2021/09/18		98	%	80 - 120
	A356325	FM0	Spiked Blank	Total Nitrogen (N)	2021/09/18		109	%	80 - 120
	A356325	FM0	Method Blank	Total Nitrogen (N)	2021/09/18	<0.020		mg/L	
	A356325	FM0	RPD	Total Nitrogen (N)	2021/09/18	6.9		%	20
	A356385	BYM	Matrix Spike [AFY382-06]	Chemical Oxygen Demand	2021/09/17		100	%	80 - 120
	A356385	BYM	Spiked Blank	Chemical Oxygen Demand	2021/09/17		101	%	80 - 120
	A356385	BYM	Method Blank	Chemical Oxygen Demand	2021/09/17	<10		mg/L	
	A356385	BYM	RPD [AFY382-06]	Chemical Oxygen Demand	2021/09/17	2.1		%	20
	A357284	ANE	Matrix Spike [AFY434-13]	Dissolved Aluminum (Al)	2021/09/24		92	%	80 - 120
				Dissolved Antimony (Sb)	2021/09/24		97	%	80 - 120
				Dissolved Arsenic (As)	2021/09/24		88	%	80 - 120
				Dissolved Barium (Ba)	2021/09/24		85	%	80 - 120
				Dissolved Beryllium (Be)	2021/09/24		107	%	80 - 120
				Dissolved Bismuth (Bi)	2021/09/24		91	%	80 - 120
				Dissolved Boron (B)	2021/09/24		130 (1)	%	80 - 120
				Dissolved Cadmium (Cd)	2021/09/24		85	%	80 - 120
				Dissolved Chromium (Cr)	2021/09/24		90	%	80 - 120
				Dissolved Cobalt (Co)	2021/09/24		87	%	80 - 120
				Dissolved Copper (Cu)	2021/09/24		91	%	80 - 120
				Dissolved Iron (Fe)	2021/09/24		105	%	80 - 120
				Dissolved Lead (Pb)	2021/09/24		92	%	80 - 120
				Dissolved Lithium (Li)	2021/09/24		103	%	80 - 120
				Dissolved Manganese (Mn)	2021/09/24		88	%	80 - 120
				Dissolved Molybdenum (Mo)	2021/09/24		87	%	80 - 120
				Dissolved Nickel (Ni)	2021/09/24		88	%	80 - 120
				Dissolved Selenium (Se)	2021/09/24		101	%	80 - 120
				Dissolved Silicon (Si)	2021/09/24		76 (1)	%	80 - 120
				Dissolved Silver (Ag)	2021/09/24		85	%	80 - 120
				Dissolved Strontium (Sr)	2021/09/24		NC	%	80 - 120
				Dissolved Thallium (Tl)	2021/09/24		89	%	80 - 120
				Dissolved Tin (Sn)	2021/09/24		101	%	80 - 120
				Dissolved Titanium (Ti)	2021/09/24		89	%	80 - 120
				Dissolved Uranium (U)	2021/09/24		99	%	80 - 120
				Dissolved Vanadium (V)	2021/09/24		90	%	80 - 120
				Dissolved Zinc (Zn)	2021/09/24		100	%	80 - 120
				Dissolved Zirconium (Zr)	2021/09/24		96	%	80 - 120
	A357284	ANE	Spiked Blank	Dissolved Aluminum (Al)	2021/09/24		88	%	80 - 120
				Dissolved Antimony (Sb)	2021/09/24		96	%	80 - 120
				Dissolved Arsenic (As)	2021/09/24		89	%	80 - 120
				Dissolved Barium (Ba)	2021/09/24		85	%	80 - 120
				Dissolved Beryllium (Be)	2021/09/24		107	%	80 - 120
				Dissolved Bismuth (Bi)	2021/09/24		90	%	80 - 120
				Dissolved Boron (B)	2021/09/24		116	%	80 - 120
				Dissolved Cadmium (Cd)	2021/09/24		86	%	80 - 120
				Dissolved Chromium (Cr)	2021/09/24		89	%	80 - 120
				Dissolved Cobalt (Co)	2021/09/24		87	%	80 - 120
				Dissolved Copper (Cu)	2021/09/24		91	%	80 - 120
				Dissolved Iron (Fe)	2021/09/24		107	%	80 - 120
				Dissolved Lead (Pb)	2021/09/24		92	%	80 - 120
				Dissolved Lithium (Li)	2021/09/24		100	%	80 - 120
				Dissolved Manganese (Mn)	2021/09/24		88	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A357284	ANE	Method Blank	Dissolved Molybdenum (Mo)	2021/09/24		86	%	80 - 120	
			Dissolved Nickel (Ni)	2021/09/24		89	%	80 - 120	
			Dissolved Selenium (Se)	2021/09/24		102	%	80 - 120	
			Dissolved Silicon (Si)	2021/09/24		72 (1)	%	80 - 120	
			Dissolved Silver (Ag)	2021/09/24		85	%	80 - 120	
			Dissolved Strontium (Sr)	2021/09/24		81	%	80 - 120	
			Dissolved Thallium (Tl)	2021/09/24		89	%	80 - 120	
			Dissolved Tin (Sn)	2021/09/24		107	%	80 - 120	
			Dissolved Titanium (Ti)	2021/09/24		90	%	80 - 120	
			Dissolved Uranium (U)	2021/09/24		96	%	80 - 120	
			Dissolved Vanadium (V)	2021/09/24		89	%	80 - 120	
			Dissolved Zinc (Zn)	2021/09/24		103	%	80 - 120	
			Dissolved Zirconium (Zr)	2021/09/24		125 (1)	%	80 - 120	
			Dissolved Aluminum (Al)	2021/09/28		0.94, RDL=0.50 (2)		ug/L	
			Dissolved Antimony (Sb)	2021/09/28		<0.020		ug/L	
			Dissolved Arsenic (As)	2021/09/28		<0.020		ug/L	
			Dissolved Barium (Ba)	2021/09/28		<0.020		ug/L	
			Dissolved Beryllium (Be)	2021/09/28		<0.010		ug/L	
			Dissolved Bismuth (Bi)	2021/09/28		<0.0050		ug/L	
			Dissolved Boron (B)	2021/09/28		<10		ug/L	
			Dissolved Cadmium (Cd)	2021/09/28		<0.0050		ug/L	
			Dissolved Chromium (Cr)	2021/09/28		0.10, RDL=0.10 (2)		ug/L	
			Dissolved Cobalt (Co)	2021/09/28		<0.0050		ug/L	
			Dissolved Copper (Cu)	2021/09/28		<0.050		ug/L	
			Dissolved Iron (Fe)	2021/09/28		<1.0		ug/L	
			Dissolved Lead (Pb)	2021/09/28		<0.0050		ug/L	
			Dissolved Lithium (Li)	2021/09/28		<0.50		ug/L	
			Dissolved Manganese (Mn)	2021/09/28		<0.050		ug/L	
			Dissolved Molybdenum (Mo)	2021/09/28		<0.050		ug/L	
			Dissolved Nickel (Ni)	2021/09/28		<0.020		ug/L	
			Dissolved Selenium (Se)	2021/09/28		<0.040		ug/L	
			Dissolved Silicon (Si)	2021/09/28		<50		ug/L	
			Dissolved Silver (Ag)	2021/09/28		<0.0050		ug/L	
			Dissolved Strontium (Sr)	2021/09/28		<0.050		ug/L	
			Dissolved Thallium (Tl)	2021/09/28		<0.0020		ug/L	
			Dissolved Tin (Sn)	2021/09/28		0.24, RDL=0.20 (2)		ug/L	
			Dissolved Titanium (Ti)	2021/09/28		<0.50		ug/L	
			Dissolved Uranium (U)	2021/09/28		<0.0020		ug/L	
			Dissolved Vanadium (V)	2021/09/28		<0.20		ug/L	
			Dissolved Zinc (Zn)	2021/09/28		<0.10		ug/L	
			Dissolved Zirconium (Zr)	2021/09/28		<0.10		ug/L	
A357284	ANE	RPD [AFY434-13]	Dissolved Aluminum (Al)	2021/09/24		6.8	%	20	
			Dissolved Antimony (Sb)	2021/09/24		16	%	20	
			Dissolved Arsenic (As)	2021/09/24		0.58	%	20	
			Dissolved Barium (Ba)	2021/09/24		2.2	%	20	
			Dissolved Beryllium (Be)	2021/09/24		NC	%	20	
			Dissolved Bismuth (Bi)	2021/09/24		NC	%	20	
			Dissolved Cadmium (Cd)	2021/09/24		NC	%	20	
			Dissolved Chromium (Cr)	2021/09/24		1.7	%	20	
			Dissolved Cobalt (Co)	2021/09/24		4.1	%	20	
			Dissolved Copper (Cu)	2021/09/24		1.4	%	20	
			Dissolved Iron (Fe)	2021/09/24		2.6	%	20	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A357290	PC5	Matrix Spike	Dissolved Lead (Pb)	2021/09/24	1.1			%	20
			Dissolved Lithium (Li)	2021/09/24	8.2			%	20
			Dissolved Manganese (Mn)	2021/09/24	5.5			%	20
			Dissolved Nickel (Ni)	2021/09/24	3.7			%	20
			Dissolved Selenium (Se)	2021/09/24	12			%	20
			Dissolved Silicon (Si)	2021/09/24	1.1			%	20
			Dissolved Silver (Ag)	2021/09/24	NC			%	20
			Dissolved Strontium (Sr)	2021/09/24	2.5			%	20
			Dissolved Thallium (Tl)	2021/09/24	5.3			%	20
			Dissolved Tin (Sn)	2021/09/24	NC			%	20
			Dissolved Titanium (Ti)	2021/09/24	6.4			%	20
			Dissolved Uranium (U)	2021/09/24	10			%	20
			Dissolved Zirconium (Zr)	2021/09/24	NC			%	20
			Total Aluminum (Al)	2021/09/19			100	%	80 - 120
			Total Antimony (Sb)	2021/09/19			105	%	80 - 120
			Total Arsenic (As)	2021/09/19			86	%	80 - 120
			Total Barium (Ba)	2021/09/19			NC	%	80 - 120
			Total Beryllium (Be)	2021/09/19			99	%	80 - 120
			Total Bismuth (Bi)	2021/09/19			86	%	80 - 120
			Total Boron (B)	2021/09/19			123 (1)	%	80 - 120
			Total Cadmium (Cd)	2021/09/19			86	%	80 - 120
			Total Chromium (Cr)	2021/09/19			94	%	80 - 120
			Total Cobalt (Co)	2021/09/19			89	%	80 - 120
			Total Copper (Cu)	2021/09/19			78 (1)	%	80 - 120
			Total Iron (Fe)	2021/09/19			95	%	80 - 120
			Total Lead (Pb)	2021/09/19			92	%	80 - 120
			Total Lithium (Li)	2021/09/19			118	%	80 - 120
			Total Manganese (Mn)	2021/09/19			NC	%	80 - 120
			Total Molybdenum (Mo)	2021/09/19			NC	%	80 - 120
			Total Nickel (Ni)	2021/09/19			86	%	80 - 120
			Total Selenium (Se)	2021/09/19			107	%	80 - 120
			Total Silicon (Si)	2021/09/19			74 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/19			83	%	80 - 120
			Total Strontium (Sr)	2021/09/19			NC	%	80 - 120
			Total Thallium (Tl)	2021/09/19			91	%	80 - 120
			Total Tin (Sn)	2021/09/19			101	%	80 - 120
			Total Titanium (Ti)	2021/09/19			87	%	80 - 120
			Total Uranium (U)	2021/09/19			108	%	80 - 120
			Total Vanadium (V)	2021/09/19			95	%	80 - 120
			Total Zinc (Zn)	2021/09/19			84	%	80 - 120
			Total Zirconium (Zr)	2021/09/19			80	%	80 - 120
A357290	PC5	Spiked Blank	Total Aluminum (Al)	2021/09/19			103	%	80 - 120
			Total Antimony (Sb)	2021/09/19			109	%	80 - 120
			Total Arsenic (As)	2021/09/19			84	%	80 - 120
			Total Barium (Ba)	2021/09/19			88	%	80 - 120
			Total Beryllium (Be)	2021/09/19			103	%	80 - 120
			Total Bismuth (Bi)	2021/09/19			95	%	80 - 120
			Total Boron (B)	2021/09/19			124 (1)	%	80 - 120
			Total Cadmium (Cd)	2021/09/19			91	%	80 - 120
			Total Chromium (Cr)	2021/09/19			101	%	80 - 120
			Total Cobalt (Co)	2021/09/19			96	%	80 - 120
			Total Copper (Cu)	2021/09/19			82	%	80 - 120
			Total Iron (Fe)	2021/09/19			105	%	80 - 120
			Total Lead (Pb)	2021/09/19			96	%	80 - 120
			Total Lithium (Li)	2021/09/19			125 (1)	%	80 - 120





BV Labs Job #: C168465  
Report Date: 2021/10/14

HATFIELD CONSULTANTS  
Client Project #: SYNCRUDE MESOCOSM EXPERIMENT

### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A357290	PC5	Method Blank		Total Manganese (Mn)	2021/09/19		104	%	80 - 120
				Total Molybdenum (Mo)	2021/09/19		87	%	80 - 120
				Total Nickel (Ni)	2021/09/19		95	%	80 - 120
				Total Selenium (Se)	2021/09/19		107	%	80 - 120
				Total Silicon (Si)	2021/09/19		73 (1)	%	80 - 120
				Total Silver (Ag)	2021/09/19		88	%	80 - 120
				Total Strontium (Sr)	2021/09/19		83	%	80 - 120
				Total Thallium (Tl)	2021/09/19		94	%	80 - 120
				Total Tin (Sn)	2021/09/19		102	%	80 - 120
				Total Titanium (Ti)	2021/09/19		91	%	80 - 120
				Total Uranium (U)	2021/09/19		108	%	80 - 120
				Total Vanadium (V)	2021/09/19		100	%	80 - 120
				Total Zinc (Zn)	2021/09/19		107	%	80 - 120
				Total Zirconium (Zr)	2021/09/19		98	%	80 - 120
				Total Aluminum (Al)	2021/09/19	<0.50		ug/L	
				Total Antimony (Sb)	2021/09/19	<0.020		ug/L	
				Total Arsenic (As)	2021/09/19	<0.020		ug/L	
				Total Barium (Ba)	2021/09/19	<0.020		ug/L	
				Total Beryllium (Be)	2021/09/19	<0.010		ug/L	
				Total Bismuth (Bi)	2021/09/19	<0.0050		ug/L	
				Total Boron (B)	2021/09/19	<10		ug/L	
				Total Cadmium (Cd)	2021/09/19	<0.0050		ug/L	
				Total Chromium (Cr)	2021/09/19	<0.10		ug/L	
				Total Cobalt (Co)	2021/09/19	<0.0050		ug/L	
				Total Copper (Cu)	2021/09/19	<0.050		ug/L	
				Total Iron (Fe)	2021/09/19	<1.0		ug/L	
				Total Lead (Pb)	2021/09/19	<0.0050		ug/L	
				Total Lithium (Li)	2021/09/19	<0.50		ug/L	
				Total Manganese (Mn)	2021/09/19	<0.050		ug/L	
				Total Molybdenum (Mo)	2021/09/19	<0.050		ug/L	
				Total Nickel (Ni)	2021/09/19	<0.020		ug/L	
				Total Selenium (Se)	2021/09/19	<0.040		ug/L	
				Total Silicon (Si)	2021/09/19	<50		ug/L	
				Total Silver (Ag)	2021/09/19	<0.0050		ug/L	
				Total Strontium (Sr)	2021/09/19	<0.050		ug/L	
				Total Thallium (Tl)	2021/09/19	<0.0020		ug/L	
				Total Tin (Sn)	2021/09/19	<0.20		ug/L	
				Total Titanium (Ti)	2021/09/19	<0.50		ug/L	
				Total Uranium (U)	2021/09/19	<0.0020		ug/L	
				Total Vanadium (V)	2021/09/19	<0.20		ug/L	
				Total Zinc (Zn)	2021/09/19	0.29, RDL=0.10 (3)		ug/L	
A357290	PC5	RPD		Total Zirconium (Zr)	2021/09/19	<0.10		ug/L	
				Total Arsenic (As)	2021/09/19	2.0		%	20
				Total Boron (B)	2021/09/19	3.0		%	20
				Total Cadmium (Cd)	2021/09/19	NC		%	20
				Total Chromium (Cr)	2021/09/19	2.3		%	20
				Total Cobalt (Co)	2021/09/19	2.8		%	20
				Total Copper (Cu)	2021/09/19	0.67		%	20
				Total Lead (Pb)	2021/09/19	2.1		%	20
				Total Molybdenum (Mo)	2021/09/19	1.2		%	20
				Total Selenium (Se)	2021/09/19	0.52		%	20
				Total Vanadium (V)	2021/09/19	0.97		%	20
A357870	KGR	Spiked Blank		Total Zinc (Zn)	2021/09/19	38 (1)		%	20
				Conductivity	2021/09/19		101	%	90 - 110





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A357870	KGR	Method Blank	Conductivity	2021/09/19	<2.0		uS/cm	
A357870	KGR	RPD [AFY391-02]	Conductivity	2021/09/19	NC		%	10
A357871	KGR	Spiked Blank	pH	2021/09/19		100	%	97 - 103
A357871	KGR	RPD [AFY391-02]	pH	2021/09/19	0.12		%	N/A
A357872	KGR	Matrix Spike [AFY391-02]	Dissolved Fluoride (F)	2021/09/19		95	%	80 - 120
A357872	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/09/19		90	%	80 - 120
A357872	KGR	Method Blank	Dissolved Fluoride (F)	2021/09/19	<0.050		mg/L	
A357872	KGR	RPD [AFY391-02]	Dissolved Fluoride (F)	2021/09/19	NC		%	20
A357873	KGR	Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/19		97	%	80 - 120
A357873	KGR	Method Blank	Alkalinity (PP as CaCO3)	2021/09/19	<1.0		mg/L	
			Alkalinity (Total as CaCO3)	2021/09/19	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/09/19	<1.0		mg/L	
			Carbonate (CO3)	2021/09/19	<1.0		mg/L	
			Hydroxide (OH)	2021/09/19	<1.0		mg/L	
A357873	KGR	RPD [AFY391-02]	Alkalinity (PP as CaCO3)	2021/09/19	NC		%	20
			Alkalinity (Total as CaCO3)	2021/09/19	NC		%	20
			Bicarbonate (HCO3)	2021/09/19	NC		%	20
			Carbonate (CO3)	2021/09/19	NC		%	20
			Hydroxide (OH)	2021/09/19	NC		%	20
A358075	STI	Matrix Spike [AFY391-06]	Total Nitrogen (N)	2021/09/20		100	%	80 - 120
A358075	STI	QC Standard	Total Nitrogen (N)	2021/09/20		86	%	80 - 120
A358075	STI	Spiked Blank	Total Nitrogen (N)	2021/09/20		107	%	80 - 120
A358075	STI	Method Blank	Total Nitrogen (N)	2021/09/20	<0.020		mg/L	
A358075	STI	RPD [AFY391-06]	Total Nitrogen (N)	2021/09/20	NC		%	20
A359352	LT	Matrix Spike [AFY383-01]	Total Dissolved Solids	2021/09/22		NC	%	80 - 120
A359352	LT	Spiked Blank	Total Dissolved Solids	2021/09/22		98	%	80 - 120
A359352	LT	Method Blank	Total Dissolved Solids	2021/09/22	<10		mg/L	
A359352	LT	RPD [AFY382-01]	Total Dissolved Solids	2021/09/22	0.42		%	20
A359364	LT	Matrix Spike	Total Suspended Solids	2021/09/22		108	%	80 - 120
A359364	LT	Spiked Blank	Total Suspended Solids	2021/09/22		94	%	80 - 120
A359364	LT	Method Blank	Total Suspended Solids	2021/09/22	<1.0		mg/L	
A359364	LT	RPD	Total Suspended Solids	2021/09/22	NC		%	20
A359510	ANE	Matrix Spike	Total Aluminum (Al)	2021/09/21		103	%	80 - 120
			Total Antimony (Sb)	2021/09/21		96	%	80 - 120
			Total Arsenic (As)	2021/09/21		99	%	80 - 120
			Total Barium (Ba)	2021/09/21		98	%	80 - 120
			Total Beryllium (Be)	2021/09/21		100	%	80 - 120
			Total Bismuth (Bi)	2021/09/21		101	%	80 - 120
			Total Boron (B)	2021/09/21		106	%	80 - 120
			Total Cadmium (Cd)	2021/09/21		95	%	80 - 120
			Total Chromium (Cr)	2021/09/21		111	%	80 - 120
			Total Cobalt (Co)	2021/09/21		109	%	80 - 120
			Total Copper (Cu)	2021/09/21		106	%	80 - 120
			Total Iron (Fe)	2021/09/21		103	%	80 - 120
			Total Lead (Pb)	2021/09/21		101	%	80 - 120
			Total Lithium (Li)	2021/09/21		105	%	80 - 120
			Total Manganese (Mn)	2021/09/21		NC	%	80 - 120
			Total Molybdenum (Mo)	2021/09/21		107	%	80 - 120
			Total Nickel (Ni)	2021/09/21		107	%	80 - 120
			Total Phosphorus (P)	2021/09/21		99	%	80 - 120
			Total Selenium (Se)	2021/09/21		89	%	80 - 120
			Total Silicon (Si)	2021/09/21		75 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/21		98	%	80 - 120
			Total Strontium (Sr)	2021/09/21		NC	%	80 - 120
			Total Thallium (Tl)	2021/09/21		99	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A359510	ANE	Spiked Blank	Total Tin (Sn)	2021/09/21		102	%	80 - 120
			Total Titanium (Ti)	2021/09/21		111	%	80 - 120
			Total Uranium (U)	2021/09/21		105	%	80 - 120
			Total Vanadium (V)	2021/09/21		110	%	80 - 120
			Total Zinc (Zn)	2021/09/21		88	%	80 - 120
			Total Zirconium (Zr)	2021/09/21		111	%	80 - 120
			Total Aluminum (Al)	2021/09/21		106	%	80 - 120
			Total Antimony (Sb)	2021/09/21		102	%	80 - 120
			Total Arsenic (As)	2021/09/21		104	%	80 - 120
			Total Barium (Ba)	2021/09/21		103	%	80 - 120
			Total Beryllium (Be)	2021/09/21		105	%	80 - 120
			Total Bismuth (Bi)	2021/09/21		108	%	80 - 120
			Total Boron (B)	2021/09/21		107	%	80 - 120
			Total Cadmium (Cd)	2021/09/21		101	%	80 - 120
			Total Chromium (Cr)	2021/09/21		114	%	80 - 120
			Total Cobalt (Co)	2021/09/21		113	%	80 - 120
			Total Copper (Cu)	2021/09/21		112	%	80 - 120
			Total Iron (Fe)	2021/09/21		108	%	80 - 120
			Total Lead (Pb)	2021/09/21		106	%	80 - 120
			Total Lithium (Li)	2021/09/21		109	%	80 - 120
			Total Manganese (Mn)	2021/09/21		112	%	80 - 120
			Total Molybdenum (Mo)	2021/09/21		110	%	80 - 120
			Total Nickel (Ni)	2021/09/21		114	%	80 - 120
			Total Phosphorus (P)	2021/09/21		101	%	80 - 120
			Total Selenium (Se)	2021/09/21		93	%	80 - 120
			Total Silicon (Si)	2021/09/21		76 (1)	%	80 - 120
			Total Silver (Ag)	2021/09/21		102	%	80 - 120
			Total Strontium (Sr)	2021/09/21		109	%	80 - 120
Total Thallium (Tl)	2021/09/21		104	%	80 - 120			
Total Tin (Sn)	2021/09/21		106	%	80 - 120			
Total Titanium (Ti)	2021/09/21		113	%	80 - 120			
Total Uranium (U)	2021/09/21		108	%	80 - 120			
Total Vanadium (V)	2021/09/21		115	%	80 - 120			
Total Zinc (Zn)	2021/09/21		105	%	80 - 120			
Total Zirconium (Zr)	2021/09/21		115	%	80 - 120			
A359510	ANE	Method Blank	Total Aluminum (Al)	2021/09/21	3.2, RDL=3.0 (4)		ug/L	
			Total Antimony (Sb)	2021/09/21	<0.020		ug/L	
			Total Arsenic (As)	2021/09/21	0.022, RDL=0.020 (4)		ug/L	
			Total Barium (Ba)	2021/09/21	0.068, RDL=0.050 (4)		ug/L	
			Total Beryllium (Be)	2021/09/21	<0.010		ug/L	
			Total Bismuth (Bi)	2021/09/21	<0.010		ug/L	
			Total Boron (B)	2021/09/21	<10		ug/L	
			Total Cadmium (Cd)	2021/09/21	<0.0050		ug/L	
			Total Chromium (Cr)	2021/09/21	0.17, RDL=0.10 (4)		ug/L	
			Total Cobalt (Co)	2021/09/21	<0.010		ug/L	
			Total Copper (Cu)	2021/09/21	<0.10		ug/L	
			Total Iron (Fe)	2021/09/21	<5.0		ug/L	
			Total Lead (Pb)	2021/09/21	<0.020		ug/L	
			Total Lithium (Li)	2021/09/21	<0.50		ug/L	
			Total Manganese (Mn)	2021/09/21	<0.10		ug/L	
			Total Molybdenum (Mo)	2021/09/21	<0.050		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A359510	ANE	RPD	Total Nickel (Ni)	2021/09/21	0.12, RDL=0.10 (4)		ug/L	
			Total Phosphorus (P)	2021/09/21	8.9, RDL=5.0 (4)		ug/L	
			Total Selenium (Se)	2021/09/21	<0.040		ug/L	
			Total Silicon (Si)	2021/09/21	<50		ug/L	
			Total Silver (Ag)	2021/09/21	<0.010		ug/L	
			Total Strontium (Sr)	2021/09/21	0.056, RDL=0.050 (4)		ug/L	
			Total Thallium (Tl)	2021/09/21	<0.0020		ug/L	
			Total Tin (Sn)	2021/09/21	<0.20		ug/L	
			Total Titanium (Ti)	2021/09/21	<2.0		ug/L	
			Total Uranium (U)	2021/09/21	<0.0050		ug/L	
			Total Vanadium (V)	2021/09/21	<0.20		ug/L	
			Total Zinc (Zn)	2021/09/21	<1.0		ug/L	
			Total Zirconium (Zr)	2021/09/21	<0.10		ug/L	
			Total Aluminum (Al)	2021/09/21	NC		%	20
			Total Antimony (Sb)	2021/09/21	NC		%	20
			Total Arsenic (As)	2021/09/21	4.3		%	20
			Total Barium (Ba)	2021/09/21	3.1		%	20
			Total Beryllium (Be)	2021/09/21	17		%	20
			Total Bismuth (Bi)	2021/09/21	NC		%	20
			Total Boron (B)	2021/09/21	2.4		%	20
			Total Cadmium (Cd)	2021/09/21	NC		%	20
			Total Chromium (Cr)	2021/09/21	NC		%	20
			Total Cobalt (Co)	2021/09/21	2.5		%	20
			Total Copper (Cu)	2021/09/21	4.1		%	20
			Total Iron (Fe)	2021/09/21	0.77		%	20
			Total Lead (Pb)	2021/09/21	11		%	20
			Total Lithium (Li)	2021/09/21	0.98		%	20
			Total Manganese (Mn)	2021/09/21	0.030		%	20
			Total Molybdenum (Mo)	2021/09/21	0.099		%	20
			Total Nickel (Ni)	2021/09/21	3.9		%	20
			Total Phosphorus (P)	2021/09/21	2.5		%	20
			Total Selenium (Se)	2021/09/21	NC		%	20
			Total Silicon (Si)	2021/09/21	3.2		%	20
			Total Silver (Ag)	2021/09/21	NC		%	20
			Total Strontium (Sr)	2021/09/21	0.57		%	20
			Total Thallium (Tl)	2021/09/21	NC		%	20
			Total Tin (Sn)	2021/09/21	2.0		%	20
			Total Titanium (Ti)	2021/09/21	NC		%	20
			Total Uranium (U)	2021/09/21	NC		%	20
			Total Vanadium (V)	2021/09/21	15		%	20
			Total Zinc (Zn)	2021/09/21	11		%	20
			Total Zirconium (Zr)	2021/09/21	NC		%	20
A361530	JAB	Matrix Spike	Dissolved Calcium (Ca)	2021/09/24		103	%	80 - 120
			Dissolved Iron (Fe)	2021/09/24		96	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/24		99	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/24		100	%	80 - 120
			Dissolved Potassium (K)	2021/09/24		98	%	80 - 120
A361530	JAB	Spiked Blank	Dissolved Sodium (Na)	2021/09/24		95	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/24		104	%	80 - 120
			Dissolved Iron (Fe)	2021/09/24		105	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/24		101	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/24		109	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A361530	JAB	Method Blank	Dissolved Potassium (K)	2021/09/24		100	%	80 - 120
			Dissolved Sodium (Na)	2021/09/24		96	%	80 - 120
			Dissolved Calcium (Ca)	2021/09/22	<0.30		mg/L	
			Dissolved Iron (Fe)	2021/09/22	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2021/09/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/09/22	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/09/22	<0.30		mg/L	
A361530	JAB	RPD	Dissolved Sodium (Na)	2021/09/22	<0.50		mg/L	
			Dissolved Calcium (Ca)	2021/09/24	1.8		%	20
			Dissolved Iron (Fe)	2021/09/24	NC		%	20
			Dissolved Magnesium (Mg)	2021/09/24	0.98		%	20
			Dissolved Manganese (Mn)	2021/09/24	0		%	20
			Dissolved Potassium (K)	2021/09/24	0.14		%	20
			Dissolved Sodium (Na)	2021/09/24	0.67		%	20
A362239	JLP	Matrix Spike [AFY391-16]	Total Mercury (Hg)	2021/09/24		100	%	70 - 130
A362239	JLP	Spiked Blank	Total Mercury (Hg)	2021/09/24		94	%	70 - 130
A362239	JLP	Method Blank	Total Mercury (Hg)	2021/09/24	<0.00010		ug/L	
A362239	JLP	RPD [AFY391-16]	Total Mercury (Hg)	2021/09/24	0.52		%	20
A364746	ZWU	Matrix Spike	Total Organic Carbon (C)	2021/09/25		102	%	80 - 120
A364746	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/09/25		87	%	80 - 120
A364746	ZWU	Method Blank	Total Organic Carbon (C)	2021/09/25	<0.50		mg/L	
A364746	ZWU	RPD	Total Organic Carbon (C)	2021/09/25	NC		%	20
A364749	ZWU	Matrix Spike [AFY383-06]	Total Organic Carbon (C)	2021/09/25		97	%	80 - 120
A364749	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/09/25		88	%	80 - 120
A364749	ZWU	Method Blank	Total Organic Carbon (C)	2021/09/25	<0.50		mg/L	
A364749	ZWU	RPD [AFY383-06]	Total Organic Carbon (C)	2021/09/25	8.6		%	20
A364758	ZWU	Matrix Spike	Total Organic Carbon (C)	2021/09/25		114	%	80 - 120
A364758	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/09/25		91	%	80 - 120
A364758	ZWU	Method Blank	Total Organic Carbon (C)	2021/09/25	<0.50		mg/L	
A364758	ZWU	RPD	Total Organic Carbon (C)	2021/09/25	NC		%	20
A364822	STI	Matrix Spike [AFY385-06]	Total Phosphorus (P)	2021/09/26		100	%	80 - 120
A364822	STI	QC Standard	Total Phosphorus (P)	2021/09/26		89	%	80 - 120
A364822	STI	Spiked Blank	Total Phosphorus (P)	2021/09/26		96	%	80 - 120
A364822	STI	Method Blank	Total Phosphorus (P)	2021/09/26	<0.0010		mg/L	
A364822	STI	RPD [AFY385-06]	Total Phosphorus (P)	2021/09/26	5.2		%	20
A364859	ZWU	Matrix Spike	Dissolved Organic Carbon (C)	2021/09/26		107	%	80 - 120
A364859	ZWU	Spiked Blank	Dissolved Organic Carbon (C)	2021/09/26		106	%	80 - 120
A364859	ZWU	Method Blank	Dissolved Organic Carbon (C)	2021/09/26	<0.50		mg/L	
A364859	ZWU	RPD	Dissolved Organic Carbon (C)	2021/09/26	4.2		%	20
A365270	YPA	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/09/26		102	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/09/26		102	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/09/26		105	%	50 - 140
			Bromodichloromethane	2021/09/26		99	%	50 - 140
			Bromoform	2021/09/26		128	%	50 - 140
			Bromomethane	2021/09/26		84	%	50 - 140
			Carbon tetrachloride	2021/09/26		92	%	50 - 140
			Chlorobenzene	2021/09/26		101	%	50 - 140
			Dibromochloromethane	2021/09/26		120	%	50 - 140
			Chloroethane	2021/09/26		73	%	50 - 140
			Chloroform	2021/09/26		96	%	50 - 140
			Chloromethane	2021/09/26		68	%	50 - 140
			1,2-dibromoethane	2021/09/26		117	%	50 - 140
			1,2-dichlorobenzene	2021/09/26		97	%	50 - 140
			1,3-dichlorobenzene	2021/09/26		94	%	50 - 140
			1,4-dichlorobenzene	2021/09/26		93	%	50 - 140





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QA/QC									
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits	
A365270	YPA	Spiked Blank	1,1-dichloroethane	2021/09/26		91	%	50 - 140	
			1,2-dichloroethane	2021/09/26		107	%	50 - 140	
			1,1-dichloroethene	2021/09/26		88	%	50 - 140	
			cis-1,2-dichloroethene	2021/09/26		99	%	50 - 140	
			trans-1,2-dichloroethene	2021/09/26		88	%	50 - 140	
			Dichloromethane	2021/09/26		96	%	50 - 140	
			1,2-dichloropropane	2021/09/26		98	%	50 - 140	
			cis-1,3-dichloropropene	2021/09/26		89	%	50 - 140	
			trans-1,3-dichloropropene	2021/09/26		117	%	50 - 140	
			Methyl methacrylate	2021/09/26		123	%	50 - 140	
			Methyl-tert-butylether (MTBE)	2021/09/26		99	%	50 - 140	
			Styrene	2021/09/26		98	%	50 - 140	
			1,1,1,2-tetrachloroethane	2021/09/26		104	%	50 - 140	
			1,1,2,2-tetrachloroethane	2021/09/26		122	%	50 - 140	
			Tetrachloroethene	2021/09/26		89	%	50 - 140	
			1,2,3-trichlorobenzene	2021/09/26		98	%	50 - 140	
			1,2,4-trichlorobenzene	2021/09/26		91	%	50 - 140	
			1,3,5-trichlorobenzene	2021/09/26		83	%	50 - 140	
			1,1,1-trichloroethane	2021/09/26		94	%	50 - 140	
			1,1,2-trichloroethane	2021/09/26		111	%	50 - 140	
			Trichloroethene	2021/09/26		94	%	50 - 140	
			Trichlorofluoromethane	2021/09/26		88	%	50 - 140	
			1,2,4-trimethylbenzene	2021/09/26		92	%	50 - 140	
			1,3,5-trimethylbenzene	2021/09/26		92	%	50 - 140	
			Vinyl chloride	2021/09/26		82	%	50 - 140	
			1,4-Difluorobenzene (sur.)	2021/09/26		102	%	50 - 140	
			4-Bromofluorobenzene (sur.)	2021/09/26		103	%	50 - 140	
			D4-1,2-Dichloroethane (sur.)	2021/09/26		98	%	50 - 140	
			Bromodichloromethane	2021/09/26		95	%	60 - 130	
			Bromoform	2021/09/26		119	%	60 - 130	
			Bromomethane	2021/09/26		79	%	60 - 130	
			Carbon tetrachloride	2021/09/26		93	%	60 - 130	
			Chlorobenzene	2021/09/26		101	%	60 - 130	
			Dibromochloromethane	2021/09/26		115	%	60 - 130	
			Chloroethane	2021/09/26		73	%	60 - 130	
			Chloroform	2021/09/26		94	%	60 - 130	
			Chloromethane	2021/09/26		67	%	60 - 130	
			1,2-dibromoethane	2021/09/26		107	%	60 - 130	
			1,2-dichlorobenzene	2021/09/26		96	%	60 - 130	
			1,3-dichlorobenzene	2021/09/26		94	%	60 - 130	
			1,4-dichlorobenzene	2021/09/26		92	%	60 - 130	
			1,1-dichloroethane	2021/09/26		89	%	60 - 130	
			1,2-dichloroethane	2021/09/26		99	%	60 - 130	
			1,1-dichloroethene	2021/09/26		89	%	60 - 130	
			cis-1,2-dichloroethene	2021/09/26		96	%	60 - 130	
			trans-1,2-dichloroethene	2021/09/26		87	%	60 - 130	
			Dichloromethane	2021/09/26		92	%	60 - 130	
			1,2-dichloropropane	2021/09/26		95	%	60 - 130	
			cis-1,3-dichloropropene	2021/09/26		80	%	60 - 130	
			trans-1,3-dichloropropene	2021/09/26		90	%	60 - 130	
			Methyl methacrylate	2021/09/26		110	%	60 - 130	
			Methyl-tert-butylether (MTBE)	2021/09/26		95	%	60 - 130	
			Styrene	2021/09/26		98	%	60 - 130	
			1,1,1,2-tetrachloroethane	2021/09/26		104	%	60 - 130	
			1,1,2,2-tetrachloroethane	2021/09/26		113	%	60 - 130	





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QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A365270	YPA	Method Blank		Tetrachloroethene	2021/09/26		91	%	60 - 130
				1,2,3-trichlorobenzene	2021/09/26		87	%	60 - 130
				1,2,4-trichlorobenzene	2021/09/26		85	%	60 - 130
				1,3,5-trichlorobenzene	2021/09/26		81	%	60 - 130
				1,1,1-trichloroethane	2021/09/26		94	%	60 - 130
				1,1,2-trichloroethane	2021/09/26		102	%	60 - 130
				Trichloroethene	2021/09/26		94	%	60 - 130
				Trichlorofluoromethane	2021/09/26		90	%	60 - 130
				1,2,4-trimethylbenzene	2021/09/26		91	%	60 - 130
				1,3,5-trimethylbenzene	2021/09/26		94	%	60 - 130
				Vinyl chloride	2021/09/26		83	%	60 - 130
				1,4-Difluorobenzene (sur.)	2021/09/26		102	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/09/26		97	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/09/26		101	%	50 - 140
				Bromodichloromethane	2021/09/26	<0.50		ug/L	
				Bromoform	2021/09/26	<0.50		ug/L	
				Bromomethane	2021/09/26	<2.0		ug/L	
				Carbon tetrachloride	2021/09/26	<0.50		ug/L	
				Chlorobenzene	2021/09/26	<0.50		ug/L	
				Dibromochloromethane	2021/09/26	<1.0		ug/L	
				Chloroethane	2021/09/26	<1.0		ug/L	
				Chloroform	2021/09/26	<0.50		ug/L	
				Chloromethane	2021/09/26	<2.0		ug/L	
				1,2-dibromoethane	2021/09/26	<0.20		ug/L	
				1,2-dichlorobenzene	2021/09/26	<0.50		ug/L	
				1,3-dichlorobenzene	2021/09/26	<0.50		ug/L	
				1,4-dichlorobenzene	2021/09/26	<0.50		ug/L	
				1,1-dichloroethane	2021/09/26	<0.50		ug/L	
				1,2-dichloroethane	2021/09/26	<0.50		ug/L	
				1,1-dichloroethene	2021/09/26	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/09/26	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/09/26	<0.50		ug/L	
				Dichloromethane	2021/09/26	<2.0		ug/L	
				1,2-dichloropropane	2021/09/26	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/09/26	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/09/26	<0.50		ug/L	
				Methyl methacrylate	2021/09/26	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/09/26	<0.50		ug/L	
				Styrene	2021/09/26	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/09/26	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/09/26	<2.0		ug/L	
				Tetrachloroethene	2021/09/26	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/09/26	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/09/26	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/09/26	<0.50		ug/L	
				1,1,1-trichloroethane	2021/09/26	<0.50		ug/L	
				1,1,2-trichloroethane	2021/09/26	<0.50		ug/L	
				Trichloroethene	2021/09/26	<0.50		ug/L	
				Trichlorofluoromethane	2021/09/26	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/09/26	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/09/26	<0.50		ug/L	
				Vinyl chloride	2021/09/26	<0.50		ug/L	
A365270	YPA	RPD		1,2-dibromoethane	2021/09/26	NC		%	30
				1,2-dichloroethane	2021/09/26	NC		%	30
A365824	STI	Matrix Spike [AFY383-07]		Dissolved Phosphorus (P)	2021/09/27		92	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A365824	STI	QC Standard	Dissolved Phosphorus (P)	2021/09/27		89	%	80 - 120
A365824	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/09/27		97	%	80 - 120
A365824	STI	Method Blank	Dissolved Phosphorus (P)	2021/09/27	<0.0010		mg/L	
A365824	STI	RPD [AFY383-07]	Dissolved Phosphorus (P)	2021/09/27	NC		%	20
A365830	STI	Matrix Spike	Total Phosphorus (P)	2021/09/26		97	%	80 - 120
A365830	STI	QC Standard	Total Phosphorus (P)	2021/09/26		80	%	80 - 120
A365830	STI	Spiked Blank	Total Phosphorus (P)	2021/09/26		89	%	80 - 120
A365830	STI	Method Blank	Total Phosphorus (P)	2021/09/26	<0.0010		mg/L	
A365830	STI	RPD	Total Phosphorus (P)	2021/09/26	NC		%	20
A366458	STI	Matrix Spike	Total Phosphorus (P)	2021/09/28		102	%	80 - 120
A366458	STI	QC Standard	Total Phosphorus (P)	2021/09/28		89	%	80 - 120
A366458	STI	Spiked Blank	Total Phosphorus (P)	2021/09/28		91	%	80 - 120
A366458	STI	Method Blank	Total Phosphorus (P)	2021/09/28	<0.0010		mg/L	
A366458	STI	RPD	Total Phosphorus (P)	2021/09/28	17		%	20
A366621	SJ1	Spiked Blank	2,3,4-trichlorophenol	2021/09/27		80	%	50 - 140
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/27		87	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/27		84	%	50 - 140
			Phenol	2021/09/27		44	%	30 - 130
			3 & 4-chlorophenol	2021/09/27		76	%	50 - 140
			2,3,5,6-tetrachlorophenol	2021/09/27		84	%	50 - 140
			2,3,4,6-tetrachlorophenol	2021/09/27		84	%	50 - 140
			2,4,5-trichlorophenol	2021/09/27		88	%	50 - 140
			2,4,6-trichlorophenol	2021/09/27		80	%	50 - 140
			2,3,5-trichlorophenol	2021/09/27		76	%	50 - 140
			2,4-dichlorophenol	2021/09/27		80	%	50 - 140
			2,4-dimethylphenol	2021/09/27		72	%	50 - 140
			2,4-dinitrophenol	2021/09/27		84	%	30 - 130
			2,6-dichlorophenol	2021/09/27		80	%	50 - 140
			2-chlorophenol	2021/09/27		72	%	50 - 140
			2-methylphenol	2021/09/27		64	%	50 - 140
			2-nitrophenol	2021/09/27		64	%	50 - 140
			3 & 4-methylphenol	2021/09/27		62	%	50 - 140
			4,6-dinitro-2-methylphenol	2021/09/27		80	%	30 - 130
			4-chloro-3-methylphenol	2021/09/27		76	%	50 - 140
			4-nitrophenol	2021/09/27		44 (1)	%	50 - 140
			Pentachlorophenol	2021/09/27		80	%	50 - 140
A366621	SJ1	Method Blank	2,3,4-trichlorophenol	2021/09/27	<0.00010		mg/L	
			2,4,6-TRIBROMOPHENOL (sur.)	2021/09/27		84	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/09/27		81	%	50 - 140
			Phenol	2021/09/27	<0.00010		mg/L	
			3 & 4-chlorophenol	2021/09/27	<0.00010		mg/L	
			2,3,5,6-tetrachlorophenol	2021/09/27	<0.00010		mg/L	
			2,3,4,6-tetrachlorophenol	2021/09/27	<0.00010		mg/L	
			2,4,5-trichlorophenol	2021/09/27	<0.00010		mg/L	
			2,4,6-trichlorophenol	2021/09/27	<0.00010		mg/L	
			2,3,5-trichlorophenol	2021/09/27	<0.00010		mg/L	
			2,4-dichlorophenol	2021/09/27	<0.00010		mg/L	
			2,4-dimethylphenol	2021/09/27	<0.00010		mg/L	
			2,4-dinitrophenol	2021/09/27	<0.0010		mg/L	
			2,6-dichlorophenol	2021/09/27	<0.00010		mg/L	
			2-chlorophenol	2021/09/27	<0.00010		mg/L	
			2-methylphenol	2021/09/27	<0.00010		mg/L	
			2-nitrophenol	2021/09/27	<0.0010		mg/L	
			3 & 4-methylphenol	2021/09/27	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/09/27	<0.0010		mg/L	





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			4-chloro-3-methylphenol	2021/09/27	<0.00010		mg/L	
			4-nitrophenol	2021/09/27	<0.0010		mg/L	
			Pentachlorophenol	2021/09/27	<0.00010		mg/L	
A366671	STI	Matrix Spike	Dissolved Phosphorus (P)	2021/09/27		96	%	80 - 120
A366671	STI	QC Standard	Dissolved Phosphorus (P)	2021/09/27		88	%	80 - 120
A366671	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/09/27		93	%	80 - 120
A366671	STI	Method Blank	Dissolved Phosphorus (P)	2021/09/27	0.0013, RDL=0.0010 (5)		mg/L	
A366671	STI	RPD	Dissolved Phosphorus (P)	2021/09/27	6.2		%	20
A366941	STI	Matrix Spike	Total Phosphorus (P)	2021/09/27		97	%	80 - 120
A366941	STI	QC Standard	Total Phosphorus (P)	2021/09/27		89	%	80 - 120
A366941	STI	Spiked Blank	Total Phosphorus (P)	2021/09/27		84	%	80 - 120
A366941	STI	Method Blank	Total Phosphorus (P)	2021/09/27	<0.0010		mg/L	
A366941	STI	RPD	Total Phosphorus (P)	2021/09/27	9.6		%	20
A367034	JFH	Matrix Spike	Total Ammonia (N)	2021/09/27		68 (1)	%	80 - 120
A367034	JFH	Spiked Blank	Total Ammonia (N)	2021/09/27		100	%	80 - 120
A367034	JFH	Method Blank	Total Ammonia (N)	2021/09/27	<0.015		mg/L	
A367034	JFH	RPD	Total Ammonia (N)	2021/09/27	0.020		%	20
A367133	JFH	Matrix Spike [AFY435-17]	Total Ammonia (N)	2021/09/27		99	%	80 - 120
A367133	JFH	Spiked Blank	Total Ammonia (N)	2021/09/27		100	%	80 - 120
A367133	JFH	Method Blank	Total Ammonia (N)	2021/09/27	<0.015		mg/L	
A367133	JFH	RPD [AFY435-17]	Total Ammonia (N)	2021/09/27	0.86		%	20
A367172	MDO	Matrix Spike	Dissolved Organic Carbon (C)	2021/09/28		105	%	80 - 120
A367172	MDO	Spiked Blank	Dissolved Organic Carbon (C)	2021/09/28		105	%	80 - 120
A367172	MDO	Method Blank	Dissolved Organic Carbon (C)	2021/09/28	<0.50		mg/L	
A367172	MDO	RPD	Dissolved Organic Carbon (C)	2021/09/28	NC		%	20
A367178	MDO	Matrix Spike	Total Organic Carbon (C)	2021/09/28		108	%	80 - 120
A367178	MDO	Spiked Blank	Total Organic Carbon (C)	2021/09/28		109	%	80 - 120
A367178	MDO	Method Blank	Total Organic Carbon (C)	2021/09/28	<0.50		mg/L	
A367178	MDO	RPD	Total Organic Carbon (C)	2021/09/28	NC		%	20
A367290	JC8	Matrix Spike [AFY382-15]	Dissolved Mercury (Hg)	2021/09/27		101	%	70 - 130
A367290	JC8	Spiked Blank	Dissolved Mercury (Hg)	2021/09/27		88	%	70 - 130
A367290	JC8	Method Blank	Dissolved Mercury (Hg)	2021/09/27	<0.00010		ug/L	
A367290	JC8	RPD [AFY382-15]	Dissolved Mercury (Hg)	2021/09/27	2.1		%	20
A369155	NR	Matrix Spike	Dissolved Chloride (Cl)	2021/09/28		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		NC	%	80 - 120
A369155	NR	Spiked Blank	Dissolved Chloride (Cl)	2021/09/28		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/28		100	%	80 - 120
A369155	NR	Method Blank	Dissolved Chloride (Cl)	2021/09/28	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/28	<1.0		mg/L	
A369155	NR	RPD	Dissolved Chloride (Cl)	2021/09/28	0.50		%	20
			Dissolved Sulphate (SO4)	2021/09/28	0.52		%	20
A369700	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/09/29		105	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/29		NC	%	80 - 120
A369700	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/09/29		105	%	80 - 120
			Dissolved Sulphate (SO4)	2021/09/29		100	%	80 - 120
A369700	BFE	Method Blank	Dissolved Chloride (Cl)	2021/09/29	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/09/29	<1.0		mg/L	
A369700	BFE	RPD	Dissolved Chloride (Cl)	2021/09/29	2.1		%	20
A371010	ANE	Matrix Spike	Total Molybdenum (Mo)	2021/09/30		104	%	80 - 120
			Total Vanadium (V)	2021/09/30		111	%	80 - 120
			Total Zinc (Zn)	2021/09/30		104	%	80 - 120
A371010	ANE	Spiked Blank	Total Molybdenum (Mo)	2021/09/30		103	%	80 - 120
			Total Vanadium (V)	2021/09/30		112	%	80 - 120
			Total Zinc (Zn)	2021/09/30		121 (1)	%	80 - 120





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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371010	ANE	Method Blank	Total Molybdenum (Mo)	2021/10/06	<0.050		ug/L	
			Total Vanadium (V)	2021/10/06	<0.20		ug/L	
			Total Zinc (Zn)	2021/10/06	2.7, RDL=1.5 (6)		ug/L	
A371010	ANE	RPD	Total Molybdenum (Mo)	2021/10/06	2.8		%	20
			Total Vanadium (V)	2021/10/06	0.091		%	20
			Total Zinc (Zn)	2021/10/06	16		%	20
A376917	DBA	Spiked Blank	pH (15 C)	2021/10/05		98	%	97 - 103
A384717	PC5	Spiked Blank	Dissolved Boron (B)	2021/10/13		106	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/10/13		101	%	80 - 120
			Dissolved Vanadium (V)	2021/10/13		99	%	80 - 120
			Dissolved Zinc (Zn)	2021/10/13		103	%	80 - 120
A384717	PC5	Method Blank	Dissolved Boron (B)	2021/10/13	<10		ug/L	
			Dissolved Molybdenum (Mo)	2021/10/13	<0.050		ug/L	
			Dissolved Vanadium (V)	2021/10/13	<0.20		ug/L	
			Dissolved Zinc (Zn)	2021/10/13	<0.10		ug/L	

N/A = Not Applicable

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

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Method blank <2XRDL

(3) Method blank above criteria. Data inspected. All data <2X RDL or greater than 10x Method Blank.

(4) Method Blank <2XDL

(5) Method blank above criteria and less than 2X RDL. Data inspected.

(6) Method Blank <2X RDL.





### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Maria Magdalena Florescu, Ph.D., P.Chem., QP, Inorganics Manager

Qiliang (Alex) Wu, Analyst II

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.




Bureau Veritas Laboratories  
4000 19<sup>th</sup> N.E. Calgary, Alberta Canada T2E 6P8 Tel (403) 291-9468 www.bvlabs.com  
Toll-free 800-563-6266 Fax (403) 291-3077

Regulatory Criteria:			Special Instructions			ANALYSIS REQUESTED (PLEASE BE SPECIFIC)										Turnaround Time (TAT) Required: <small>(Please provide advance notice for rush projects)</small>		
<input type="checkbox"/> ATI	<input type="checkbox"/> CCME	<input type="checkbox"/> Other														<input type="checkbox"/>	<input type="checkbox"/>	
SAMPLES MUST BE KEPT DOOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS																		
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y/N)										# of Bottles	Comments		
1	TABLE 1	SEVTH	11:30		X													
2	TABLE 2		11:20		X													
3	TABLE 3		10:50		X													
4	TABLE 4		10:20		X													
5	TABLE 5		10:00		X													
6	TABLE 6		9:32		X													
7	TABLE 7		10:50		X													
8	TABLE 8		10:00		X													
9	DUPLICATE		10:50		X										SAMPLED AT TABLE 7			
10	BLANK		11:45		X													
RELINQUISHED BY: (Signature/Print) ZACH MUELLER			Date: (YY/MM/DD) 21/09/14 15:23		RECEIVED BY: (Signature/Print) Reem Philippos Ryan		Date: (YY/MM/DD) 2021/09/15 16:30		# Jars used and not submitted		Temperature (°C) on Receipt See AG12		Laboratory Use Only Custody Seal Intact on Cooler? <input type="checkbox"/> Yes <input type="checkbox"/> No					
UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LAB'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.																		
ALL SAMPLES ARE HELD FOR 90 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.																		

Bureau Veritas Canada (2019) Inc. Temp:





**Bureau Veritas Laboratories**  
4000 1st N.E. Calgary, Alberta Canada T2E 6P8 Tel: (403) 291-3077 Toll-free 800-563-6256 Fax: (403) 291-5468 www.bvlab.com

Page of

**CHAIN OF CUSTODY RECORD**

---

**INVOICE TO:**

Company Name: #11052 HATFIELD CONSULTANTS  
 Attention: Zach Mueller  
 Address: Suite A, 300 MacKenzie Blvd  
 FORT MCMURRAY AB T9H 4C4  
 Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com  
 Email: zmueller@hatfieldgroup.com

**REPORT TO:**

Company Name: Zach Mueller  
 Attention: Suite A, 300 MacKenzie Blvd  
 Address: FORT MCMURRAY AB T9H 4C4  
 Tel: (250) 893-4939 Fax: zmueller@hatfieldgroup.com  
 Email: zmueller@hatfieldgroup.com

**PROJECT INFORMATION:**

Quotation #: C10309  
 P.O. #: Syncrude mesocosm experiment  
 Project: Syncrude mesocosm experiment  
 Project Name: Syncrude mesocosm experiment  
 Site #: Syncrude mesocosm experiment  
 Sampled By: Syncrude mesocosm experiment

**Laboratory Use Only:**

BV Labs Job #: C168465  
 Bottle Order #: 64187  
 COC #: C168465  
 Project Manager: Amanda L'Hondelle  
 C168465-02-01

---

**Regulatory Criteria:**

☐ ATI  
☐ CCME  
☐ Other

**Special Instructions**

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

**ANALYSIS REQUESTED (PLEASE BE SPECIFIC)**

Metals Field Filtered (Y/N) ☒ ENV - 2021 Syncrude Mesocosm

**Turnaround Time (TAT) Required:**

Regular (Standard) TAT: ☐  
 (Will be applied if Rush TAT is not specified)  
 Standard TAT = 5-7 Working days for most tests.  
 Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details  
 Job Specific Rush TAT (if applies to entire submission) ☐  
 Date Required: \_\_\_\_\_  
 Rush Confirmation Number: \_\_\_\_\_  
 # of Bottles: \_\_\_\_\_  
 Comments: \_\_\_\_\_

---

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Time	Date: (YYMM/DD)	Time	# Jars used and not submitted	Time Sampled	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
1	RAWER WATER TANK	SEPT 4	13:45			2021/09/15	06:30			See ACTR	<input type="checkbox"/> Yes <input type="checkbox"/> No
2	TREATED OSAW TANK	4	12:00			2021/09/15	06:30			See ACTR	<input type="checkbox"/> Yes <input type="checkbox"/> No
3											
4											
5											
6											
7											
8											
9											
10											

---

**RELINQUISHED BY: (Signature/Print)**

ZACH MUELLER

**RECEIVED BY: (Signature/Print)**

Reem Phillips, Rm

**Date: (YYMM/DD)**

21/09/14 15:23

**Time**

15:23

---

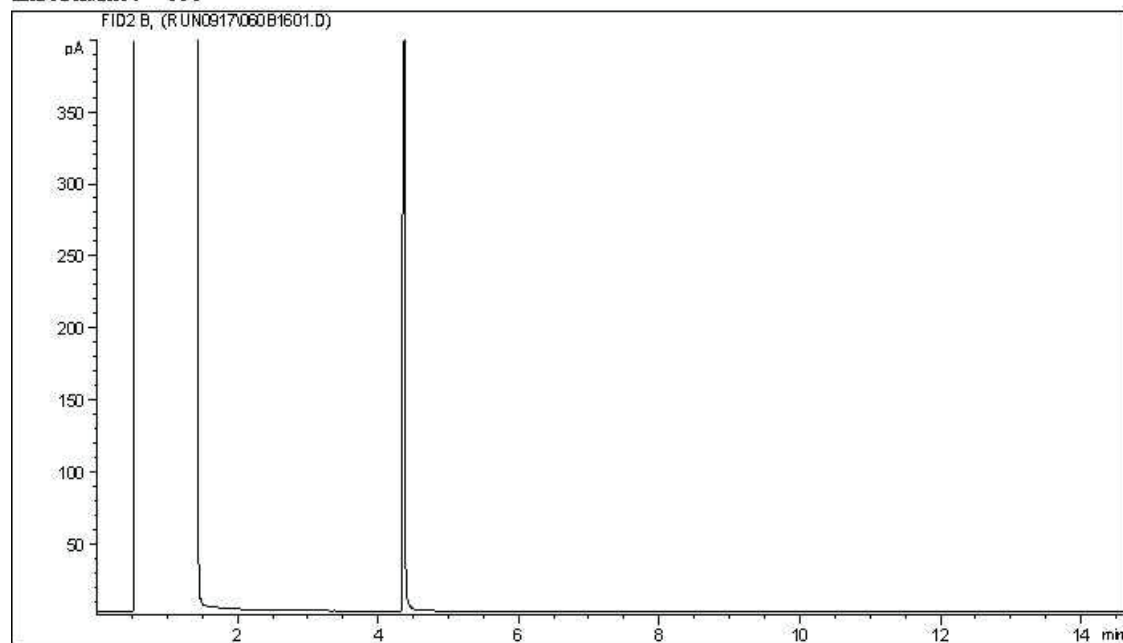
\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.  
 \* IT IS THE RESPONSIBILITY OF THE RELINQUISHING TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.  
 \* ALL SAMPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.

SEP 14 2021  
 03:23 PM  
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 10-yes cs-no

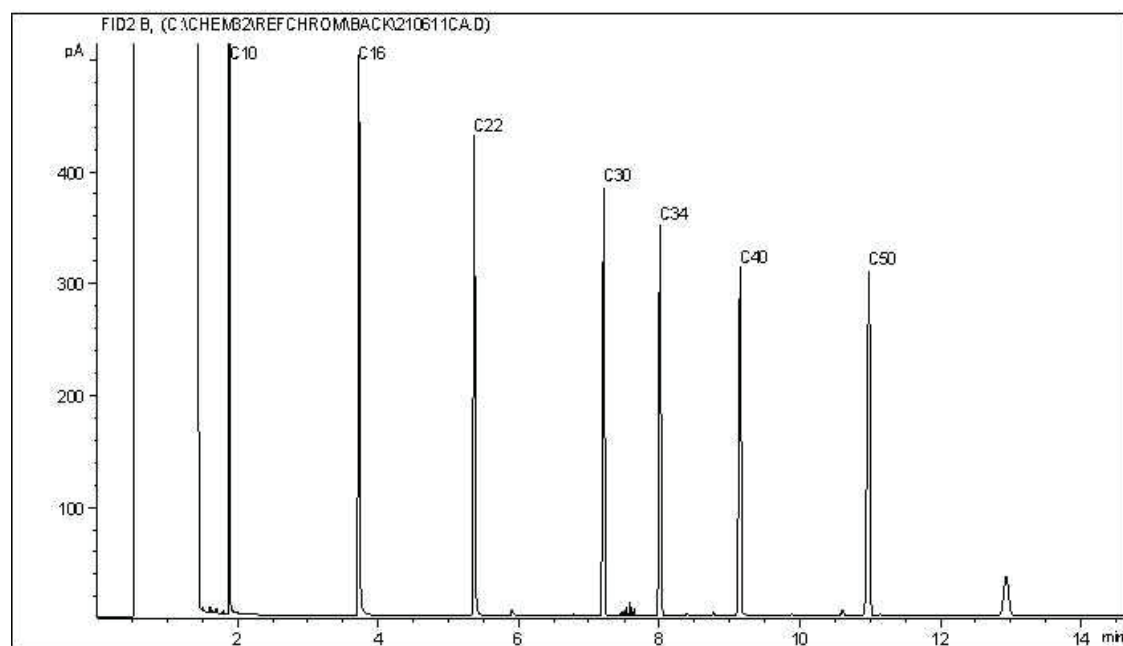


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

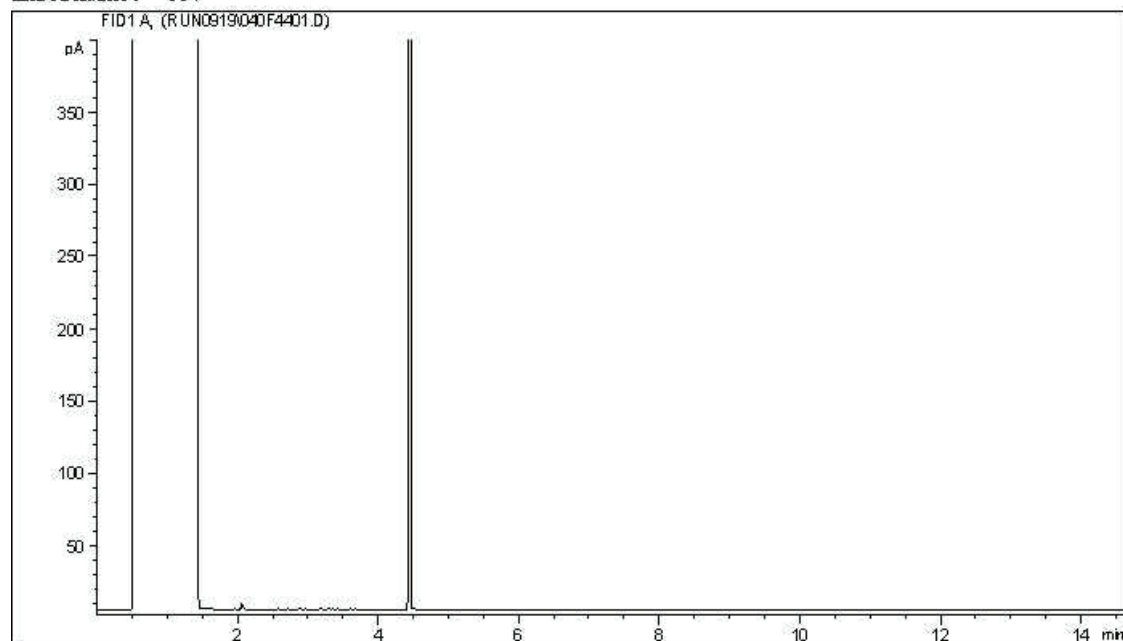
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

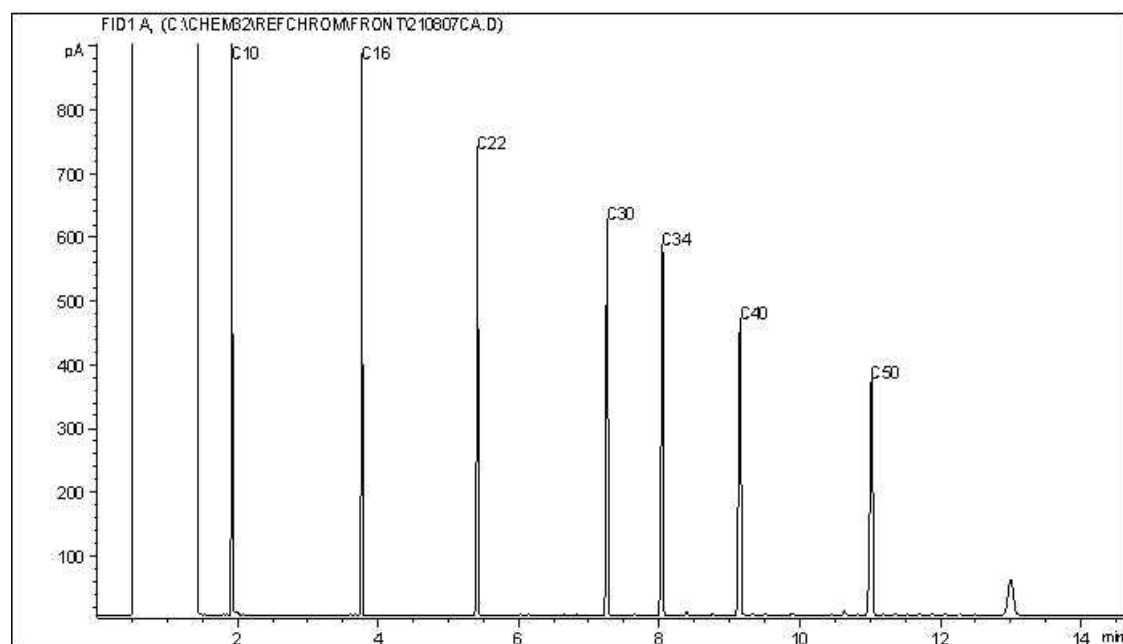


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

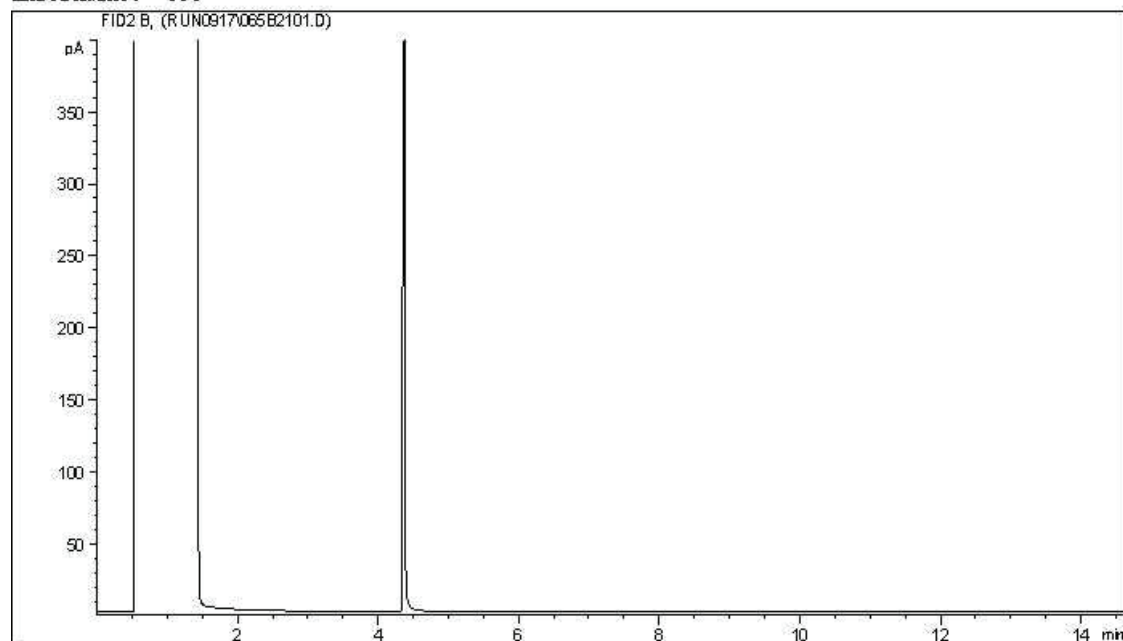
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

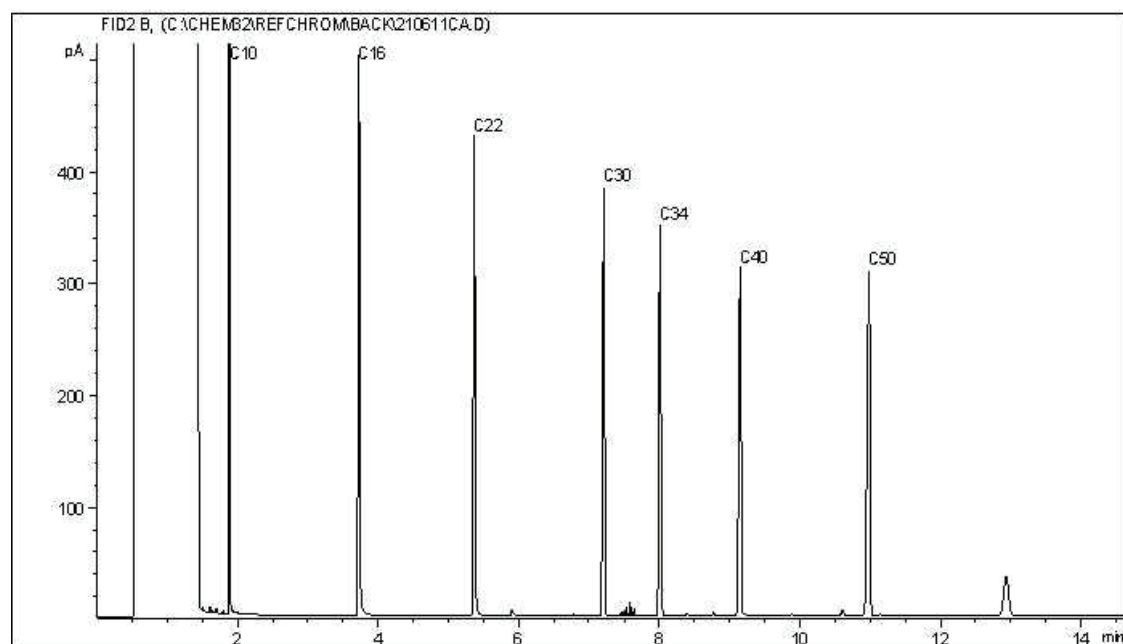


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

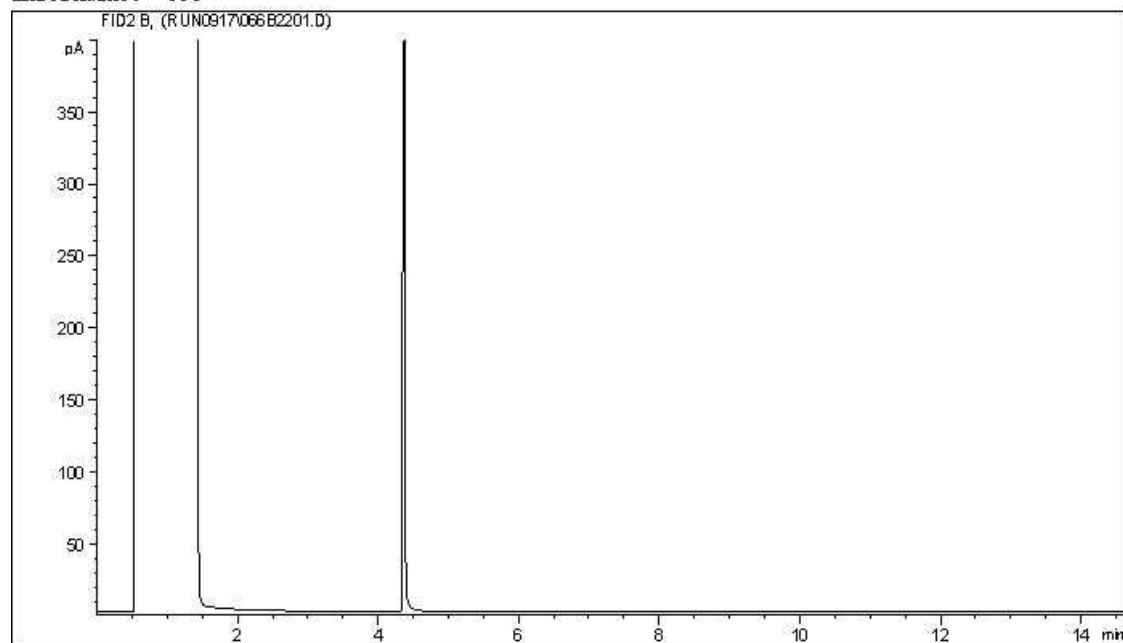
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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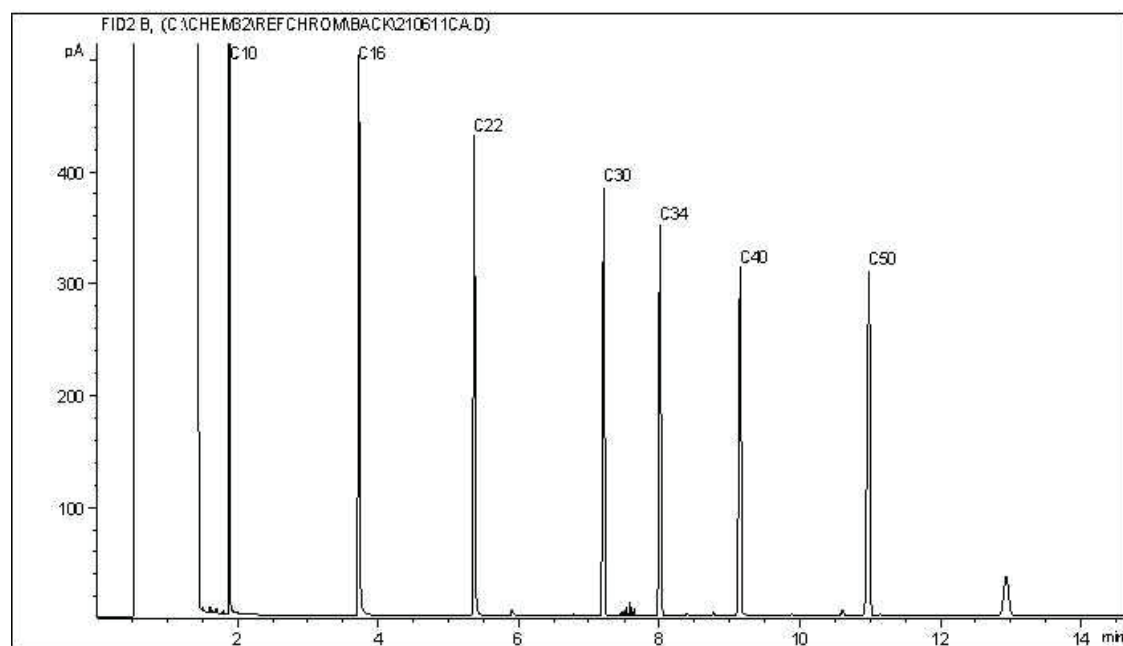


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

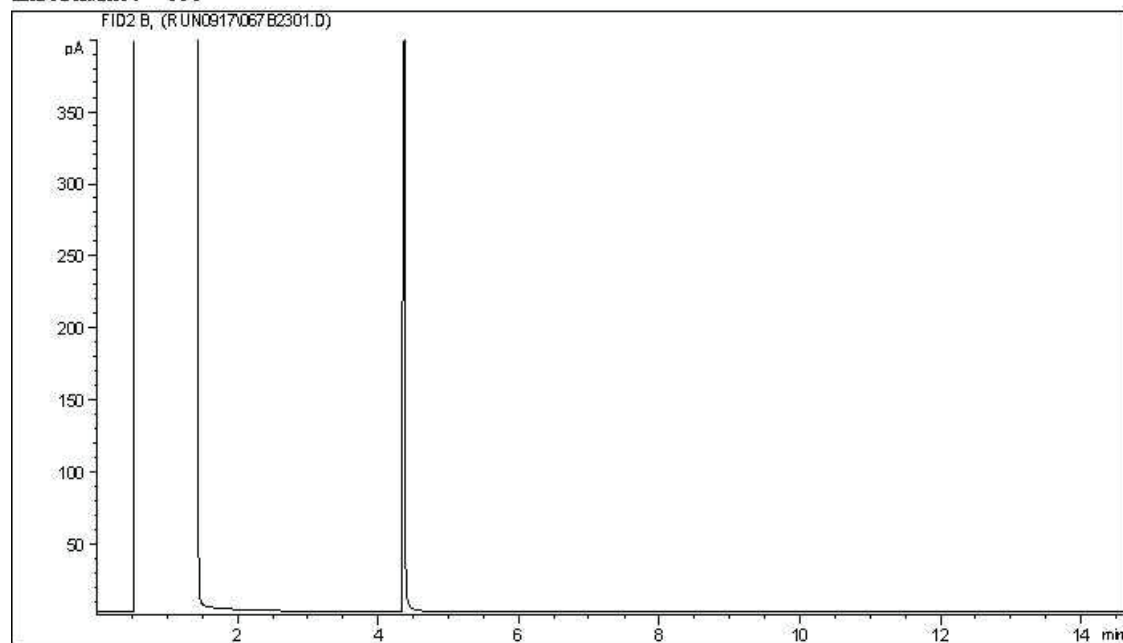
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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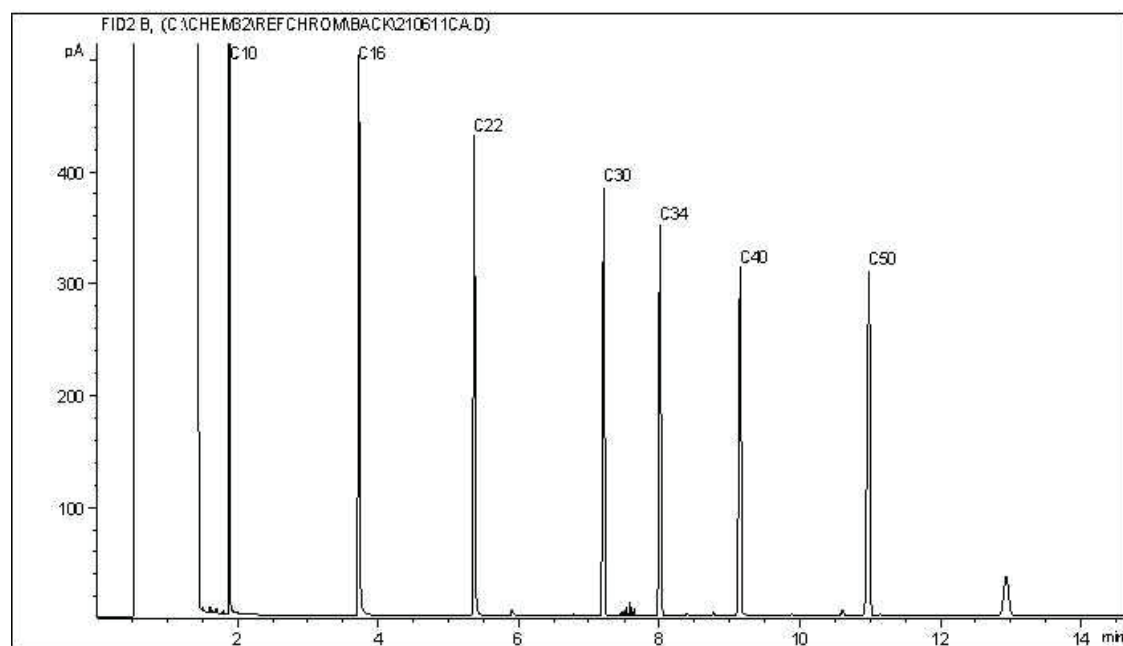


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

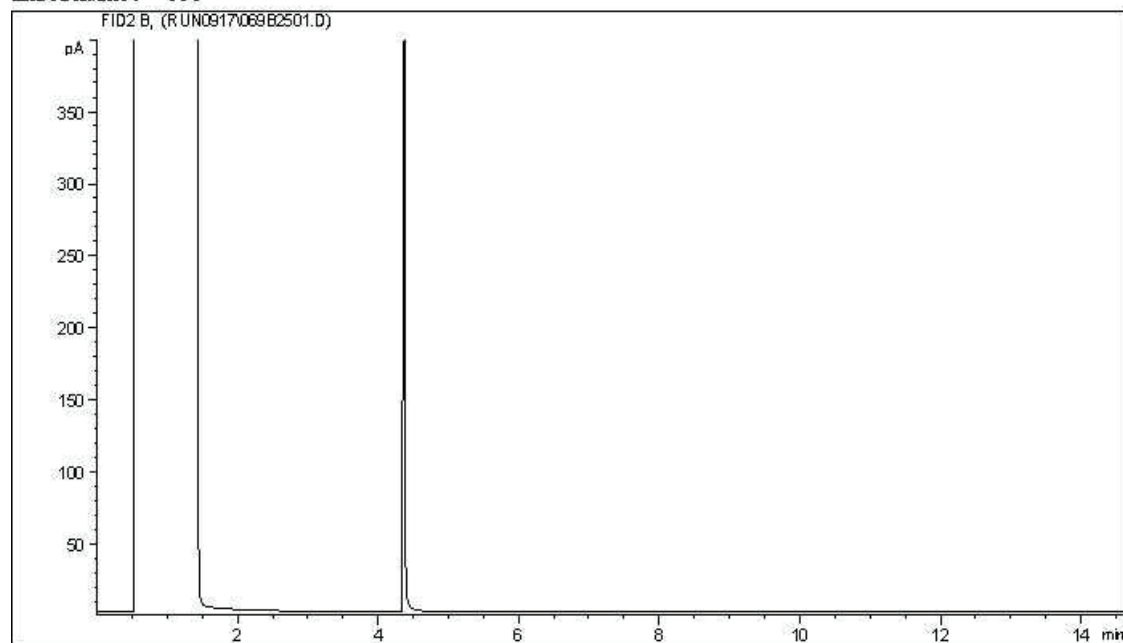
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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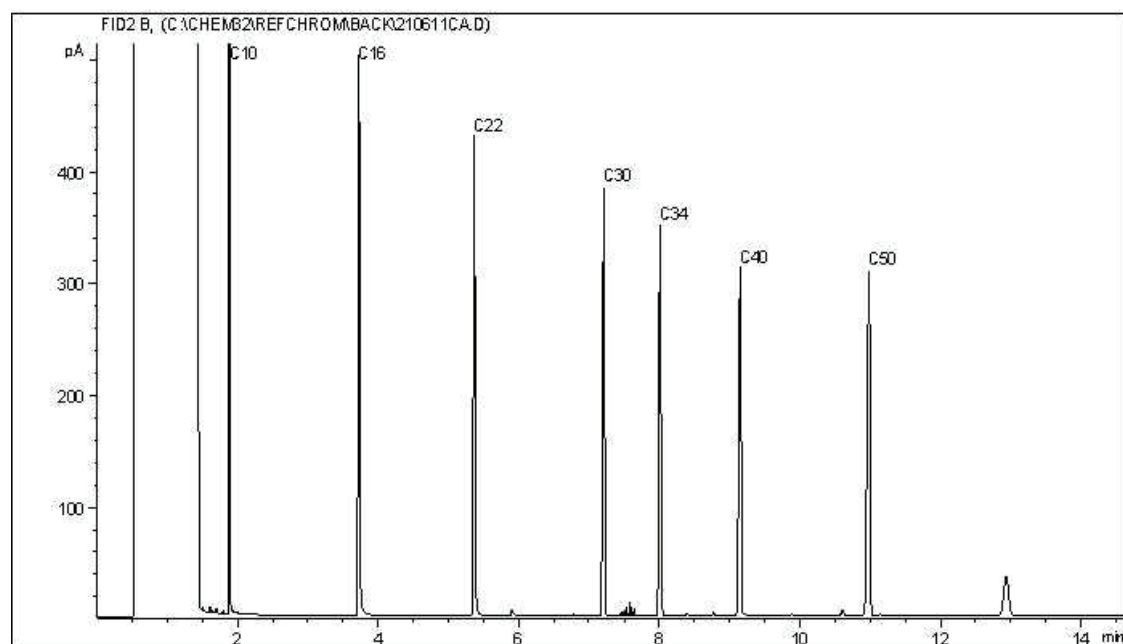


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

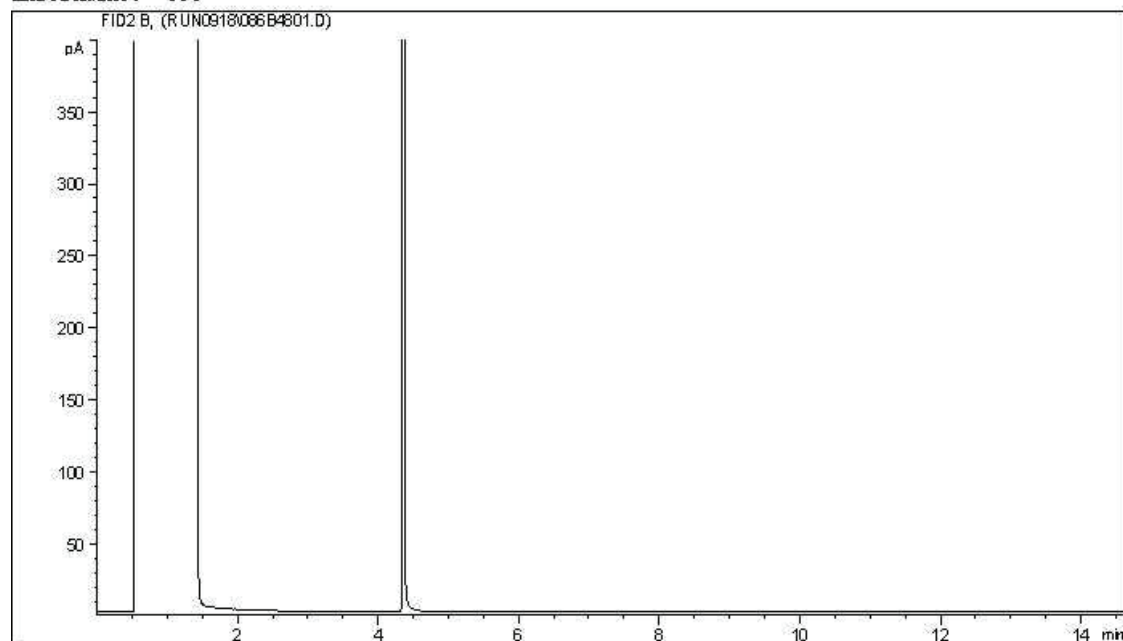
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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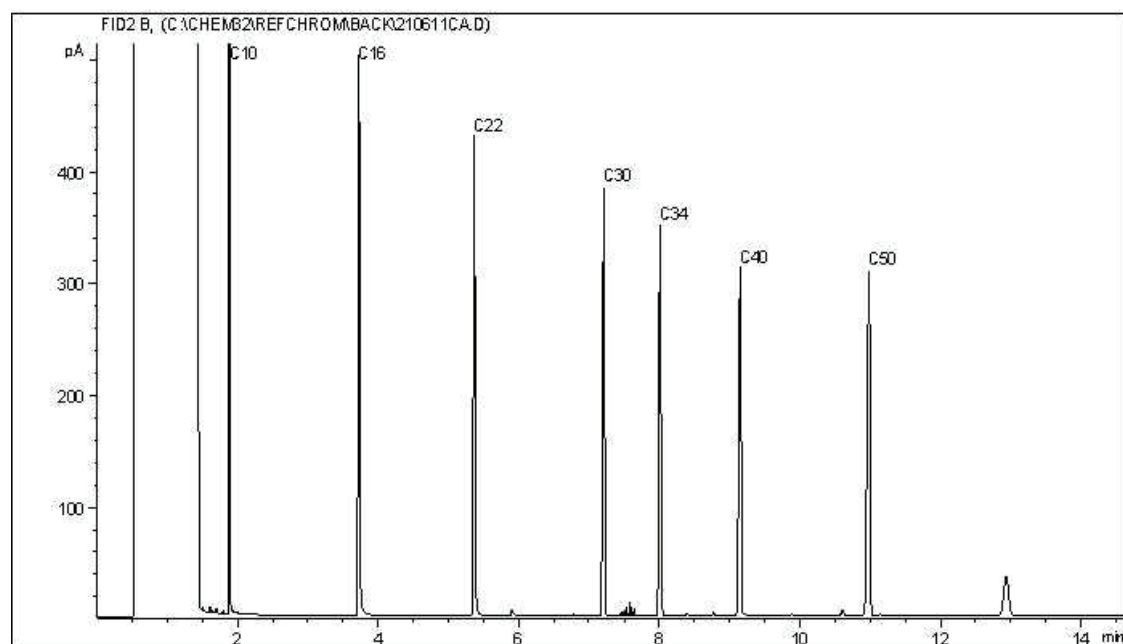


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

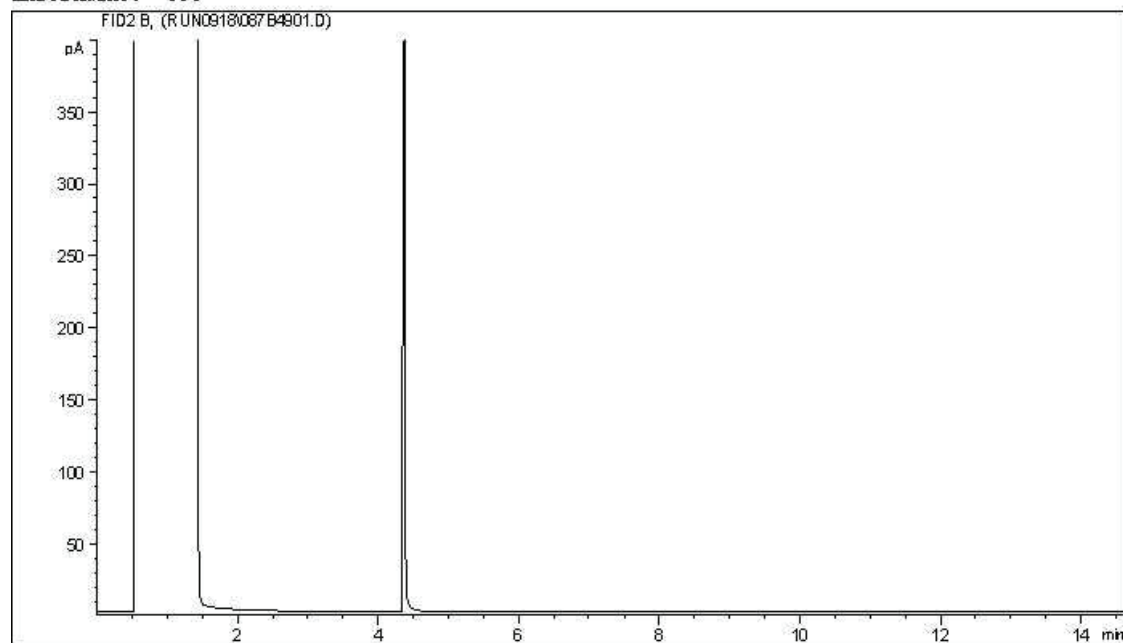
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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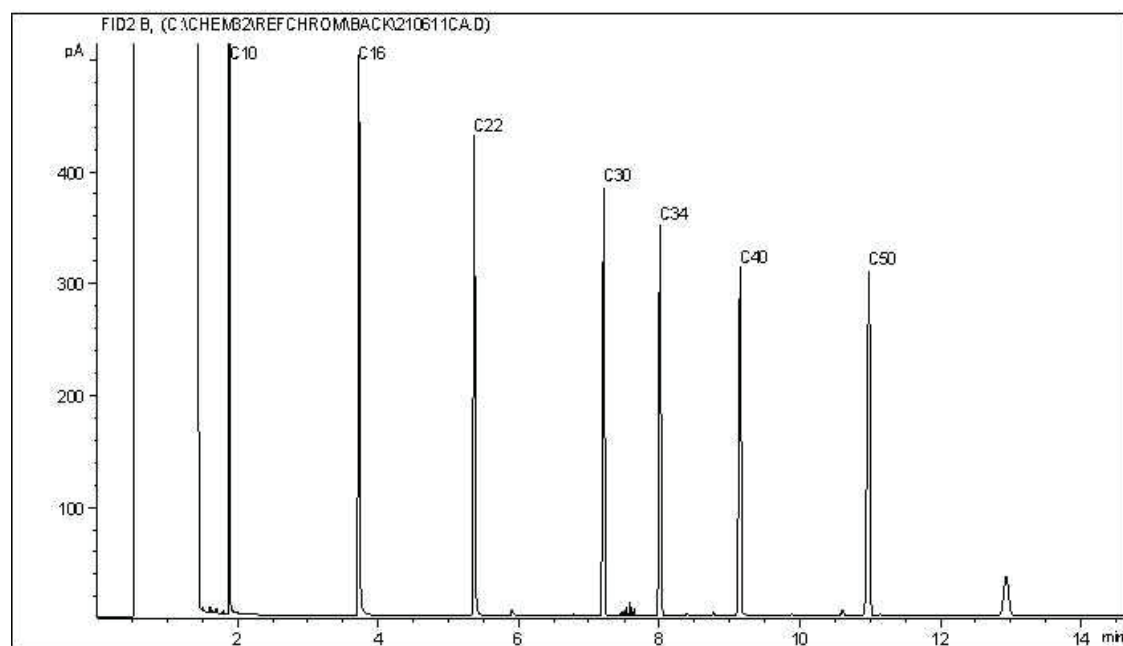


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

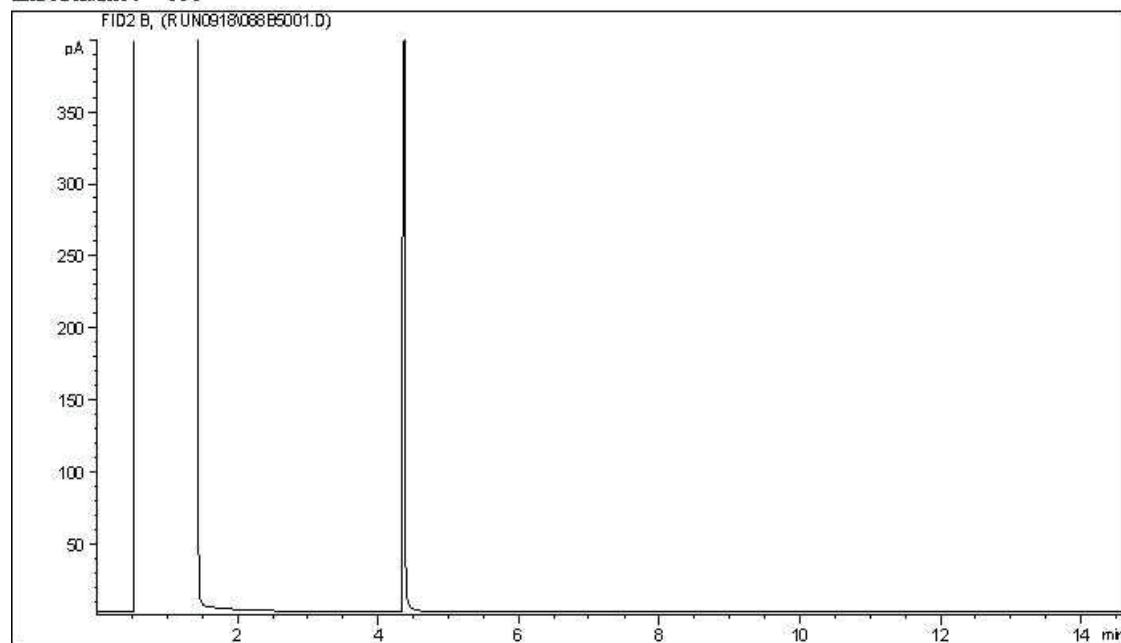
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

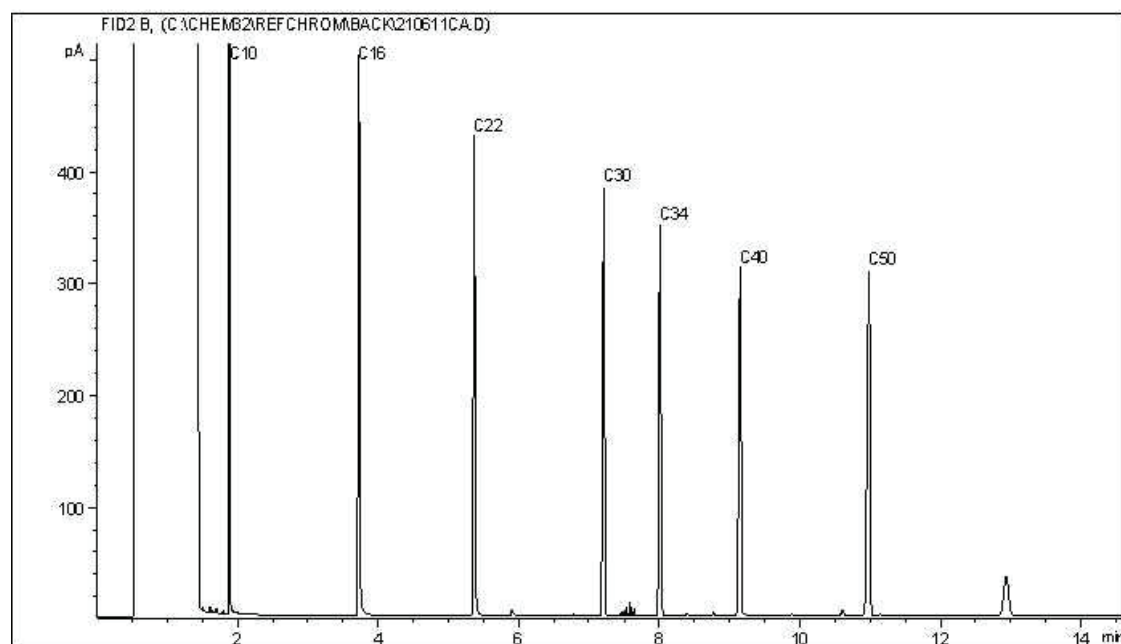


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

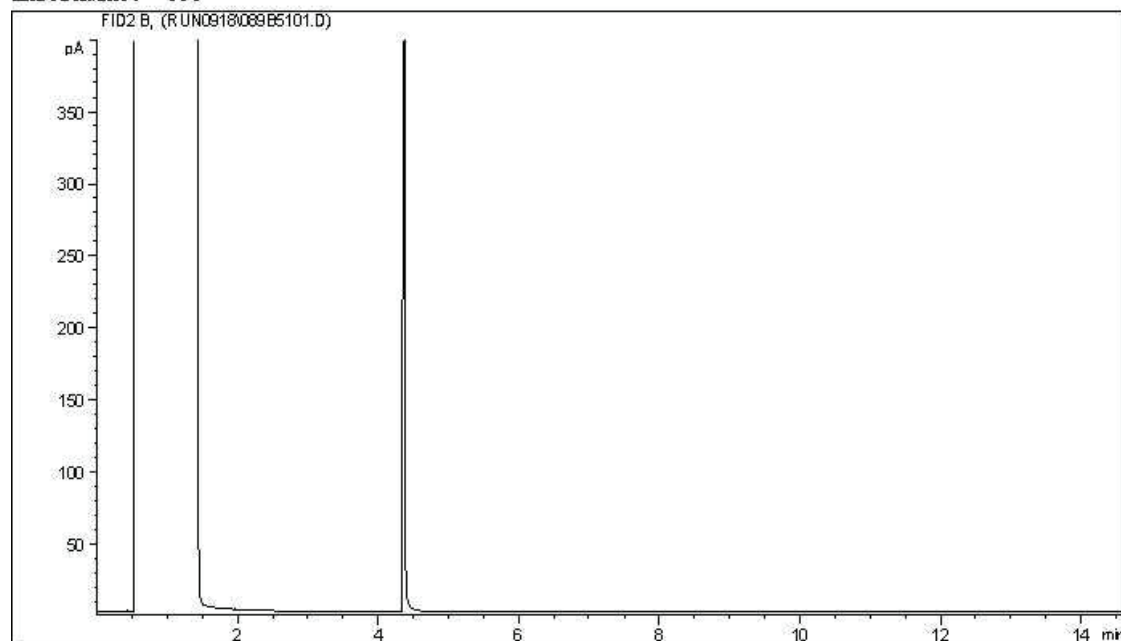
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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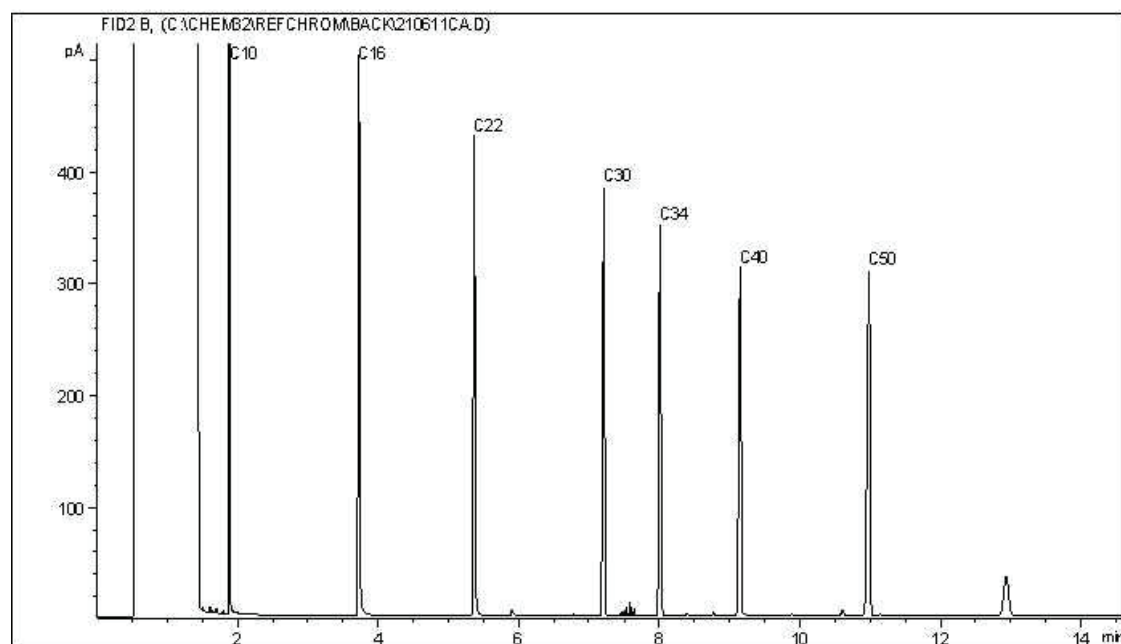


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

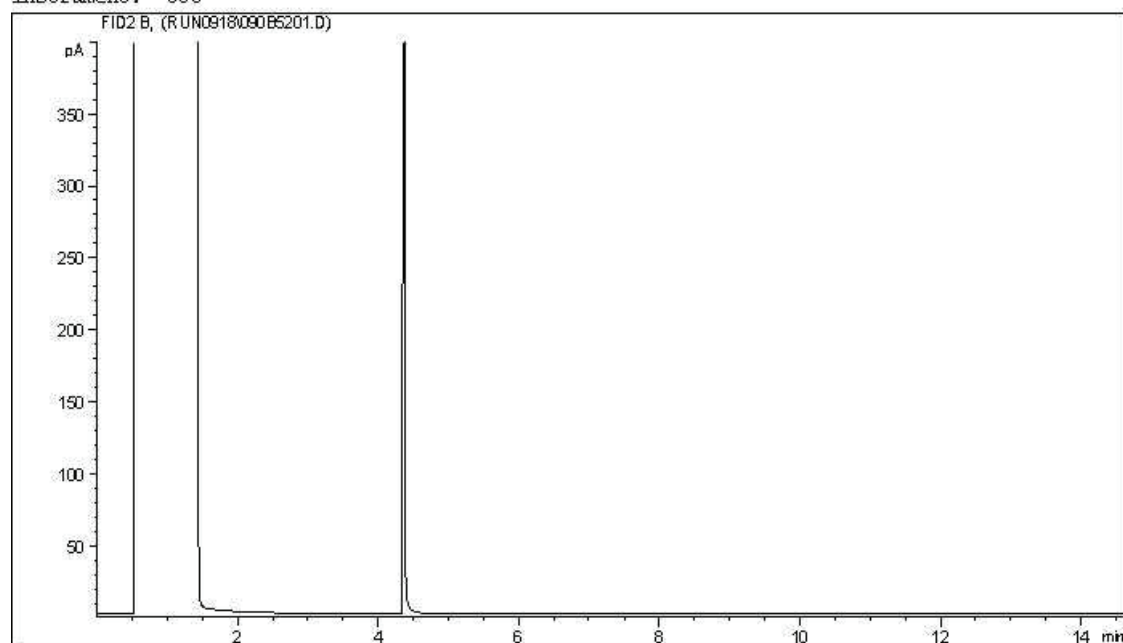
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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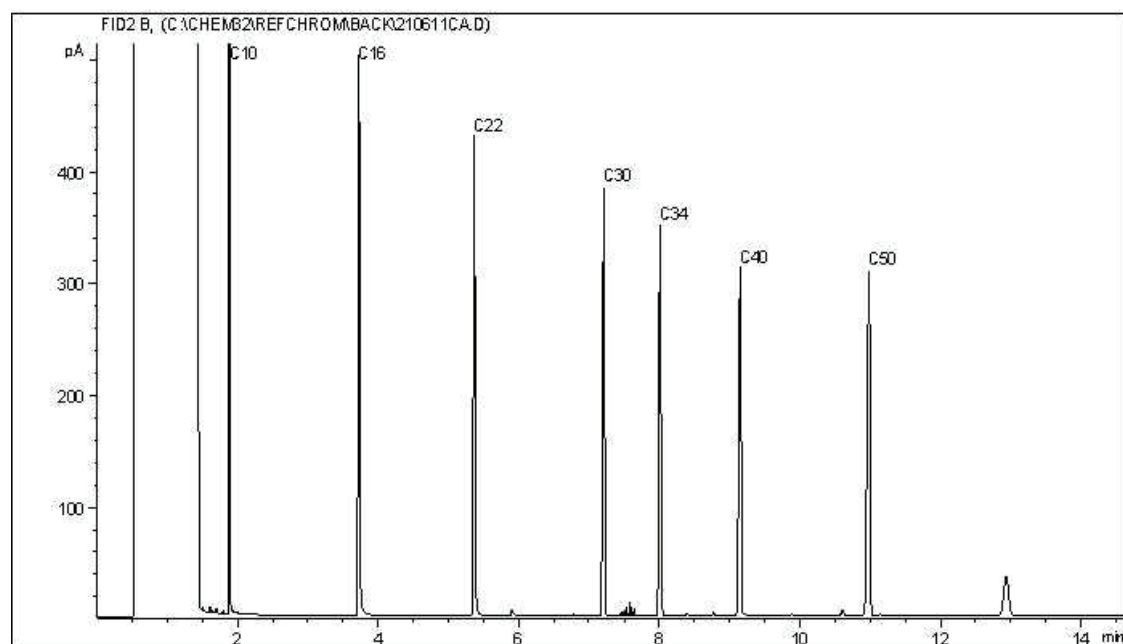


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

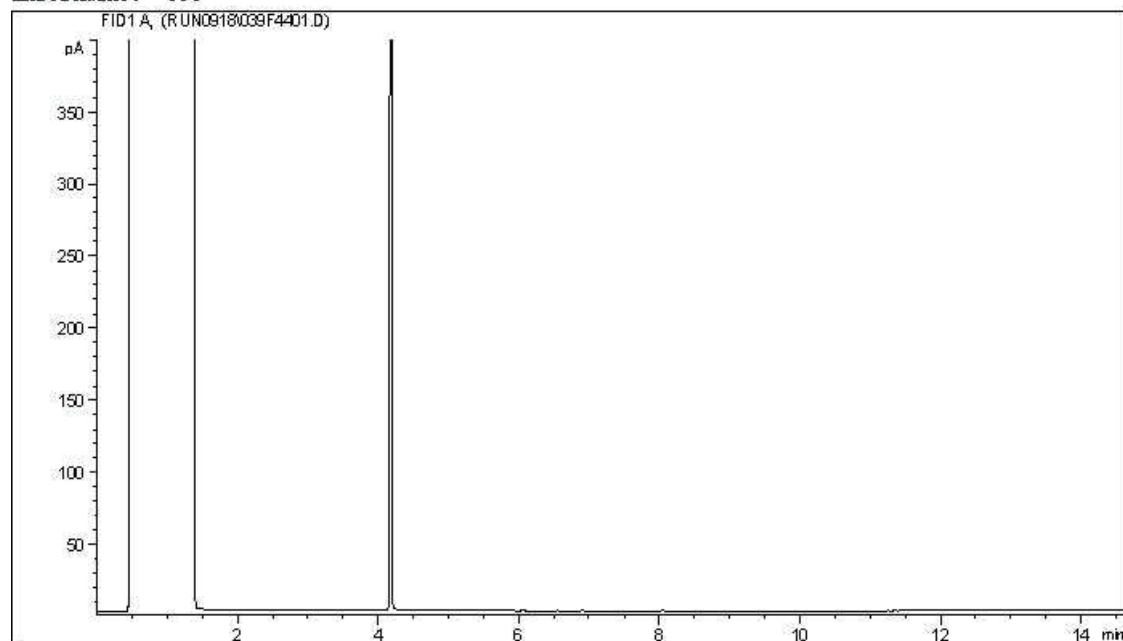
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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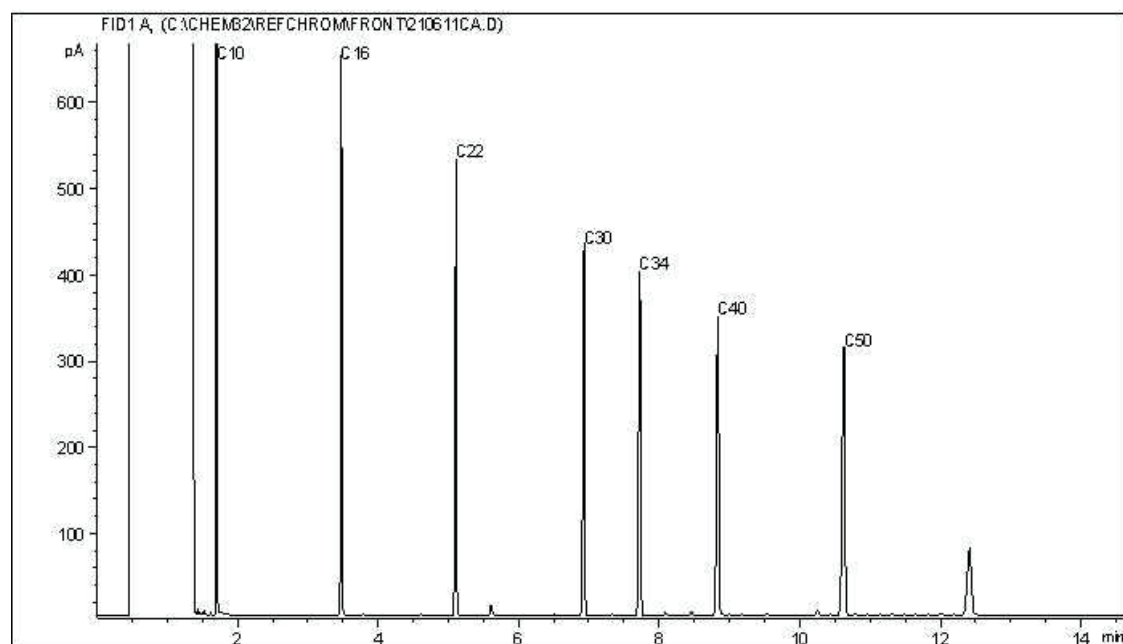


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/20**

Report #: R3087312

Version: 1 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	8	N/A	2021/09/30	AB SOP-00005	SM 23 2320 B m
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	1	N/A	2021/10/02	AB SOP-00005	SM 23 2320 B m
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	1	N/A	2021/10/16	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	5	2021/09/28	2021/10/03	AB SOP-00017	SM 23 5210B m
Biochemical Oxygen Demand	5	2021/09/29	2021/10/04	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	10	N/A	2021/10/01	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	10	N/A	2021/10/02		Auto Calc
Chloride/Sulphate by Auto Colourimetry	1	N/A	2021/10/04	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
Chloride/Sulphate by Auto Colourimetry	9	N/A	2021/10/05	AB SOP-00020	SM23-4500-Cl/SO <sub>4</sub> -E m
COD by Colorimeter	9	N/A	2021/10/02	AB SOP-00016	SM 23 5220D m
COD by Colorimeter	1	N/A	2021/10/18	AB SOP-00016	SM 23 5220D m
True Colour	10	N/A	2021/09/30	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	10	N/A	2021/10/04		Auto Calc
Carbon (DOC) (2)	9	N/A	2021/10/02	AB SOP-00087	MMCW 119 1996 m
Carbon (DOC) (2)	1	N/A	2021/10/03	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	8	N/A	2021/09/30	AB SOP-00005	SM 23 2510 B m
Conductivity @25C	1	N/A	2021/10/02	AB SOP-00005	SM 23 2510 B m
Conductivity @25C	1	N/A	2021/10/16	AB SOP-00005	SM 23 2510 B m
Fluoride	9	N/A	2021/09/30	AB SOP-00005	SM 23 4500-F C m
Fluoride	1	N/A	2021/10/02	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (3)	2	2021/09/30	2021/10/02	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (3)	8	2021/09/30	2021/10/03	AB SOP-00037	CCME PHC-CWS m
Hardness	10	N/A	2021/10/01		Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (4)	4	N/A	2021/10/06	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (4)	6	N/A	2021/10/09	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	10	N/A	2021/10/01	BBY WI-00033	Auto Calc
Ultra Low Mercury - Diss, field filtered (1)	10	N/A	2021/09/30	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	9	2021/09/30	2021/09/30	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	1	2021/09/30	2021/10/01	BBY7SOP-00022	EPA 1631E m
Elements by ICP - Dissolved (5)	8	N/A	2021/09/30	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Dissolved (5)	2	N/A	2021/10/01	AB SOP-00042	EPA 6010d R5 m
Ion Balance	10	N/A	2021/10/05		Auto Calc





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/20**

Report #: R3087312

Version: 1 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sum of cations, anions	10	N/A	2021/10/01		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	10	N/A	2021/10/08	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (5)	10	N/A	2021/10/07	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	4	2021/09/30	2021/09/30	CAL SOP-00265	EPA 6020 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	4	N/A	2021/10/06	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	6	N/A	2021/10/09	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	6	N/A	2021/10/08	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	1	2021/09/30	2021/10/01	AB SOP-00060	EPA 3510C R3 / FTIR
Naphthenic Acids by IR	9	2021/10/01	2021/10/04	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH <sub>3</sub> ) as N	10	N/A	2021/10/03		Auto Calc
Ammonia-N (Total)	10	N/A	2021/10/03	AB SOP-00007	SM 23 4500 NH <sub>3</sub> A G m
Nitrate and Nitrite	9	N/A	2021/09/29		Auto Calc
Nitrate and Nitrite	1	N/A	2021/10/01		Auto Calc
NO <sub>2</sub> (N); NO <sub>2</sub> (N) + NO <sub>3</sub> (N) in Water	9	N/A	2021/09/28	AB SOP-00091	SM 23 4500 NO <sub>3</sub> m
NO <sub>2</sub> (N); NO <sub>2</sub> (N) + NO <sub>3</sub> (N) in Water	1	N/A	2021/09/29	AB SOP-00091	SM 23 4500 NO <sub>3</sub> m
Nitrate (as N)	9	2021/09/28	2021/09/29		Auto Calc
Nitrate (as N)	1	2021/09/28	2021/10/01		Auto Calc
Target & Alkylated PAH in Water by GC/MS (6)	10	2021/10/01	2021/10/02	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (7)	10	N/A	2021/10/13		Auto Calc
Filter and HNO <sub>3</sub> Preserve for Metals (1)	10	N/A	2021/10/04	BBY7 WI-00004	SM 23 3030B m
pH @25°C (8)	9	N/A	2021/09/30	AB SOP-00005	SM 23 4500-H+B m
pH @25°C (8)	1	N/A	2021/10/02	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	10	N/A	2021/10/01	Field Test	Field Test
Orthophosphate by Konelab (low level) (9)	10	N/A	2021/09/29	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	10	2021/10/03	2021/10/03	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	10	2021/10/01	2021/10/01	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	10	N/A	2021/10/05		Auto Calc
Temperature (Field)	10	N/A	2021/10/01		
Total Trihalomethanes Calculation	10	N/A	2021/10/02		Auto Calc
Carbon (Inorganic)	10	N/A	2021/10/08	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	1	2021/09/29	2021/09/30	AB SOP-00093	SM 23 4500-N C m





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/20**  
Report #: R3087312  
Version: 1 - Final

## CERTIFICATE OF ANALYSIS

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Nitrogen (Total)	8	2021/09/30	2021/10/04	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	1	2021/09/30	2021/10/05	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (10)	10	N/A	2021/10/15	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	7	2021/10/01	2021/10/02	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/04	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/17	2021/10/17	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	5	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	2	2021/10/02	2021/10/04	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	2	2021/10/02	2021/10/06	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/10/19	2021/10/19	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	10	2021/10/01	2021/10/01	AB SOP-00061	SM 23 2540 D m
Turbidity	10	N/A	2021/09/28	CAL SOP-00081	SM 23 2130 B m
VOCs in Water by HS GC/MS (Std List)	10	N/A	2021/10/01	AB SOP-00056	EPA 5021a/8260d m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01

**Attention: Zach Mueller**

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Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/20**  
Report #: R3087312  
Version: 1 - Final

## **CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Bureau Veritas Vancouver, 4606 Canada Way, Burnaby, BC, V5G 1K5

(2) DOC present in the sample should be considered as non-purgeable DOC. Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(3) Silica gel clean up employed.

(4) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(5) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(6) Alkylated PAH results are semiquantitative

(7) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

(8) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

(9) Orthophosphate > Total Phosphorus Imbalance: When applicable, Orthophosphate, Total Phosphorus and dissolved Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(10) TOC present in the sample should be considered as non-purgeable TOC.

(11) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key



Bureau Veritas

20 Oct 2021 18:16:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Amanda L'Hirondelle, Key Account Specialist

Email: Amanda.lhirondelle@bureauveritas.com

Phone# (780)577-7117

=====  
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





### RESULTS OF CHEMICAL ANALYSES OF WATER

Bureau Veritas ID		AGW993			AGW994		
Sampling Date		2021/09/24 16:20			2021/09/24 11:10		
COC Number		644187-01-01			644187-01-01		
	UNITS	RIVER WATER TANK	RDL	QC Batch	MESOCOSM TABLE 1	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.7	N/A	A367828	30	N/A	A367828
Cation Sum	meq/L	3.2	N/A	A367828	31	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	82	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A368392	82.4	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	120	0.50	A368391	71.2	0.50	A368391
Ion Balance (% Difference)	%	6.6	N/A	A367827	2.3	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.017	0.010	A367830	0.020	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.074	0.044	A367829	0.089	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	1800	10	A367831
Un-Ionized Ammonia	mg/L	<0.00082	0.00082	A368397	0.0039	0.0024	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	46 (1)	10	A369277	4.8	2.0	A367832
Chemical Oxygen Demand	mg/L	19	10	A391105	102	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.43	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	11.9	N/A	ONSITE	7.4	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	300	2.0	A371045	3100	2.0	A371045
Dissolved Organic Carbon (C)	mg/L	5.7	0.50	A372370	23	0.50	A372370
pH	pH	7.96	N/A	A371043	9.09	N/A	A371043
Total Organic Carbon (C)	mg/L	4.5	0.50	A387831	19	0.50	A387831
Total Dissolved Solids	mg/L	170	10	A372069	1900	10	A372069
Total Suspended Solids	mg/L	9.5	1.0	A372083	14	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	110	1.0	A371036
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A371036	370	1.0	A371036
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A371036	180	1.0	A371036
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	140	1.0	A371036
RDL = Reportable Detection Limit N/A = Not Applicable (1) Detection limit raised based on sample volume used for analysis.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW993			AGW994		
<b>Sampling Date</b>		2021/09/24 16:20			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 1</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.078	0.050	A371046	2.3	0.050	A371046
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371036
Orthophosphate (P)	mg/L	0.0030	0.0010	A369383	0.0059	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	4.5	1.0	A375682	400	5.0	A375682
Dissolved Sulphate (SO4)	mg/L	40	1.0	A390968	510	5.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	0.024	0.015	A373819
Total Inorganic Carbon (C)	mg/L	30	1.0	A380555	93	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0030	0.0010	A390092	0.0097	0.0010	A372557
Total Phosphorus (P)	mg/L	0.0089	0.0010	A392634	0.067	0.0010	A372554
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.017	0.010	A369130	0.020	0.010	A369130
Total Nitrogen (N)	mg/L	0.25	0.020	A371102	1.9 (1)	0.10	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A368930	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	13	2.0	A369972	15	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	10	0.10	A369027	8.2	0.10	A369027
RDL = Reportable Detection Limit							
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

Bureau Veritas ID		AGW995			AGW996		
Sampling Date		2021/09/24 11:45			2021/09/24 11:45		
COC Number		644187-01-01			644187-01-01		
	UNITS	MESOCOSM TABLE 2	RDL	QC Batch	MESOCOSM TABLE 3	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	13	N/A	A367828	7.4	N/A	A367828
Cation Sum	meq/L	12	N/A	A367828	5.9	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	120	0.50	A367826	130	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	122	0.50	A368392	133	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	113	0.50	A368391	115	0.50	A368391
Ion Balance (% Difference)	%	3.4	N/A	A367827	11	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.020	0.010	A367830	0.013	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.087	0.044	A367829	0.057	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	730	10	A367831	390	10	A367831
Un-Ionized Ammonia	mg/L	0.0015	0.0013	A368397	<0.00070	0.00070	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A367832	<2.0	2.0	A367832
Chemical Oxygen Demand	mg/L	43	10	A373642	23	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.8	N/A	ONSITE	8.5	N/A	ONSITE
Field Temperature (Fd)	deg. C	7.4	N/A	ONSITE	7.6	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	1200	2.0	A371045	590	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	12	0.50	A372370	6.8	0.50	A372370
pH	pH	8.73	N/A	A371043	8.14	N/A	A371050
Total Organic Carbon (C)	mg/L	10	0.50	A387831	6.5	0.50	A387831
Total Dissolved Solids	mg/L	710	10	A372069	340	10	A372069
Total Suspended Solids	mg/L	11	1.0	A372083	8.4	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	8.5	1.0	A371036	<1.0	1.0	A371052
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	240	1.0	A371036	200	1.0	A371052
Bicarbonate (HCO <sub>3</sub> )	mg/L	270	1.0	A371036	240	1.0	A371052
Carbonate (CO <sub>3</sub> )	mg/L	10	1.0	A371036	<1.0	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.76	0.050	A371046	0.30	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW995			AGW996		
<b>Sampling Date</b>		2021/09/24 11:45			2021/09/24 11:45		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0022	0.0010	A369383	0.0015	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	130	1.0	A376285	54	1.0	A375682
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	190	2.0	A390968	92	1.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	0.017	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	50	1.0	A380555	36	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0080	0.0010	A372557	0.0025	0.0010	A372557
Total Phosphorus (P)	mg/L	0.030	0.0010	A372554	0.015	0.0010	A373740
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369135
Dissolved Nitrate plus Nitrite (N)	mg/L	0.020 (1)	0.010	A369130	0.013	0.010	A369135
Total Nitrogen (N)	mg/L	0.77	0.020	A371102	0.41	0.020	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	14	2.0	A369972	13	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	7.9	0.10	A369034	7.4	0.10	A369034
RDL = Reportable Detection Limit							
(1) Matrix spike exceeds acceptance limits due to probable matrix interference.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW997			AGW998		
<b>Sampling Date</b>		2021/09/24 12:30			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	4.5	N/A	A367828	4.0	N/A	A367828
Cation Sum	meq/L	4.0	N/A	A367828	3.5	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	140	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	137	0.50	A368392	138	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	124	0.50	A368391	133	0.50	A368391
Ion Balance (% Difference)	%	5.1	N/A	A367827	6.3	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.012	0.010	A367830	0.011	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.052	0.044	A367829	0.048	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	240	10	A367831	200	10	A367831
Un-Ionized Ammonia	mg/L	<0.00058	0.00058	A368397	<0.00050	0.00050	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A369277	<2.6	2.0	A367832
Chemical Oxygen Demand	mg/L	18	10	A373642	16	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.4	N/A	ONSITE	8.3	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.1	N/A	ONSITE	8.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	390	2.0	A371045	340	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	6.6	0.50	A372370	5.1	0.50	A372370
pH	pH	8.11	N/A	A371043	8.04	N/A	A371050
Total Organic Carbon (C)	mg/L	5.0	0.50	A387831	4.4	0.50	A387831
Total Dissolved Solids	mg/L	240	10	A372069	200	10	A372069
Total Suspended Solids	mg/L	6.5	1.0	A372083	8.0	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A371036	140	1.0	A371052
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A371036	170	1.0	A371052
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.15	0.050	A371046	0.19	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW997			AGW998		
<b>Sampling Date</b>		2021/09/24 12:30			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0021	0.0010	A369383	0.0020	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	16	1.0	A375452	8.7	1.0	A375682
Dissolved Sulphate (SO4)	mg/L	57	1.0	A375452	44	1.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	30	1.0	A380555	30	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0023	0.0010	A372557	0.0014	0.0010	A372555
Total Phosphorus (P)	mg/L	0.015	0.0010	A373740	0.011	0.0010	A373745
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369135
Dissolved Nitrate plus Nitrite (N)	mg/L	0.012	0.010	A369130	0.011	0.010	A369135
Total Nitrogen (N)	mg/L	0.29	0.020	A371102	0.24	0.020	A371158
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	14	2.0	A369972	12	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	7.1	0.10	A369034	8.0	0.10	A369034
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW999			AGX000		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 12:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.9	N/A	A367828	3.2	N/A	A367828
Cation Sum	meq/L	3.3	N/A	A367828	3.2	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	140	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	138	0.50	A368392	138	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	121	0.50	A368391	135	0.50	A368391
Ion Balance (% Difference)	%	9.0	N/A	A367827	0.38	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.014	0.010	A367830	0.011	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.062	0.044	A367829	0.048	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	170	10	A367831
Un-Ionized Ammonia	mg/L	<0.00050	0.00050	A368397	<0.00065	0.00065	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A367832	<2.0	2.0	A369277
Chemical Oxygen Demand	mg/L	16	10	A373642	17	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.13	N/A	ONSITE	8.43	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.9	N/A	ONSITE	8.7	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	310	2.0	A373007	290	2.0	A389391
Dissolved Organic Carbon (C)	mg/L	4.5	0.50	A372370	5.0	0.50	A372370
pH	pH	8.20	N/A	A373005	8.01	N/A	A371043
Total Organic Carbon (C)	mg/L	4.6	0.50	A387831	4.3	0.50	A387831
Total Dissolved Solids	mg/L	180	10	A372069	170	10	A372069
Total Suspended Solids	mg/L	8.0	0.99	A372083	7.5	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A373006	110	1.0	A389389
Bicarbonate (HCO <sub>3</sub> )	mg/L	180	1.0	A373006	140	1.0	A389389
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Dissolved Fluoride (F)	mg/L	0.11	0.050	A373002	0.095	0.050	A371046
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW999			AGX000		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 12:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Orthophosphate (P)	mg/L	0.0030	0.0010	A369383	0.0030	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	5.3	1.0	A375470	4.6	1.0	A375452
Dissolved Sulphate (SO4)	mg/L	42	1.0	A375470	40	2.0	A390968
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	32	1.0	A380555	28	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0018	0.0010	A372557	<0.0010	0.0010	A372557
Total Phosphorus (P)	mg/L	0.016	0.0010	A372554	0.014	0.0010	A373740
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A370177	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.014	0.010	A370177	0.011	0.010	A369130
Total Nitrogen (N)	mg/L	0.28	0.020	A371102	0.25	0.020	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	12	2.0	A369972	11	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	5.6	0.10	A369034	7.6	0.10	A369034
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX001			AGX002		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 14:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.7	N/A	A367828	30	N/A	A367828
Cation Sum	meq/L	3.2	N/A	A367828	30	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	83	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	139	0.50	A368392	83.1	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	134	0.50	A368391	82.6	0.50	A368391
Ion Balance (% Difference)	%	7.1	N/A	A367827	0.023	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.011	0.010	A367830	0.020	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.048	0.044	A367829	0.088	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	1900	10	A367831
Un-Ionized Ammonia	mg/L	<0.00050	0.00050	A368397	0.0031	0.0026	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A369277	6.2	2.0	A369277
Chemical Oxygen Demand	mg/L	20	10	A373642	107	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.3	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.9	N/A	ONSITE	8.6	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	300	2.0	A371053	3100	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	5.4	0.50	A372370	23	0.50	A372370
pH	pH	8.00	N/A	A371050	9.05	N/A	A371050
Total Organic Carbon (C)	mg/L	4.6	0.50	A387831	19	0.50	A387831
Total Dissolved Solids	mg/L	180	10	A372069	1900	10	A372069
Total Suspended Solids	mg/L	14	1.0	A372083	17	1.0	A372084
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371052	84	1.0	A371052
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A371052	370	1.0	A371052
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A371052	250	1.0	A371052
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371052	100	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.078	0.050	A371054	2.3	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX001			AGX002		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 14:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371052	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0021	0.0010	A369383	0.0067	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	4.4	1.0	A375463	410	5.0	A375463
Dissolved Sulphate (SO4)	mg/L	40	1.0	A375463	550	5.0	A375463
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	0.018	0.015	A373819
Total Inorganic Carbon (C)	mg/L	35	1.0	A380555	91	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0014	0.0010	A372557	0.0097	0.0010	A372557
Total Phosphorus (P)	mg/L	0.017	0.0010	A372554	0.097	0.0010	A372544
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369135	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.011	0.010	A369135	0.020	0.010	A369130
Total Nitrogen (N)	mg/L	0.24	0.020	A371136	1.9	0.040	A369840
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	13	2.0	A369972	17	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	12	0.10	A369034	14	0.10	A369034
RDL = Reportable Detection Limit							





### PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	99	110	105	105		A368849
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RDL = Reportable Detection Limit

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	108	101	103	99		A368849
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RDL = Reportable Detection Limit

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	0.13	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	105	107		A368849
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RDL = Reportable Detection Limit





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						



**SEMIVOLATILE ORGANICS BY GC-MS (WATER)**

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	0.068	0.031	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	0.024	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	101	109	114		A367343
D8-ACENAPHTHYLENE (sur.)	%	79	94	89		A367343
D8-NAPHTHALENE (sur.)	%	63	75	69		A367343
TERPHENYL-D14 (sur.)	%	110	117	128		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	120	130	126		A374080
2,4-DIBROMOPHENOL (sur.)	%	115	107	121		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	104	102	107		A367343
D8-ACENAPHTHYLENE (sur.)	%	102	77	84		A367343
D8-NAPHTHALENE (sur.)	%	86	63	71		A367343
TERPHENYL-D14 (sur.)	%	118	114	116		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	122	123	124		A374080
2,4-DIBROMOPHENOL (sur.)	%	119	114	118		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	102	105	101		A367343
D8-ACENAPHTHYLENE (sur.)	%	82	83	83		A367343
D8-NAPHTHALENE (sur.)	%	72	75	71		A367343
TERPHENYL-D14 (sur.)	%	110	115	111		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	112	121	116		A374080
2,4-DIBROMOPHENOL (sur.)	%	104	113	111		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Polycyclic Aromatics</b>				
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	0.10	A367343
Acridine	ug/L	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	0.050	A367343
Perylene	ug/L	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	0.20	A367343
Retene	ug/L	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	0.10	A367343
C3-Naphthalene	ug/L	0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	0.020	A367343
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
C1-fluorene	ug/L	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	0.039	0.020	A367343
C2-dibenzothiophene	ug/L	0.098	0.020	A367343
C3-dibenzothiophene	ug/L	0.029	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	0.036	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	0.011	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	0.10	A367343
<b>Phenols</b>				
2,3,4-trichlorophenol	mg/L	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
2,3,5-trichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	0.00010	A374080
2-methylphenol	mg/L	0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>				
D10-ANTHRACENE (sur.)	%	109		A367343
D8-ACENAPHTHYLENE (sur.)	%	93		A367343
D8-NAPHTHALENE (sur.)	%	74		A367343
TERPHENYL-D14 (sur.)	%	119		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	126		A374080
2,4-DIBROMOPHENOL (sur.)	%	125		A374080
RDL = Reportable Detection Limit				





### MERCURY BY COLD VAPOR (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch

Elements							
Dissolved Mercury (Hg)	ug/L	0.00094	0.00127	0.00087	0.00106	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00142	0.00220	0.00169	0.00149	0.00010	A371757

RDL = Reportable Detection Limit

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

Elements							
Dissolved Mercury (Hg)	ug/L	0.00079	0.00087	0.00076	0.00104	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00173	0.00143	0.00131	0.00133	0.00010	A371757

RDL = Reportable Detection Limit

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch

Elements					
Dissolved Mercury (Hg)	ug/L	0.00072	0.00122	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00122	0.00262	0.00010	A371757

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGW993		AGW994		AGW995		
Sampling Date		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
<b>Elements</b>								
Dissolved Calcium (Ca)	mg/L	37	0.30	16	0.30	31	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	0.060	0.070	0.060	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	0.20	10	0.20	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	0.0040	0.0040	0.0044	0.0040	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	0.30	12	0.30	4.4	0.30	A370547
Dissolved Sodium (Na)	mg/L	9.7	0.50	670	2.5	210	0.50	A370547
<b>Dissolved Metals by ICPMS</b>								
Dissolved Aluminum (Al)	ug/L	7.24	0.50	76.0	2.5	29.3	2.5	A376671
Dissolved Antimony (Sb)	ug/L	0.055	0.020	0.82	0.10	0.33	0.10	A376671
Dissolved Arsenic (As)	ug/L	0.280	0.020	9.87	0.10	3.57	0.10	A376671
Dissolved Barium (Ba)	ug/L	48.7	0.020	38.5	0.10	45.8	0.10	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	<0.050	0.050	<0.050	0.050	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Boron (B)	ug/L	30	10	1930	50	634	50	A376671
Dissolved Cadmium (Cd)	ug/L	0.0078	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	<0.50	0.50	<0.50	0.50	A376671
Dissolved Cobalt (Co)	ug/L	0.0963	0.0050	0.364	0.025	0.184	0.025	A376671
Dissolved Copper (Cu)	ug/L	0.612	0.050	<0.25	0.25	<0.25	0.25	A376671
Dissolved Iron (Fe)	ug/L	22.4	1.0	63.9	5.0	25.0	5.0	A376671
Dissolved Lead (Pb)	ug/L	0.0084	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Lithium (Li)	ug/L	4.71	0.50	90.9	2.5	31.4	2.5	A376671
Dissolved Manganese (Mn)	ug/L	3.34	0.050	4.86	0.25	1.70	0.25	A376671
Dissolved Molybdenum (Mo)	ug/L	0.977	0.050	750	0.25	228	0.25	A376671
Dissolved Nickel (Ni)	ug/L	1.00	0.020	4.75	0.10	3.38	0.10	A376671
Dissolved Selenium (Se)	ug/L	0.222	0.040	2.05	0.20	0.86	0.20	A376671
Dissolved Silicon (Si)	ug/L	1110	50	1260	250	1240	250	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Strontium (Sr)	ug/L	258	0.050	433	0.25	314	0.25	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	0.0020	<0.010	0.010	<0.010	0.010	A376671
Dissolved Tin (Sn)	ug/L	<0.20	0.20	<1.0	1.0	<1.0	1.0	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	<2.5	2.5	<2.5	2.5	A376671
Dissolved Uranium (U)	ug/L	0.423	0.0020	6.79	0.010	2.44	0.010	A376671
RDL = Reportable Detection Limit								



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

Bureau Veritas ID		AGW993		AGW994		AGW995		
Sampling Date		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	<0.20	0.20	1680	1.0	540	1.0	A376671
Dissolved Zinc (Zn)	ug/L	0.94	0.10	5.64	0.50	3.59	0.50	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	0.57	0.50	<0.50	0.50	A376671
Dissolved Calcium (Ca)	mg/L	32.5	0.050	13.9	0.25	26.9	0.25	A368394
Dissolved Magnesium (Mg)	mg/L	10.4	0.050	9.64	0.25	10.6	0.25	A368394
Dissolved Potassium (K)	mg/L	1.04	0.050	10.2	0.25	4.00	0.25	A368394
Dissolved Sodium (Na)	mg/L	9.16	0.050	624	0.25	207	0.25	A368394
Dissolved Sulphur (S)	mg/L	9.6	3.0	179	15	47	15	A368394
<b>Total Metals by ICPMS</b>								
Total Aluminum (Al)	ug/L	96.3	0.50	146	2.5	164	2.5	A376677
Total Antimony (Sb)	ug/L	0.052	0.020	0.74	0.10	0.33	0.10	A376677
Total Arsenic (As)	ug/L	0.340	0.020	9.73	0.10	3.58	0.10	A376677
Total Barium (Ba)	ug/L	47.0	0.020	39.4	0.10	49.2	0.10	A376677
Total Beryllium (Be)	ug/L	0.011	0.010	<0.050	0.050	<0.050	0.050	A376677
Total Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Boron (B)	ug/L	24	10	2090	50	618	50	A376677
Total Cadmium (Cd)	ug/L	0.0101	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Chromium (Cr)	ug/L	0.36	0.10	<0.50	0.50	<0.50	0.50	A376677
Total Cobalt (Co)	ug/L	0.177	0.0050	0.406	0.025	0.289	0.025	A376677
Total Copper (Cu)	ug/L	0.756	0.050	0.54	0.25	0.81	0.25	A376677
Total Iron (Fe)	ug/L	318	1.0	406	5.0	337	5.0	A376677
Total Lead (Pb)	ug/L	0.162	0.0050	0.093	0.025	0.131	0.025	A376677
Total Lithium (Li)	ug/L	4.73	0.50	86.1	2.5	32.9	2.5	A376677
Total Manganese (Mn)	ug/L	21.4	0.050	16.6	0.25	19.5	0.25	A376677
Total Molybdenum (Mo)	ug/L	0.843	0.050	668	0.25	242	0.25	A376677
Total Nickel (Ni)	ug/L	1.14	0.020	4.35	0.10	2.43	0.10	A376677
Total Selenium (Se)	ug/L	0.211	0.040	1.99	0.20	0.87	0.20	A376677
Total Silicon (Si)	ug/L	1280	50	1520	250	1540	250	A376677
Total Silver (Ag)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Strontium (Sr)	ug/L	226	0.050	415	0.25	338	0.25	A376677
Total Thallium (Tl)	ug/L	0.0059	0.0020	<0.010	0.010	<0.010	0.010	A376677
Total Tin (Sn)	ug/L	<0.20	0.20	<1.0	1.0	<1.0	1.0	A376677
Total Titanium (Ti)	ug/L	2.36	0.50	<2.5	2.5	4.2	2.5	A376677
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW993		AGW994		AGW995		
<b>Sampling Date</b>		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
<b>COC Number</b>		644187-01-01		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>MESOCOSM TABLE 1</b>	<b>RDL</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>
Total Uranium (U)	ug/L	0.407	0.0020	6.63	0.010	2.52	0.010	A376677
Total Vanadium (V)	ug/L	<0.20	0.20	1490	1.0	525	1.0	A376677
Total Zinc (Zn)	ug/L	2.14	0.10	5.76	0.50	7.73	0.50	A376677
Total Zirconium (Zr)	ug/L	<0.10	0.10	0.72	0.50	<0.50	0.50	A376677
Total Calcium (Ca)	mg/L	33.4	0.050	13.9	0.25	28.2	0.25	A368395
Total Magnesium (Mg)	mg/L	8.83	0.050	8.86	0.25	10.3	0.25	A368395
Total Potassium (K)	mg/L	0.953	0.050	9.47	0.25	4.06	0.25	A368395
Total Sodium (Na)	mg/L	8.03	0.050	561	0.25	206	0.25	A368395
Total Sulphur (S)	mg/L	7.3	3.0	180	15	65	15	A368395
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>						
Dissolved Calcium (Ca)	mg/L	35	A370547	36	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	A370547	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	A370547	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	A370547	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	2.2	A370547	1.5	0.30	A370547
Dissolved Sodium (Na)	mg/L	74	A370547	29	0.50	A370547
<b>Dissolved Metals by ICPMS</b>						
Dissolved Aluminum (Al)	ug/L	14.4	A376671	8.84	0.50	A376671
Dissolved Antimony (Sb)	ug/L	0.145	A376671	0.080	0.020	A376671
Dissolved Arsenic (As)	ug/L	1.31	A376671	0.634	0.020	A376671
Dissolved Barium (Ba)	ug/L	48.0	A376671	48.6	0.020	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	A376671	<0.010	0.010	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Boron (B)	ug/L	202	A376671	80	10	A376671
Dissolved Cadmium (Cd)	ug/L	<0.0050	A391916	0.0059	0.0050	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	A376671	<0.10	0.10	A376671
Dissolved Cobalt (Co)	ug/L	0.119	A376671	0.0948	0.0050	A376671
Dissolved Copper (Cu)	ug/L	0.633	A376671	0.715	0.050	A376671
Dissolved Iron (Fe)	ug/L	24.2	A376671	21.5	1.0	A376671
Dissolved Lead (Pb)	ug/L	0.0228	A376671	0.0136	0.0050	A376671
Dissolved Lithium (Li)	ug/L	13.3	A376671	7.28	0.50	A376671
Dissolved Manganese (Mn)	ug/L	1.27	A376671	1.23	0.050	A376671
Dissolved Molybdenum (Mo)	ug/L	73.4	A376671	23.6	0.050	A376671
Dissolved Nickel (Ni)	ug/L	1.32	A376671	0.998	0.020	A376671
Dissolved Selenium (Se)	ug/L	0.408	A376671	0.265	0.040	A376671
Dissolved Silicon (Si)	ug/L	1130	A376671	943	50	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Strontium (Sr)	ug/L	285	A376671	266	0.050	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	A376671	<0.0020	0.0020	A376671
Dissolved Tin (Sn)	ug/L	<0.20	A376671	<0.20	0.20	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	A376671	<0.50	0.50	A376671
Dissolved Uranium (U)	ug/L	1.07	A376671	0.626	0.0020	A376671
RDL = Reportable Detection Limit						





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Vanadium (V)	ug/L	171	A376671	53.8	0.20	A376671
Dissolved Zinc (Zn)	ug/L	6.96	A376671	0.82	0.10	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	A376671	<0.10	0.10	A376671
Dissolved Calcium (Ca)	mg/L	31.1	A368394	32.1	0.050	A368394
Dissolved Magnesium (Mg)	mg/L	10.3	A368394	10.5	0.050	A368394
Dissolved Potassium (K)	mg/L	1.95	A368394	1.35	0.050	A368394
Dissolved Sodium (Na)	mg/L	69.3	A368394	28.7	0.050	A368394
Dissolved Sulphur (S)	mg/L	27.4	A368394	14.1	3.0	A368394
<b>Total Metals by ICPMS</b>						
Total Aluminum (Al)	ug/L	165	A376677	128	0.50	A376677
Total Antimony (Sb)	ug/L	0.117	A376677	0.090	0.020	A376677
Total Arsenic (As)	ug/L	1.21	A376677	0.742	0.020	A376677
Total Barium (Ba)	ug/L	45.7	A376677	51.5	0.020	A376677
Total Beryllium (Be)	ug/L	0.013	A376677	<0.010	0.010	A376677
Total Bismuth (Bi)	ug/L	<0.0050	A376677	<0.0050	0.0050	A376677
Total Boron (B)	ug/L	213	A376677	117	10	A376677
Total Cadmium (Cd)	ug/L	<0.0050	A376677	0.0126	0.0050	A376677
Total Chromium (Cr)	ug/L	0.27	A376677	0.23	0.10	A376677
Total Cobalt (Co)	ug/L	0.179	A376677	0.197	0.0050	A376677
Total Copper (Cu)	ug/L	0.724	A376677	0.871	0.050	A376677
Total Iron (Fe)	ug/L	315	A376677	292	1.0	A376677
Total Lead (Pb)	ug/L	0.145	A376677	0.174	0.0050	A376677
Total Lithium (Li)	ug/L	13.3	A376677	7.45	0.50	A376677
Total Manganese (Mn)	ug/L	17.1	A376677	20.4	0.050	A376677
Total Molybdenum (Mo)	ug/L	61.7	A376677	23.4	0.050	A376677
Total Nickel (Ni)	ug/L	1.23	A376677	1.36	0.020	A376677
Total Selenium (Se)	ug/L	0.438	A376677	0.258	0.040	A376677
Total Silicon (Si)	ug/L	1420	A376677	1350	50	A376677
Total Silver (Ag)	ug/L	<0.0050	A376677	<0.0050	0.0050	A376677
Total Strontium (Sr)	ug/L	244	A376677	268	0.050	A376677
Total Thallium (Tl)	ug/L	0.0058	A376677	0.0024	0.0020	A376677
Total Tin (Sn)	ug/L	<0.20	A376677	<0.20	0.20	A376677
Total Titanium (Ti)	ug/L	4.36	A376677	3.23	0.50	A376677
RDL = Reportable Detection Limit						





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
Total Uranium (U)	ug/L	0.982	A376677	0.636	0.0020	A376677
Total Vanadium (V)	ug/L	138	A376677	53.4	0.20	A376677
Total Zinc (Zn)	ug/L	1.42	A376677	3.37	0.10	A376677
Total Zirconium (Zr)	ug/L	0.22	A376677	0.23	0.10	A376677
Total Calcium (Ca)	mg/L	31.6	A368395	32.6	0.050	A368395
Total Magnesium (Mg)	mg/L	8.74	A368395	10.4	0.050	A368395
Total Potassium (K)	mg/L	1.73	A368395	1.35	0.050	A368395
Total Sodium (Na)	mg/L	59.6	A368395	28.1	0.050	A368395
Total Sulphur (S)	mg/L	20.3	A368395	10.2	3.0	A368395
RDL = Reportable Detection Limit						





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW998			AGW999		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	37	0.30	A370547	37	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A370547	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	0.20	A370547	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A370547	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	0.30	A370547	1.2	0.30	A370547
Dissolved Sodium (Na)	mg/L	17	0.50	A370547	11	0.50	A370547
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	7.11	0.50	A376671	7.84	0.50	A376671
Dissolved Antimony (Sb)	ug/L	0.064	0.020	A376671	0.052	0.020	A376671
Dissolved Arsenic (As)	ug/L	0.435	0.020	A376671	0.345	0.020	A376671
Dissolved Barium (Ba)	ug/L	48.2	0.020	A376671	48.4	0.020	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A376671	<0.010	0.010	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Boron (B)	ug/L	45	10	A376671	29	10	A376671
Dissolved Cadmium (Cd)	ug/L	0.0078	0.0050	A376671	0.0125	0.0050	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	A376671	<0.10	0.10	A376671
Dissolved Cobalt (Co)	ug/L	0.0861	0.0050	A376671	0.0878	0.0050	A376671
Dissolved Copper (Cu)	ug/L	0.654	0.050	A376671	0.692	0.050	A376671
Dissolved Iron (Fe)	ug/L	25.2	1.0	A376671	24.9	1.0	A376671
Dissolved Lead (Pb)	ug/L	0.0103	0.0050	A376671	0.0147	0.0050	A376671
Dissolved Lithium (Li)	ug/L	5.65	0.50	A376671	4.88	0.50	A376671
Dissolved Manganese (Mn)	ug/L	1.39	0.050	A376671	1.38	0.050	A376671
Dissolved Molybdenum (Mo)	ug/L	8.59	0.050	A376671	2.61	0.050	A376671
Dissolved Nickel (Ni)	ug/L	0.951	0.020	A376671	0.918	0.020	A376671
Dissolved Selenium (Se)	ug/L	0.245	0.040	A376671	0.222	0.040	A376671
Dissolved Silicon (Si)	ug/L	875	50	A376671	896	50	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Strontium (Sr)	ug/L	255	0.050	A376671	257	0.050	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	0.0020	A376671	<0.0020	0.0020	A376671
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A376671	<0.20	0.20	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A376671	<0.50	0.50	A376671
Dissolved Uranium (U)	ug/L	0.498	0.0020	A376671	0.446	0.0020	A376671
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGW998			AGW999		
Sampling Date		2021/09/24 11:10			2021/09/24 11:10		
COC Number		644187-01-01			644187-01-01		
	UNITS	MESOCOSM TABLE 5	RDL	QC Batch	MESOCOSM TABLE 6	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	17.6	0.20	A376671	3.95	0.20	A376671
Dissolved Zinc (Zn)	ug/L	0.87	0.10	A376671	1.05	0.10	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A376671	<0.10	0.10	A376671
Dissolved Calcium (Ca)	mg/L	32.1	0.050	A368394	32.4	0.050	A368394
Dissolved Magnesium (Mg)	mg/L	10.2	0.050	A368394	10.6	0.050	A368394
Dissolved Potassium (K)	mg/L	1.13	0.050	A368394	1.07	0.050	A368394
Dissolved Sodium (Na)	mg/L	15.5	0.050	A368394	10.7	0.050	A368394
Dissolved Sulphur (S)	mg/L	12.2	3.0	A368394	9.6	3.0	A368394
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	157	3.0	A371010	73.1	2.5	A376677
Total Antimony (Sb)	ug/L	0.065	0.020	A371010	<0.10	0.10	A376677
Total Arsenic (As)	ug/L	0.517	0.020	A371010	0.34	0.10	A376677
Total Barium (Ba)	ug/L	52.3	0.050	A371010	49.1	0.10	A376677
Total Beryllium (Be)	ug/L	0.012	0.010	A371010	<0.050	0.050	A376677
Total Bismuth (Bi)	ug/L	<0.010	0.010	A371010	<0.025	0.025	A376677
Total Boron (B)	ug/L	53	10	A371010	<50	50	A376677
Total Cadmium (Cd)	ug/L	0.0132	0.0050	A371010	<0.025	0.025	A376677
Total Chromium (Cr)	ug/L	0.38	0.10	A371010	<0.50	0.50	A376677
Total Cobalt (Co)	ug/L	0.206	0.010	A371010	0.180	0.025	A376677
Total Copper (Cu)	ug/L	1.08	0.10	A371010	0.75	0.25	A376677
Total Iron (Fe)	ug/L	360	5.0	A371010	261	5.0	A376677
Total Lead (Pb)	ug/L	0.171	0.020	A371010	0.169	0.025	A376677
Total Lithium (Li)	ug/L	6.25	0.50	A371010	4.4	2.5	A376677
Total Manganese (Mn)	ug/L	22.2	0.10	A371010	19.7	0.25	A376677
Total Molybdenum (Mo)	ug/L	8.28	0.050	A371010	2.29	0.25	A376677
Total Nickel (Ni)	ug/L	1.30	0.10	A371010	0.87	0.10	A376677
Total Phosphorus (P)	ug/L	26.1	5.0	A371010			
Total Selenium (Se)	ug/L	0.300	0.040	A371010	0.23	0.20	A376677
Total Silicon (Si)	ug/L	1440	50	A371010	1100	250	A376677
Total Silver (Ag)	ug/L	<0.010	0.010	A371010	<0.025	0.025	A376677
Total Strontium (Sr)	ug/L	272	0.050	A371010	239	0.25	A376677
Total Thallium (Tl)	ug/L	0.0068	0.0020	A371010	<0.010	0.010	A376677
Total Tin (Sn)	ug/L	<0.20	0.20	A371010	<1.0	1.0	A376677
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW998			AGW999		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
Total Titanium (Ti)	ug/L	3.3	2.0	A371010	<2.5	2.5	A376677
Total Uranium (U)	ug/L	0.520	0.0050	A371010	0.448	0.010	A376677
Total Vanadium (V)	ug/L	18.8	0.20	A371010	2.0	1.0	A376677
Total Zinc (Zn)	ug/L	2.7	1.5	A371010	0.93	0.50	A376677
Total Zirconium (Zr)	ug/L	0.18	0.10	A371010	<0.50	0.50	A376677
Total Calcium (Ca)	mg/L	34.5	0.25	A368395	32.6	0.25	A368395
Total Magnesium (Mg)	mg/L	11.4	0.25	A368395	9.71	0.25	A368395
Total Potassium (K)	mg/L	1.21	0.25	A368395	0.99	0.25	A368395
Total Sodium (Na)	mg/L	16.6	0.25	A368395	9.63	0.25	A368395
Total Sulphur (S)	mg/L	6.2	3.0	A368395	<15	15	A368395
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	37	37	0.30	16	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	11	0.20	10	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	<0.0040	0.0040	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	1.1	0.30	11	0.30	A370547
Dissolved Sodium (Na)	mg/L	9.7	9.7	0.50	660	2.5	A370547
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	7.38	8.65	0.50	72.3	2.5	A376671
Dissolved Antimony (Sb)	ug/L	0.053	0.051	0.020	0.93	0.10	A376671
Dissolved Arsenic (As)	ug/L	0.287	0.311	0.020	10.5	0.10	A376671
Dissolved Barium (Ba)	ug/L	48.3	48.6	0.020	38.3	0.10	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	<0.0050	0.0050	<0.025	0.025	A376671
Dissolved Boron (B)	ug/L	23	41	10	1950	50	A376671
Dissolved Cadmium (Cd)	ug/L	0.0096	0.0066	0.0050	<0.025	0.025	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	<0.10	0.10	<0.50	0.50	A376671
Dissolved Cobalt (Co)	ug/L	0.0826	0.0840	0.0050	0.390	0.025	A376671
Dissolved Copper (Cu)	ug/L	0.719	0.705	0.050	<0.25	0.25	A376671
Dissolved Iron (Fe)	ug/L	25.6	25.9	1.0	73.3	5.0	A376671
Dissolved Lead (Pb)	ug/L	0.0134	0.0138	0.0050	<0.025	0.025	A376671
Dissolved Lithium (Li)	ug/L	4.70	4.66	0.50	92.2	2.5	A376671
Dissolved Manganese (Mn)	ug/L	1.56	1.52	0.050	4.99	0.25	A376671
Dissolved Molybdenum (Mo)	ug/L	0.978	1.01	0.050	755	0.25	A376671
Dissolved Nickel (Ni)	ug/L	0.867	0.903	0.020	4.81	0.10	A376671
Dissolved Selenium (Se)	ug/L	0.170	0.197	0.040	2.17	0.20	A376671
Dissolved Silicon (Si)	ug/L	848	900	50	1280	250	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	<0.0050	0.0050	<0.025	0.025	A376671
Dissolved Strontium (Sr)	ug/L	257	253	0.050	450	0.25	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	<0.0020	0.0020	<0.010	0.010	A376671
Dissolved Tin (Sn)	ug/L	<0.20	<0.20	0.20	<1.0	1.0	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	<0.50	0.50	<2.5	2.5	A376671
Dissolved Uranium (U)	ug/L	0.422	0.426	0.0020	6.96	0.010	A376671
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	<0.20	<0.20	0.20	1700	1.0	A376671
Dissolved Zinc (Zn)	ug/L	0.80	1.01	0.10	4.38	0.50	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	<0.10	0.10	0.62	0.50	A376671
Dissolved Calcium (Ca)	mg/L	32.6	32.4	0.050	14.5	0.25	A368394
Dissolved Magnesium (Mg)	mg/L	10.5	10.4	0.050	9.73	0.25	A368394
Dissolved Potassium (K)	mg/L	1.06	1.03	0.050	10.4	0.25	A368394
Dissolved Sodium (Na)	mg/L	9.27	9.22	0.050	630	0.25	A368394
Dissolved Sulphur (S)	mg/L	9.9	10.3	3.0	178	15	A368394
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	142	183	3.0	176	15	A371010
Total Antimony (Sb)	ug/L	0.079	0.072	0.020	0.97	0.10	A371010
Total Arsenic (As)	ug/L	0.377	0.355	0.020	10.4	0.10	A371010
Total Barium (Ba)	ug/L	53.3	52.6	0.050	46.9	0.25	A371010
Total Beryllium (Be)	ug/L	0.014	0.021	0.010	0.058	0.050	A371010
Total Bismuth (Bi)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A371010
Total Boron (B)	ug/L	28	52	10	2150	50	A371010
Total Cadmium (Cd)	ug/L	0.0119	0.0110	0.0050	<0.025	0.025	A371010
Total Chromium (Cr)	ug/L	0.39	0.44	0.10	<0.50	0.50	A371010
Total Cobalt (Co)	ug/L	0.216	0.213	0.010	0.608	0.050	A371010
Total Copper (Cu)	ug/L	1.02	1.02	0.10	2.78	0.50	A371010
Total Iron (Fe)	ug/L	366	401	5.0	1050	25	A371010
Total Lead (Pb)	ug/L	0.187	0.184	0.020	0.26	0.10	A371010
Total Lithium (Li)	ug/L	5.40	5.41	0.50	102	2.5	A371010
Total Manganese (Mn)	ug/L	23.0	24.0	0.10	33.6	0.50	A371010
Total Molybdenum (Mo)	ug/L	0.895	0.928	0.050	740	0.25	A371010
Total Nickel (Ni)	ug/L	1.18	1.26	0.10	5.77	0.50	A371010
Total Phosphorus (P)	ug/L	25.2	27.1	5.0	122	25	A371010
Total Selenium (Se)	ug/L	0.239	0.269	0.040	2.34	0.20	A371010
Total Silicon (Si)	ug/L	1420	1470	50	1750	250	A371010
Total Silver (Ag)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A371010
Total Strontium (Sr)	ug/L	277	275	0.050	495	0.25	A371010
Total Thallium (Tl)	ug/L	0.0074	0.0082	0.0020	<0.010	0.010	A371010
Total Tin (Sn)	ug/L	<0.20	<0.20	0.20	<1.0	1.0	A371010
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
Total Titanium (Ti)	ug/L	3.7	2.9	2.0	<10	10	A371010
Total Uranium (U)	ug/L	0.453	0.457	0.0050	7.16	0.025	A371010
Total Vanadium (V)	ug/L	0.73	0.86	0.20	1710	1.0	A371010
Total Zinc (Zn)	ug/L	4.1	4.3	1.5	11.4	7.5	A371010
Total Zirconium (Zr)	ug/L	0.50	0.21	0.10	0.80	0.50	A371010
Total Calcium (Ca)	mg/L	35.2	34.8	0.25	15.9	1.3	A368395
Total Magnesium (Mg)	mg/L	11.5	11.3	0.25	10.4	1.3	A368395
Total Potassium (K)	mg/L	1.14	1.14	0.25	10.9	1.3	A368395
Total Sodium (Na)	mg/L	9.88	9.70	0.25	647	1.3	A368395
Total Sulphur (S)	mg/L	7.5	6.8	3.0	171	15	A368395
RDL = Reportable Detection Limit							



**VOLATILE ORGANICS BY GC-MS (WATER)**

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch
<b>Volatiles</b>							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	108	106	106	107		A368854
4-Bromofluorobenzene (sur.)	%	99	98	98	99		A368854
D4-1,2-Dichloroethane (sur.)	%	98	98	97	99		A368854
1,4-Difluorobenzene (sur.)	%	97	97	97	97		A368866
4-Bromofluorobenzene (sur.)	%	98	97	98	98		A368866
D4-1,2-Dichloroethane (sur.)	%	109	109	108	110		A368866
RDL = Reportable Detection Limit							



**VOLATILE ORGANICS BY GC-MS (WATER)**

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

Volatiles							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866

RDL = Reportable Detection Limit





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	106	107	108	107		A368854
4-Bromofluorobenzene (sur.)	%	98	100	99	98		A368854
D4-1,2-Dichloroethane (sur.)	%	98	99	99	98		A368854
1,4-Difluorobenzene (sur.)	%	97	96	96	97		A368866
4-Bromofluorobenzene (sur.)	%	98	99	99	99		A368866
D4-1,2-Dichloroethane (sur.)	%	108	108	107	108		A368866
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch
<b>Volatiles</b>					
Total Trihalomethanes	ug/L	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	0.50	A368866
RDL = Reportable Detection Limit					





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene (sur.)	%	108	106		A368854
4-Bromofluorobenzene (sur.)	%	98	99		A368854
D4-1,2-Dichloroethane (sur.)	%	99	100		A368854
1,4-Difluorobenzene (sur.)	%	96	97		A368866
4-Bromofluorobenzene (sur.)	%	99	100		A368866
D4-1,2-Dichloroethane (sur.)	%	110	108		A368866
RDL = Reportable Detection Limit					





## GENERAL COMMENTS

Sample AGW993 [RIVER WATER TANK] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW994 [MESOCOSM TABLE 1] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW995 [MESOCOSM TABLE 2] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW996 [MESOCOSM TABLE 3] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW997 [MESOCOSM TABLE 4] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW998 [MESOCOSM TABLE 5] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW999 [MESOCOSM TABLE 6] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGX000 [MESOCOSM TABLE 7] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Alkalinity @25C (pp, total), CO<sub>3</sub>,HCO<sub>3</sub>,OH.

Sample AGX001 [MESOCOSM TABLE 8] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGX002 [TREATED OSPW TANK] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.





**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments**

Sample AGW994 [MESOCOSM TABLE 1] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.  
Sample AGW994 [MESOCOSM TABLE 1] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.  
Sample AGW995 [MESOCOSM TABLE 2] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.  
Sample AGW995 [MESOCOSM TABLE 2] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.  
Sample AGW999 [MESOCOSM TABLE 6] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.  
Sample AGX002 [TREATED OSPW TANK] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.  
Sample AGX002 [TREATED OSPW TANK] Elements by ICPMS Digested LL (total): Detection limits raised due to sample matrix.

**VOLATILE ORGANICS BY GC-MS (WATER) Comments**

Sample AGW993 [RIVER WATER TANK] BTEX/F1 in Water by HS GC/MS/FID: Headspace in sample container was noted at the time of extraction  
Sample AGW993, Chloride/Sulphate by Auto Colourimetry: Test repeated.  
Sample AGW995, Chloride/Sulphate by Auto Colourimetry: Test repeated.  
Sample AGX000, Chloride/Sulphate by Auto Colourimetry: Test repeated.  
Sample AGW996, Elements by ICPMS Low Level (dissolved): Test repeated.

**Results relate only to the items tested.**





## QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	Matrix Spike		D10-ANTHRACENE (sur.)	2021/10/02		121	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		105	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		76	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		133 (1)	%	50 - 130
				Acenaphthene	2021/10/02		114	%	50 - 130
				Acenaphthylene	2021/10/02		116	%	50 - 130
				Acridine	2021/10/02		96	%	50 - 130
				Anthracene	2021/10/02		93	%	50 - 130
				Benzo(a)anthracene	2021/10/02		99	%	50 - 130
				Benzo(b&j)fluoranthene	2021/10/02		97	%	50 - 130
				Benzo(k)fluoranthene	2021/10/02		97	%	50 - 130
				Benzo(g,h,i)perylene	2021/10/02		84	%	50 - 130
				Benzo(c)phenanthrene	2021/10/02		105	%	50 - 130
				Benzo(a)pyrene	2021/10/02		91	%	50 - 130
				Benzo(e)pyrene	2021/10/02		97	%	50 - 130
				Chrysene	2021/10/02		92	%	50 - 130
				Dibenz(a,h)anthracene	2021/10/02		89	%	50 - 130
				Fluoranthene	2021/10/02		118	%	50 - 130
				Fluorene	2021/10/02		122	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/10/02		91	%	50 - 130
				2-Methylnaphthalene	2021/10/02		105	%	50 - 130
				Naphthalene	2021/10/02		106	%	50 - 130
				Phenanthrene	2021/10/02		113	%	50 - 130
				Perylene	2021/10/02		92	%	50 - 130
				Pyrene	2021/10/02		116	%	50 - 130
				Quinoline	2021/10/02		126	%	50 - 130
				C1-Naphthalene	2021/10/02		103	%	50 - 130
				C3-Naphthalene	2021/10/02		115	%	50 - 130
				C2-Naphthalene	2021/10/02		107	%	50 - 130
				C1-biphenyl	2021/10/02		103	%	50 - 130
				C1 phenanthrene/anthracene	2021/10/02		116	%	50 - 130
				C2 phenanthrene/anthracene	2021/10/02		115	%	50 - 130
				C1 fluoranthene/pyrene	2021/10/02		111	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/10/02		21 (1)	%	30 - 130
				1-Methylnaphthalene	2021/10/02		103	%	50 - 130
A367343	JU2	Spiked Blank		D10-ANTHRACENE (sur.)	2021/10/02		103	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		81	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		63	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		116	%	50 - 130
				Acenaphthene	2021/10/02		89	%	50 - 130
				Acenaphthylene	2021/10/02		90	%	50 - 130
				Acridine	2021/10/02		84	%	50 - 130
				Anthracene	2021/10/02		84	%	50 - 130
				Benzo(a)anthracene	2021/10/02		104	%	50 - 130
				Benzo(b&j)fluoranthene	2021/10/02		109	%	50 - 130
				Benzo(k)fluoranthene	2021/10/02		108	%	50 - 130
				Benzo(g,h,i)perylene	2021/10/02		100	%	50 - 130
				Benzo(c)phenanthrene	2021/10/02		101	%	50 - 130
				Benzo(a)pyrene	2021/10/02		104	%	50 - 130
				Benzo(e)pyrene	2021/10/02		109	%	50 - 130
				Chrysene	2021/10/02		100	%	50 - 130
				Dibenz(a,h)anthracene	2021/10/02		106	%	50 - 130
				Fluoranthene	2021/10/02		110	%	50 - 130
				Fluorene	2021/10/02		94	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/10/02		108	%	50 - 130





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	Method Blank		2-Methylnaphthalene	2021/10/02		83	%	50 - 130
				Naphthalene	2021/10/02		82	%	50 - 130
				Phenanthrene	2021/10/02		97	%	50 - 130
				Perylene	2021/10/02		108	%	50 - 130
				Pyrene	2021/10/02		110	%	50 - 130
				Quinoline	2021/10/02		119	%	50 - 130
				C1-Naphthalene	2021/10/02		79	%	50 - 130
				C3-Naphthalene	2021/10/02		84	%	50 - 130
				C2-Naphthalene	2021/10/02		81	%	50 - 130
				C1-biphenyl	2021/10/02		74	%	50 - 130
				C1 phenanthrene/anthracene	2021/10/02		108	%	50 - 130
				C2 phenanthrene/anthracene	2021/10/02		113	%	50 - 130
				C1 fluoranthene/pyrene	2021/10/02		113	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/10/02		20 (1)	%	30 - 130
				1-Methylnaphthalene	2021/10/02		79	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/10/02		100	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		79	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		60	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		117	%	50 - 130
				Acenaphthene	2021/10/02	<0.10		ug/L	
				Acenaphthylene	2021/10/02	<0.10		ug/L	
				Acridine	2021/10/02	<0.040		ug/L	
				Anthracene	2021/10/02	<0.010		ug/L	
				Benzo(a)anthracene	2021/10/02	<0.0085		ug/L	
				Benzo(b&j)fluoranthene	2021/10/02	<0.0085		ug/L	
				Benzo(k)fluoranthene	2021/10/02	<0.0085		ug/L	
				Benzo(g,h,i)perylene	2021/10/02	<0.0085		ug/L	
				Benzo(c)phenanthrene	2021/10/02	<0.050		ug/L	
				Benzo(a)pyrene	2021/10/02	<0.0075		ug/L	
				Benzo(e)pyrene	2021/10/02	<0.050		ug/L	
				Chrysene	2021/10/02	<0.0085		ug/L	
				Dibenz(a,h)anthracene	2021/10/02	<0.0075		ug/L	
				Fluoranthene	2021/10/02	<0.010		ug/L	
				Fluorene	2021/10/02	<0.050		ug/L	
				Indeno(1,2,3-cd)pyrene	2021/10/02	<0.0085		ug/L	
				Indeno(1,2,3-cd)fluoranthene	2021/10/02	<0.0085		ug/L	
				2-Methylnaphthalene	2021/10/02	<0.10		ug/L	
				Naphthalene	2021/10/02	<0.10		ug/L	
				Phenanthrene	2021/10/02	<0.050		ug/L	
				Perylene	2021/10/02	<0.050		ug/L	
				Pyrene	2021/10/02	<0.020		ug/L	
				Quinoline	2021/10/02	<0.20		ug/L	
				Retene	2021/10/02	<0.050		ug/L	
				C1-Naphthalene	2021/10/02	<0.10		ug/L	
				C3-Naphthalene	2021/10/02	<0.10		ug/L	
				C4-Naphthalene	2021/10/02	<0.10		ug/L	
				C2-Naphthalene	2021/10/02	<0.10		ug/L	
				Biphenyl	2021/10/02	<0.020		ug/L	
				C1-biphenyl	2021/10/02	<0.020		ug/L	
				C2-biphenyl	2021/10/02	<0.020		ug/L	
				C1-fluorene	2021/10/02	<0.050		ug/L	
				C2-fluorene	2021/10/02	<0.050		ug/L	
				C3-fluorene	2021/10/02	<0.050		ug/L	
				Dibenzothiophene	2021/10/02	<0.020		ug/L	
				C1-dibenzothiophene	2021/10/02	<0.020		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	RPD		C2-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C3-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C4-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C1 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C2 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C3 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C4 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C1 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C2 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C3 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C4 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C1 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C2 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C3 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C4 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C1benzobkfluoranthene/benzoapyrene	2021/10/02	<0.0075		ug/L	
				C2benzobkfluoranthene/benzoapyrene	2021/10/02	<0.0075		ug/L	
				C1-Acenaphthene	2021/10/02	<0.10		ug/L	
				1-Methylnaphthalene	2021/10/02	<0.10		ug/L	
				Acenaphthene	2021/10/02	NC		%	30
				Acenaphthylene	2021/10/02	NC		%	30
				Acridine	2021/10/02	NC		%	30
				Anthracene	2021/10/02	NC		%	30
				Benzo(a)anthracene	2021/10/02	NC		%	30
				Benzo(b&j)fluoranthene	2021/10/02	NC		%	30
				Benzo(k)fluoranthene	2021/10/02	NC		%	30
				Benzo(g,h,i)perylene	2021/10/02	NC		%	30
				Benzo(c)phenanthrene	2021/10/02	NC		%	30
				Benzo(a)pyrene	2021/10/02	NC		%	30
				Benzo(e)pyrene	2021/10/02	NC		%	30
				Chrysene	2021/10/02	NC		%	30
				Dibenz(a,h)anthracene	2021/10/02	NC		%	30
				Fluoranthene	2021/10/02	NC		%	30
				Fluorene	2021/10/02	NC		%	30
				Indeno(1,2,3-cd)pyrene	2021/10/02	NC		%	30
				Indeno(1,2,3-cd)fluoranthene	2021/10/02	NC		%	30
				2-Methylnaphthalene	2021/10/02	NC		%	30
				Naphthalene	2021/10/02	NC		%	30
				Phenanthrene	2021/10/02	8.6		%	30
				Perylene	2021/10/02	NC		%	30
				Pyrene	2021/10/02	NC		%	30
				Quinoline	2021/10/02	NC		%	30
				Retene	2021/10/02	NC		%	30
				C1-Naphthalene	2021/10/02	NC		%	30
				C3-Naphthalene	2021/10/02	NC		%	30
				C4-Naphthalene	2021/10/02	NC		%	30
				C2-Naphthalene	2021/10/02	NC		%	30
				Biphenyl	2021/10/02	NC		%	30
				C1-biphenyl	2021/10/02	NC		%	30
				C2-biphenyl	2021/10/02	93 (1)		%	30
				C1-fluorene	2021/10/02	0.60		%	30
				C2-fluorene	2021/10/02	24		%	30
				C3-fluorene	2021/10/02	5.9		%	30
				Dibenzothiophene	2021/10/02	NC		%	30
				C1-dibenzothiophene	2021/10/02	3.9		%	30





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				C2-dibenzothiophene	2021/10/02	12		%	30
				C3-dibenzothiophene	2021/10/02	17		%	30
				C4-dibenzothiophene	2021/10/02	NC		%	30
				C1 phenanthrene/anthracene	2021/10/02	14		%	30
				C2 phenanthrene/anthracene	2021/10/02	14		%	30
				C3 phenanthrene/anthracene	2021/10/02	18		%	30
				C4 phenanthrene/anthracene	2021/10/02	NC		%	30
				C1 fluoranthene/pyrene	2021/10/02	NC		%	30
				C2 fluoranthene/pyrene	2021/10/02	NC		%	30
				C3 fluoranthene/pyrene	2021/10/02	NC		%	30
				C4 fluoranthene/pyrene	2021/10/02	NC		%	30
				C1 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
				C2 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
				C3 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
				C4 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
				C1benzobkfluoranthene/benzoapyrene	2021/10/02	NC		%	30
				C2benzobkfluoranthene/benzoapyrene	2021/10/02	NC		%	30
				C1-Acenaphthene	2021/10/02	NC		%	30
				1-Methylnaphthalene	2021/10/02	NC		%	30
A367832	BYM		Spiked Blank	Biochemical Oxygen Demand	2021/10/03		89	%	85 - 115
A367832	BYM		Method Blank	Biochemical Oxygen Demand	2021/10/03	<2.0		mg/L	
A367832	BYM		RPD	Biochemical Oxygen Demand	2021/10/03	0.54		%	20
A368849	MHF		Matrix Spike [AGW993-14]	O-TERPHENYL (sur.)	2021/10/02		97	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/10/02		96	%	60 - 140
				F3 (C16-C34 Hydrocarbons)	2021/10/02		97	%	60 - 140
				F4 (C34-C50 Hydrocarbons)	2021/10/02		98	%	60 - 140
A368849	MHF		Spiked Blank	O-TERPHENYL (sur.)	2021/10/02		109	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/10/02		106	%	60 - 140
				F3 (C16-C34 Hydrocarbons)	2021/10/02		109	%	60 - 140
				F4 (C34-C50 Hydrocarbons)	2021/10/02		108	%	60 - 140
A368849	MHF		Method Blank	O-TERPHENYL (sur.)	2021/10/02		100	%	60 - 140
				F2 (C10-C16 Hydrocarbons)	2021/10/02	<0.10		mg/L	
				F3 (C16-C34 Hydrocarbons)	2021/10/02	<0.10		mg/L	
				F4 (C34-C50 Hydrocarbons)	2021/10/02	<0.20		mg/L	
A368849	MHF		RPD [AGX002-14]	F2 (C10-C16 Hydrocarbons)	2021/10/02	NC		%	30
				F3 (C16-C34 Hydrocarbons)	2021/10/02	29		%	30
				F4 (C34-C50 Hydrocarbons)	2021/10/02	NC		%	30
A368854	DO1		Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/01		93	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		95	%	50 - 140
				Benzene	2021/10/01		89	%	50 - 140
				Toluene	2021/10/01		84	%	50 - 140
				Ethylbenzene	2021/10/01		88	%	50 - 140
				m & p-Xylene	2021/10/01		88	%	50 - 140
				o-Xylene	2021/10/01		89	%	50 - 140
				F1 (C6-C10)	2021/10/01		93	%	60 - 140
A368854	DO1		Spiked Blank	1,4-Difluorobenzene (sur.)	2021/10/01		94	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		96	%	50 - 140
				Benzene	2021/10/01		89	%	60 - 130
				Toluene	2021/10/01		83	%	60 - 130
				Ethylbenzene	2021/10/01		88	%	60 - 130
				m & p-Xylene	2021/10/01		87	%	60 - 130
				o-Xylene	2021/10/01		89	%	60 - 130





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A368854	DO1	Method Blank	F1 (C6-C10)	2021/10/01		101	%	60 - 140
			1,4-Difluorobenzene (sur.)	2021/10/01		107	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		100	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		99	%	50 - 140
			Benzene	2021/10/01	<0.40		ug/L	
			Toluene	2021/10/01	<0.40		ug/L	
			Ethylbenzene	2021/10/01	<0.40		ug/L	
			m & p-Xylene	2021/10/01	<0.80		ug/L	
			o-Xylene	2021/10/01	<0.40		ug/L	
			F1 (C6-C10)	2021/10/01	<100		ug/L	
A368854	DO1	RPD	Benzene	2021/10/01	NC		%	30
			Toluene	2021/10/01	NC		%	30
			Ethylbenzene	2021/10/01	NC		%	30
			m & p-Xylene	2021/10/01	NC		%	30
			o-Xylene	2021/10/01	NC		%	30
			F1 (C6-C10)	2021/10/01	NC		%	30
A368866	QW1	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/01		104	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		104	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		99	%	50 - 140
			Bromodichloromethane	2021/10/01		99	%	50 - 140
			Bromoform	2021/10/01		97	%	50 - 140
			Bromomethane	2021/10/01		112	%	50 - 140
			Carbon tetrachloride	2021/10/01		102	%	50 - 140
			Chlorobenzene	2021/10/01		100	%	50 - 140
			Dibromochloromethane	2021/10/01		104	%	50 - 140
			Chloroethane	2021/10/01		91	%	50 - 140
			Chloroform	2021/10/01		96	%	50 - 140
			Chloromethane	2021/10/01		122	%	50 - 140
			1,2-dibromoethane	2021/10/01		94	%	50 - 140
			1,2-dichlorobenzene	2021/10/01		105	%	50 - 140
			1,3-dichlorobenzene	2021/10/01		101	%	50 - 140
			1,4-dichlorobenzene	2021/10/01		101	%	50 - 140
			1,1-dichloroethane	2021/10/01		95	%	50 - 140
			1,2-dichloroethane	2021/10/01		105	%	50 - 140
			1,1-dichloroethene	2021/10/01		99	%	50 - 140
			cis-1,2-dichloroethene	2021/10/01		102	%	50 - 140
			trans-1,2-dichloroethene	2021/10/01		92	%	50 - 140
			Dichloromethane	2021/10/01		95	%	50 - 140
			1,2-dichloropropane	2021/10/01		103	%	50 - 140
			cis-1,3-dichloropropene	2021/10/01		127	%	50 - 140
			trans-1,3-dichloropropene	2021/10/01		139	%	50 - 140
			Methyl methacrylate	2021/10/01		106	%	50 - 140
			Methyl-tert-butylether (MTBE)	2021/10/01		102	%	50 - 140
			Styrene	2021/10/01		93	%	50 - 140
			1,1,1,2-tetrachloroethane	2021/10/01		96	%	50 - 140
			1,1,2,2-tetrachloroethane	2021/10/01		100	%	50 - 140
			Tetrachloroethene	2021/10/01		87	%	50 - 140
			1,2,3-trichlorobenzene	2021/10/01		95	%	50 - 140
			1,2,4-trichlorobenzene	2021/10/01		95	%	50 - 140
			1,3,5-trichlorobenzene	2021/10/01		92	%	50 - 140
			1,1,1-trichloroethane	2021/10/01		103	%	50 - 140
			1,1,2-trichloroethane	2021/10/01		102	%	50 - 140
			Trichloroethene	2021/10/01		106	%	50 - 140
			Trichlorofluoromethane	2021/10/01		105	%	50 - 140
			1,2,4-trimethylbenzene	2021/10/01		103	%	50 - 140





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A368866	QW1	Spiked Blank		1,3,5-trimethylbenzene	2021/10/01		106	%	50 - 140
				Vinyl chloride	2021/10/01		127	%	50 - 140
				1,4-Difluorobenzene (sur.)	2021/10/01		104	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		105	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		98	%	50 - 140
				Bromodichloromethane	2021/10/01		98	%	60 - 130
				Bromoform	2021/10/01		94	%	60 - 130
				Bromomethane	2021/10/01		99	%	60 - 130
				Carbon tetrachloride	2021/10/01		101	%	60 - 130
				Chlorobenzene	2021/10/01		98	%	60 - 130
				Dibromochloromethane	2021/10/01		102	%	60 - 130
				Chloroethane	2021/10/01		84	%	60 - 130
				Chloroform	2021/10/01		94	%	60 - 130
				Chloromethane	2021/10/01		97	%	60 - 130
				1,2-dibromoethane	2021/10/01		92	%	60 - 130
				1,2-dichlorobenzene	2021/10/01		105	%	60 - 130
				1,3-dichlorobenzene	2021/10/01		101	%	60 - 130
				1,4-dichlorobenzene	2021/10/01		101	%	60 - 130
				1,1-dichloroethane	2021/10/01		94	%	60 - 130
				1,2-dichloroethane	2021/10/01		104	%	60 - 130
				1,1-dichloroethene	2021/10/01		96	%	60 - 130
				cis-1,2-dichloroethene	2021/10/01		100	%	60 - 130
				trans-1,2-dichloroethene	2021/10/01		90	%	60 - 130
				Dichloromethane	2021/10/01		91	%	60 - 130
				1,2-dichloropropane	2021/10/01		102	%	60 - 130
				cis-1,3-dichloropropene	2021/10/01		120	%	60 - 130
				trans-1,3-dichloropropene	2021/10/01		125	%	60 - 130
				Methyl methacrylate	2021/10/01		104	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/10/01		100	%	60 - 130
				Styrene	2021/10/01		92	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/10/01		94	%	60 - 130
				1,1,2,2-tetrachloroethane	2021/10/01		98	%	60 - 130
				Tetrachloroethene	2021/10/01		85	%	60 - 130
				1,2,3-trichlorobenzene	2021/10/01		97	%	60 - 130
				1,2,4-trichlorobenzene	2021/10/01		95	%	60 - 130
				1,3,5-trichlorobenzene	2021/10/01		92	%	60 - 130
				1,1,1-trichloroethane	2021/10/01		103	%	60 - 130
				1,1,2-trichloroethane	2021/10/01		101	%	60 - 130
				Trichloroethene	2021/10/01		105	%	60 - 130
				Trichlorofluoromethane	2021/10/01		100	%	60 - 130
				1,2,4-trimethylbenzene	2021/10/01		104	%	60 - 130
				1,3,5-trimethylbenzene	2021/10/01		107	%	60 - 130
				Vinyl chloride	2021/10/01		110	%	60 - 130
A368866	QW1	Method Blank		1,4-Difluorobenzene (sur.)	2021/10/01		96	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		108	%	50 - 140
				Bromodichloromethane	2021/10/01	<0.50		ug/L	
				Bromoform	2021/10/01	<0.50		ug/L	
				Bromomethane	2021/10/01	<2.0		ug/L	
				Carbon tetrachloride	2021/10/01	<0.50		ug/L	
				Chlorobenzene	2021/10/01	<0.50		ug/L	
				Dibromochloromethane	2021/10/01	<1.0		ug/L	
				Chloroethane	2021/10/01	<1.0		ug/L	
				Chloroform	2021/10/01	<0.50		ug/L	
				Chloromethane	2021/10/01	<2.0		ug/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				1,2-dibromoethane	2021/10/01	<0.20		ug/L	
				1,2-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,3-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,4-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,1-dichloroethane	2021/10/01	<0.50		ug/L	
				1,2-dichloroethane	2021/10/01	<0.50		ug/L	
				1,1-dichloroethene	2021/10/01	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/10/01	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/10/01	<0.50		ug/L	
				Dichloromethane	2021/10/01	<2.0		ug/L	
				1,2-dichloropropane	2021/10/01	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/10/01	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/10/01	<0.50		ug/L	
				Methyl methacrylate	2021/10/01	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/10/01	<0.50		ug/L	
				Styrene	2021/10/01	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/10/01	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/10/01	<2.0		ug/L	
				Tetrachloroethene	2021/10/01	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/10/01	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/10/01	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/10/01	<0.50		ug/L	
				1,1,1-trichloroethane	2021/10/01	<0.50		ug/L	
				1,1,2-trichloroethane	2021/10/01	<0.50		ug/L	
				Trichloroethene	2021/10/01	<0.50		ug/L	
				Trichlorofluoromethane	2021/10/01	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/10/01	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/10/01	<0.50		ug/L	
				Vinyl chloride	2021/10/01	<0.50		ug/L	
A368866	QW1	RPD		Bromodichloromethane	2021/10/01	NC		%	30
				Bromoform	2021/10/01	NC		%	30
				Bromomethane	2021/10/01	NC		%	30
				Carbon tetrachloride	2021/10/01	NC		%	30
				Chlorobenzene	2021/10/01	NC		%	30
				Dibromochloromethane	2021/10/01	NC		%	30
				Chloroethane	2021/10/01	NC		%	30
				Chloroform	2021/10/01	NC		%	30
				Chloromethane	2021/10/01	NC		%	30
				1,2-dibromoethane	2021/10/01	NC		%	30
				1,2-dichlorobenzene	2021/10/01	NC		%	30
				1,3-dichlorobenzene	2021/10/01	NC		%	30
				1,4-dichlorobenzene	2021/10/01	NC		%	30
				1,1-dichloroethane	2021/10/01	NC		%	30
				1,2-dichloroethane	2021/10/01	NC		%	30
				1,1-dichloroethene	2021/10/01	NC		%	30
				cis-1,2-dichloroethene	2021/10/01	NC		%	30
				trans-1,2-dichloroethene	2021/10/01	NC		%	30
				Dichloromethane	2021/10/01	NC		%	30
				1,2-dichloropropane	2021/10/01	NC		%	30
				cis-1,3-dichloropropene	2021/10/01	NC		%	30
				trans-1,3-dichloropropene	2021/10/01	NC		%	30
				Methyl methacrylate	2021/10/01	NC		%	30
				Methyl-tert-butylether (MTBE)	2021/10/01	NC		%	30
				Styrene	2021/10/01	NC		%	30
				1,1,1,2-tetrachloroethane	2021/10/01	NC		%	30





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,1,2,2-tetrachloroethane	2021/10/01	NC		%	30
			Tetrachloroethene	2021/10/01	NC		%	30
			1,2,3-trichlorobenzene	2021/10/01	NC		%	30
			1,2,4-trichlorobenzene	2021/10/01	NC		%	30
			1,3,5-trichlorobenzene	2021/10/01	NC		%	30
			1,1,1-trichloroethane	2021/10/01	NC		%	30
			1,1,2-trichloroethane	2021/10/01	NC		%	30
			Trichloroethene	2021/10/01	NC		%	30
			Trichlorofluoromethane	2021/10/01	NC		%	30
			1,2,4-trimethylbenzene	2021/10/01	NC		%	30
			1,3,5-trimethylbenzene	2021/10/01	NC		%	30
			Vinyl chloride	2021/10/01	NC		%	30
A368930	CAU	Matrix Spike	Naphthenic Acids	2021/10/01		73	%	70 - 130
A368930	CAU	Spiked Blank	Naphthenic Acids	2021/10/01		83	%	70 - 130
A368930	CAU	Method Blank	Naphthenic Acids	2021/10/01	<2.0		mg/L	
A368930	CAU	RPD	Naphthenic Acids	2021/10/01	NC		%	30
A369013	CAU	Matrix Spike [AGW994-13]	Naphthenic Acids	2021/10/04		77	%	70 - 130
A369013	CAU	Spiked Blank	Naphthenic Acids	2021/10/04		84	%	70 - 130
A369013	CAU	Method Blank	Naphthenic Acids	2021/10/04	<2.0		mg/L	
A369013	CAU	RPD	Naphthenic Acids	2021/10/04	NC		%	30
A369027	AP1	Spiked Blank	Turbidity	2021/09/28		103	%	80 - 120
A369027	AP1	Method Blank	Turbidity	2021/09/28	<0.10		NTU	
A369027	AP1	RPD	Turbidity	2021/09/28	0.28		%	20
A369034	AP1	Spiked Blank	Turbidity	2021/09/28		103	%	80 - 120
A369034	AP1	Method Blank	Turbidity	2021/09/28	<0.10		NTU	
A369034	AP1	RPD [AGW995-01]	Turbidity	2021/09/28	0.64		%	20
A369130	JFH	Matrix Spike [AGW995-02]	Dissolved Nitrite (N)	2021/09/28		92	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		121 (1)	%	80 - 120
A369130	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/28		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		105	%	80 - 120
A369130	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/28	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	<0.010		mg/L	
A369130	JFH	RPD [AGW995-02]	Dissolved Nitrite (N)	2021/09/28	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	13		%	20
A369135	JFH	Matrix Spike [AGX001-02]	Dissolved Nitrite (N)	2021/09/28		99	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		114	%	80 - 120
A369135	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/28		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		104	%	80 - 120
A369135	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/28	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	<0.010		mg/L	
A369135	JFH	RPD [AGX001-02]	Dissolved Nitrite (N)	2021/09/28	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	12		%	20
A369277	PK8	Spiked Blank	Biochemical Oxygen Demand	2021/10/04		91	%	85 - 115
A369277	PK8	Method Blank	Biochemical Oxygen Demand	2021/10/04	<2.0		mg/L	
A369277	PK8	RPD	Biochemical Oxygen Demand	2021/10/04	NC		%	20
A369383	FM0	Matrix Spike [AGX002-02]	Orthophosphate (P)	2021/09/29		89	%	80 - 120
A369383	FM0	Spiked Blank	Orthophosphate (P)	2021/09/29		102	%	80 - 120
A369383	FM0	Method Blank	Orthophosphate (P)	2021/09/29	<0.0010		mg/L	
A369383	FM0	RPD [AGX002-02]	Orthophosphate (P)	2021/09/29	3.0		%	20
A369840	FM0	Matrix Spike	Total Nitrogen (N)	2021/09/30		98	%	80 - 120
A369840	FM0	QC Standard	Total Nitrogen (N)	2021/09/30		90	%	80 - 120
A369840	FM0	Spiked Blank	Total Nitrogen (N)	2021/09/30		87	%	80 - 120
A369840	FM0	Method Blank	Total Nitrogen (N)	2021/09/30	<0.020		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A369840	FM0	RPD		Total Nitrogen (N)	2021/09/30	20		%	20
A369972	STI	Matrix Spike [AGX002-02]		True Colour	2021/09/29		96	%	80 - 120
A369972	STI	Spiked Blank		True Colour	2021/09/29		109	%	80 - 120
A369972	STI	Method Blank		True Colour	2021/09/29	<2.0		PtCo units	
A369972	STI	RPD [AGX002-02]		True Colour	2021/09/30	6.3		%	20
A370177	SKM	Matrix Spike		Dissolved Nitrite (N)	2021/10/01		86	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/10/01		-4.5 (1)	%	80 - 120
A370177	SKM	Spiked Blank		Dissolved Nitrite (N)	2021/10/01		100	%	80 - 120
				Dissolved Nitrate plus Nitrite (N)	2021/10/01		103	%	80 - 120
A370177	SKM	Method Blank		Dissolved Nitrite (N)	2021/09/29	<0.010		mg/L	
				Dissolved Nitrate plus Nitrite (N)	2021/09/29	<0.010		mg/L	
A370177	SKM	RPD		Dissolved Nitrite (N)	2021/10/01	NC		%	20
				Dissolved Nitrate plus Nitrite (N)	2021/10/01	NC		%	20
A370547	JAB	Matrix Spike		Dissolved Calcium (Ca)	2021/09/30		NC	%	80 - 120
				Dissolved Iron (Fe)	2021/09/30		NC	%	80 - 120
				Dissolved Magnesium (Mg)	2021/09/30		95	%	80 - 120
				Dissolved Manganese (Mn)	2021/09/30		NC	%	80 - 120
				Dissolved Potassium (K)	2021/09/30		98	%	80 - 120
				Dissolved Sodium (Na)	2021/09/30		NC	%	80 - 120
A370547	JAB	Spiked Blank		Dissolved Calcium (Ca)	2021/09/30		96	%	80 - 120
				Dissolved Iron (Fe)	2021/09/30		103	%	80 - 120
				Dissolved Magnesium (Mg)	2021/09/30		101	%	80 - 120
				Dissolved Manganese (Mn)	2021/09/30		100	%	80 - 120
				Dissolved Potassium (K)	2021/09/30		99	%	80 - 120
				Dissolved Sodium (Na)	2021/09/30		94	%	80 - 120
A370547	JAB	Method Blank		Dissolved Calcium (Ca)	2021/10/01	<0.30		mg/L	
				Dissolved Iron (Fe)	2021/10/01	<0.060		mg/L	
				Dissolved Magnesium (Mg)	2021/10/01	<0.20		mg/L	
				Dissolved Manganese (Mn)	2021/10/01	<0.0040		mg/L	
				Dissolved Potassium (K)	2021/10/01	<0.30		mg/L	
				Dissolved Sodium (Na)	2021/10/01	<0.50		mg/L	
A370547	JAB	RPD		Dissolved Calcium (Ca)	2021/09/30	0.64		%	20
				Dissolved Iron (Fe)	2021/09/30	0.090		%	20
				Dissolved Magnesium (Mg)	2021/09/30	0.80		%	20
				Dissolved Manganese (Mn)	2021/09/30	0.016		%	20
				Dissolved Potassium (K)	2021/09/30	0.51		%	20
				Dissolved Sodium (Na)	2021/09/30	0.30		%	20
A371010	ANE	Matrix Spike		Total Aluminum (Al)	2021/09/30		117	%	80 - 120
				Total Antimony (Sb)	2021/09/30		110	%	80 - 120
				Total Arsenic (As)	2021/09/30		102	%	80 - 120
				Total Barium (Ba)	2021/09/30		NC	%	80 - 120
				Total Beryllium (Be)	2021/09/30		99	%	80 - 120
				Total Bismuth (Bi)	2021/09/30		102	%	80 - 120
				Total Boron (B)	2021/09/30		105	%	80 - 120
				Total Cadmium (Cd)	2021/09/30		98	%	80 - 120
				Total Chromium (Cr)	2021/09/30		110	%	80 - 120
				Total Cobalt (Co)	2021/09/30		108	%	80 - 120
				Total Copper (Cu)	2021/09/30		107	%	80 - 120
				Total Iron (Fe)	2021/09/30		110	%	80 - 120
				Total Lead (Pb)	2021/09/30		101	%	80 - 120
				Total Lithium (Li)	2021/09/30		97	%	80 - 120
				Total Manganese (Mn)	2021/09/30		110	%	80 - 120
				Total Molybdenum (Mo)	2021/09/30		104	%	80 - 120
				Total Nickel (Ni)	2021/09/30		109	%	80 - 120
				Total Phosphorus (P)	2021/09/30		112	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC									
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits	
A371010	ANE	Spiked Blank	Total Selenium (Se)	2021/09/30		98	%	80 - 120	
			Total Silicon (Si)	2021/09/30		78 (1)	%	80 - 120	
			Total Silver (Ag)	2021/09/30		98	%	80 - 120	
			Total Strontium (Sr)	2021/09/30		NC	%	80 - 120	
			Total Thallium (Tl)	2021/09/30		98	%	80 - 120	
			Total Tin (Sn)	2021/09/30		101	%	80 - 120	
			Total Titanium (Ti)	2021/09/30		121 (1)	%	80 - 120	
			Total Uranium (U)	2021/09/30		103	%	80 - 120	
			Total Vanadium (V)	2021/09/30		111	%	80 - 120	
			Total Zinc (Zn)	2021/09/30		104	%	80 - 120	
			Total Zirconium (Zr)	2021/09/30		110	%	80 - 120	
			Total Aluminum (Al)	2021/09/30		104	%	80 - 120	
			Total Antimony (Sb)	2021/09/30		113	%	80 - 120	
			Total Arsenic (As)	2021/09/30		104	%	80 - 120	
			Total Barium (Ba)	2021/09/30		101	%	80 - 120	
			Total Beryllium (Be)	2021/09/30		102	%	80 - 120	
			Total Bismuth (Bi)	2021/09/30		105	%	80 - 120	
			Total Boron (B)	2021/09/30		106	%	80 - 120	
			Total Cadmium (Cd)	2021/09/30		100	%	80 - 120	
			Total Chromium (Cr)	2021/09/30		113	%	80 - 120	
			Total Cobalt (Co)	2021/09/30		112	%	80 - 120	
			Total Copper (Cu)	2021/09/30		111	%	80 - 120	
			Total Iron (Fe)	2021/09/30		109	%	80 - 120	
			Total Lead (Pb)	2021/09/30		103	%	80 - 120	
			Total Lithium (Li)	2021/09/30		99	%	80 - 120	
			Total Manganese (Mn)	2021/09/30		112	%	80 - 120	
			Total Molybdenum (Mo)	2021/09/30		103	%	80 - 120	
			Total Nickel (Ni)	2021/09/30		113	%	80 - 120	
			Total Phosphorus (P)	2021/09/30		111	%	80 - 120	
			Total Selenium (Se)	2021/09/30		100	%	80 - 120	
			Total Silicon (Si)	2021/09/30		76 (1)	%	80 - 120	
			Total Silver (Ag)	2021/09/30		99	%	80 - 120	
Total Strontium (Sr)	2021/09/30		109	%	80 - 120				
Total Thallium (Tl)	2021/09/30		101	%	80 - 120				
Total Tin (Sn)	2021/09/30		102	%	80 - 120				
Total Titanium (Ti)	2021/09/30		111	%	80 - 120				
Total Uranium (U)	2021/09/30		105	%	80 - 120				
Total Vanadium (V)	2021/09/30		112	%	80 - 120				
Total Zinc (Zn)	2021/09/30		121 (1)	%	80 - 120				
Total Zirconium (Zr)	2021/09/30		115	%	80 - 120				
A371010	ANE	Method Blank	Total Aluminum (Al)	2021/10/06	<3.0		ug/L		
			Total Antimony (Sb)	2021/10/06	<0.020		ug/L		
			Total Arsenic (As)	2021/10/06	<0.020		ug/L		
			Total Barium (Ba)	2021/10/06	0.159, RDL=0.050 (2)		ug/L		
			Total Beryllium (Be)	2021/10/06	<0.010		ug/L		
			Total Bismuth (Bi)	2021/10/06	<0.010		ug/L		
			Total Boron (B)	2021/10/06	19, RDL=10 (3)		ug/L		
			Total Cadmium (Cd)	2021/10/06	<0.0050		ug/L		
			Total Chromium (Cr)	2021/10/06	0.16, RDL=0.10 (3)		ug/L		
			Total Cobalt (Co)	2021/10/06	<0.010		ug/L		
			Total Copper (Cu)	2021/10/06	0.14, RDL=0.10 (3)		ug/L		





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Total Iron (Fe)	2021/10/06	5.6, RDL=5.0 (3)		ug/L	
				Total Lead (Pb)	2021/10/06	<0.020		ug/L	
				Total Lithium (Li)	2021/10/06	<0.50		ug/L	
				Total Manganese (Mn)	2021/10/06	<0.10		ug/L	
				Total Molybdenum (Mo)	2021/10/06	<0.050		ug/L	
				Total Nickel (Ni)	2021/10/06	0.12, RDL=0.10 (3)		ug/L	
				Total Phosphorus (P)	2021/10/06	<5.0		ug/L	
				Total Selenium (Se)	2021/10/06	<0.040		ug/L	
				Total Silicon (Si)	2021/10/06	<50		ug/L	
				Total Silver (Ag)	2021/10/06	<0.010		ug/L	
				Total Strontium (Sr)	2021/10/06	<0.050		ug/L	
				Total Thallium (Tl)	2021/10/06	<0.0020		ug/L	
				Total Tin (Sn)	2021/10/06	<0.20		ug/L	
				Total Titanium (Ti)	2021/10/06	<2.0		ug/L	
				Total Uranium (U)	2021/10/06	<0.0050		ug/L	
				Total Vanadium (V)	2021/10/06	<0.20		ug/L	
				Total Zinc (Zn)	2021/10/06	2.7, RDL=1.5 (3)		ug/L	
				Total Zirconium (Zr)	2021/10/06	<0.10		ug/L	
A371010	ANE	RPD		Total Aluminum (Al)	2021/10/06	3.3		%	20
				Total Antimony (Sb)	2021/10/06	8.3		%	20
				Total Arsenic (As)	2021/10/06	14		%	20
				Total Barium (Ba)	2021/10/06	2.6		%	20
				Total Beryllium (Be)	2021/10/06	3.5		%	20
				Total Bismuth (Bi)	2021/10/06	NC		%	20
				Total Boron (B)	2021/10/06	2.8		%	20
				Total Cadmium (Cd)	2021/10/06	NC		%	20
				Total Chromium (Cr)	2021/10/06	79 (1)		%	20
				Total Cobalt (Co)	2021/10/06	3.3		%	20
				Total Copper (Cu)	2021/10/06	7.1		%	20
				Total Iron (Fe)	2021/10/06	5.9		%	20
				Total Lead (Pb)	2021/10/06	NC		%	20
				Total Lithium (Li)	2021/10/06	0.69		%	20
				Total Manganese (Mn)	2021/10/06	3.5		%	20
				Total Molybdenum (Mo)	2021/10/06	2.8		%	20
				Total Nickel (Ni)	2021/10/06	71 (1)		%	20
				Total Selenium (Se)	2021/10/06	0.82		%	20
				Total Silicon (Si)	2021/10/06	2.4		%	20
				Total Silver (Ag)	2021/10/06	NC		%	20
				Total Strontium (Sr)	2021/10/06	7.9		%	20
				Total Thallium (Tl)	2021/10/06	2.4		%	20
				Total Tin (Sn)	2021/10/06	NC		%	20
				Total Titanium (Ti)	2021/10/06	NC		%	20
				Total Uranium (U)	2021/10/06	1.1		%	20
				Total Vanadium (V)	2021/10/06	0.091		%	20
				Total Zinc (Zn)	2021/10/06	16		%	20
				Total Zirconium (Zr)	2021/10/06	NC		%	20
A371036	KGR	Spiked Blank		Alkalinity (Total as CaCO3)	2021/09/30		104	%	80 - 120
A371036	KGR	Method Blank		Alkalinity (PP as CaCO3)	2021/09/30	<1.0		mg/L	
				Alkalinity (Total as CaCO3)	2021/09/30	<1.0		mg/L	
				Bicarbonate (HCO3)	2021/09/30	<1.0		mg/L	
				Carbonate (CO3)	2021/09/30	<1.0		mg/L	
				Hydroxide (OH)	2021/09/30	<1.0		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371036	KGR	RPD	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	NC		%	20
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	3.8		%	20
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	3.8		%	20
			Carbonate (CO <sub>3</sub> )	2021/09/30	NC		%	20
			Hydroxide (OH)	2021/09/30	NC		%	20
A371043	KGR	Spiked Blank	pH	2021/09/30		101	%	97 - 103
A371043	KGR	RPD	pH	2021/09/30	1.7		%	N/A
A371045	KGR	Spiked Blank	Conductivity	2021/09/30		104	%	90 - 110
A371045	KGR	Method Blank	Conductivity	2021/09/30	<2.0		uS/cm	
A371045	KGR	RPD	Conductivity	2021/09/30	1.2		%	10
A371046	KGR	Matrix Spike	Dissolved Fluoride (F)	2021/09/30		103	%	80 - 120
A371046	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/09/30		98	%	80 - 120
A371046	KGR	Method Blank	Dissolved Fluoride (F)	2021/09/30	<0.050		mg/L	
A371046	KGR	RPD	Dissolved Fluoride (F)	2021/09/30	NC		%	20
A371050	KGR	Spiked Blank	pH	2021/09/30		101	%	97 - 103
A371050	KGR	RPD [AGW996-02]	pH	2021/09/30	2.1		%	N/A
A371052	KGR	Spiked Blank	Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30		97	%	80 - 120
A371052	KGR	Method Blank	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Carbonate (CO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Hydroxide (OH)	2021/09/30	<1.0		mg/L	
A371052	KGR	RPD [AGW996-02]	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	NC		%	20
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	0.66		%	20
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	0.66		%	20
			Carbonate (CO <sub>3</sub> )	2021/09/30	NC		%	20
			Hydroxide (OH)	2021/09/30	NC		%	20
A371053	KGR	Spiked Blank	Conductivity	2021/09/30		104	%	90 - 110
A371053	KGR	Method Blank	Conductivity	2021/09/30	<2.0		uS/cm	
A371053	KGR	RPD [AGW996-02]	Conductivity	2021/09/30	0.35		%	10
A371054	KGR	Matrix Spike [AGW996-02]	Dissolved Fluoride (F)	2021/09/30		101	%	80 - 120
A371054	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/09/30		99	%	80 - 120
A371054	KGR	Method Blank	Dissolved Fluoride (F)	2021/09/30	<0.050		mg/L	
A371054	KGR	RPD [AGW996-02]	Dissolved Fluoride (F)	2021/09/30	6.4		%	20
A371102	STI	Matrix Spike	Total Nitrogen (N)	2021/10/04		98	%	80 - 120
A371102	STI	QC Standard	Total Nitrogen (N)	2021/10/04		101	%	80 - 120
A371102	STI	Spiked Blank	Total Nitrogen (N)	2021/10/04		97	%	80 - 120
A371102	STI	Method Blank	Total Nitrogen (N)	2021/10/04	<0.020		mg/L	
A371102	STI	RPD	Total Nitrogen (N)	2021/10/04	NC		%	20
A371136	STI	Matrix Spike	Total Nitrogen (N)	2021/10/04		NC	%	80 - 120
A371136	STI	QC Standard	Total Nitrogen (N)	2021/10/04		98	%	80 - 120
A371136	STI	Spiked Blank	Total Nitrogen (N)	2021/10/04		95	%	80 - 120
A371136	STI	Method Blank	Total Nitrogen (N)	2021/10/04	<0.020		mg/L	
A371136	STI	RPD	Total Nitrogen (N)	2021/10/04	8.0		%	20
A371158	FM0	Matrix Spike	Total Nitrogen (N)	2021/10/05		NC	%	80 - 120
A371158	FM0	QC Standard	Total Nitrogen (N)	2021/10/05		100	%	80 - 120
A371158	FM0	Spiked Blank	Total Nitrogen (N)	2021/10/05		92	%	80 - 120
A371158	FM0	Method Blank	Total Nitrogen (N)	2021/10/05	<0.020		mg/L	
A371158	FM0	RPD	Total Nitrogen (N)	2021/10/05	7.9		%	20
A371324	JC8	Matrix Spike	Dissolved Mercury (Hg)	2021/09/30		96	%	70 - 130
A371324	JC8	Spiked Blank	Dissolved Mercury (Hg)	2021/09/30		96	%	70 - 130
A371324	JC8	Method Blank	Dissolved Mercury (Hg)	2021/09/30	<0.00010		ug/L	
A371324	JC8	RPD	Dissolved Mercury (Hg)	2021/09/30	10		%	20





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371757	JC8	Matrix Spike [AGW993-16]	Total Mercury (Hg)	2021/09/30		89	%	70 - 130
A371757	JC8	Spiked Blank	Total Mercury (Hg)	2021/09/30		102	%	70 - 130
A371757	JC8	Method Blank	Total Mercury (Hg)	2021/09/30	<0.00010		ug/L	
A371757	JC8	RPD [AGW993-16]	Total Mercury (Hg)	2021/09/30	6.8		%	20
A372069	AP1	Matrix Spike	Total Dissolved Solids	2021/10/01		96	%	80 - 120
A372069	AP1	Spiked Blank	Total Dissolved Solids	2021/10/01		98	%	80 - 120
A372069	AP1	Method Blank	Total Dissolved Solids	2021/10/01	<10		mg/L	
A372069	AP1	RPD	Total Dissolved Solids	2021/10/01	1.1		%	20
A372083	AP1	Matrix Spike	Total Suspended Solids	2021/10/01		96	%	80 - 120
A372083	AP1	Spiked Blank	Total Suspended Solids	2021/10/01		90	%	80 - 120
A372083	AP1	Method Blank	Total Suspended Solids	2021/10/01	<1.0		mg/L	
A372083	AP1	RPD	Total Suspended Solids	2021/10/01	2.2		%	20
A372084	QNG	Matrix Spike	Total Suspended Solids	2021/10/01		98	%	80 - 120
A372084	QNG	Spiked Blank	Total Suspended Solids	2021/10/01		91	%	80 - 120
A372084	QNG	Method Blank	Total Suspended Solids	2021/10/01	<1.0		mg/L	
A372084	QNG	RPD	Total Suspended Solids	2021/10/01	3.3		%	20
A372370	ZWU	Matrix Spike	Dissolved Organic Carbon (C)	2021/10/02		NC	%	80 - 120
A372370	ZWU	Spiked Blank	Dissolved Organic Carbon (C)	2021/10/02		100	%	80 - 120
A372370	ZWU	Method Blank	Dissolved Organic Carbon (C)	2021/10/02	<0.50		mg/L	
A372370	ZWU	RPD	Dissolved Organic Carbon (C)	2021/10/02	3.6		%	20
A372544	FM0	Matrix Spike	Total Phosphorus (P)	2021/10/01		97	%	80 - 120
A372544	FM0	QC Standard	Total Phosphorus (P)	2021/10/01		93	%	80 - 120
A372544	FM0	Spiked Blank	Total Phosphorus (P)	2021/10/01		96	%	80 - 120
A372544	FM0	Method Blank	Total Phosphorus (P)	2021/10/01	0.0014, RDL=0.0010 (3)		mg/L	
A372544	FM0	RPD	Total Phosphorus (P)	2021/10/01	NC		%	20
A372554	FM0	Matrix Spike	Total Phosphorus (P)	2021/10/01		91	%	80 - 120
A372554	FM0	QC Standard	Total Phosphorus (P)	2021/10/01		92	%	80 - 120
A372554	FM0	Spiked Blank	Total Phosphorus (P)	2021/10/01		94	%	80 - 120
A372554	FM0	Method Blank	Total Phosphorus (P)	2021/10/01	<0.0010		mg/L	
A372554	FM0	RPD	Total Phosphorus (P)	2021/10/01	NC		%	20
A372555	FM0	Matrix Spike	Dissolved Phosphorus (P)	2021/10/01		103	%	80 - 120
A372555	FM0	QC Standard	Dissolved Phosphorus (P)	2021/10/01		84	%	80 - 120
A372555	FM0	Spiked Blank	Dissolved Phosphorus (P)	2021/10/01		96	%	80 - 120
A372555	FM0	Method Blank	Dissolved Phosphorus (P)	2021/10/01	<0.0010		mg/L	
A372555	FM0	RPD	Dissolved Phosphorus (P)	2021/10/01	NC		%	20
A372557	FM0	Matrix Spike [AGX000-08]	Dissolved Phosphorus (P)	2021/10/04		95	%	80 - 120
A372557	FM0	QC Standard	Dissolved Phosphorus (P)	2021/10/02		92	%	80 - 120
A372557	FM0	Spiked Blank	Dissolved Phosphorus (P)	2021/10/02		97	%	80 - 120
A372557	FM0	Method Blank	Dissolved Phosphorus (P)	2021/10/02	0.0017, RDL=0.0010 (3)		mg/L	
A372557	FM0	RPD [AGX000-08]	Dissolved Phosphorus (P)	2021/10/04	NC		%	20
A373002	KGR	Matrix Spike	Dissolved Fluoride (F)	2021/10/02		101	%	80 - 120
A373002	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/10/02		100	%	80 - 120
A373002	KGR	Method Blank	Dissolved Fluoride (F)	2021/10/02	<0.050		mg/L	
A373002	KGR	RPD	Dissolved Fluoride (F)	2021/10/02	NC		%	20
A373005	KGR	Spiked Blank	pH	2021/10/02		100	%	97 - 103
A373005	KGR	RPD	pH	2021/10/02	1.6		%	N/A
A373006	KGR	Spiked Blank	Alkalinity (Total as CaCO3)	2021/10/02		101	%	80 - 120
A373006	KGR	Method Blank	Alkalinity (PP as CaCO3)	2021/10/02	<1.0		mg/L	
			Alkalinity (Total as CaCO3)	2021/10/02	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/10/02	<1.0		mg/L	
			Carbonate (CO3)	2021/10/02	<1.0		mg/L	
			Hydroxide (OH)	2021/10/02	<1.0		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A373006	KGR	RPD		Alkalinity (PP as CaCO3)	2021/10/02	NC		%	20
				Alkalinity (Total as CaCO3)	2021/10/02	NC		%	20
				Bicarbonate (HCO3)	2021/10/02	NC		%	20
				Carbonate (CO3)	2021/10/02	NC		%	20
				Hydroxide (OH)	2021/10/02	NC		%	20
A373007	KGR	Spiked Blank		Conductivity	2021/10/02		104	%	90 - 110
A373007	KGR	Method Blank		Conductivity	2021/10/02	<2.0		uS/cm	
A373007	KGR	RPD		Conductivity	2021/10/02	0.17		%	10
A373642	BYM	Matrix Spike		Chemical Oxygen Demand	2021/10/02		92	%	80 - 120
A373642	BYM	Spiked Blank		Chemical Oxygen Demand	2021/10/02		101	%	80 - 120
A373642	BYM	Method Blank		Chemical Oxygen Demand	2021/10/02	<10		mg/L	
A373642	BYM	RPD		Chemical Oxygen Demand	2021/10/02	14		%	20
A373740	STI	Matrix Spike [AGW996-06]		Total Phosphorus (P)	2021/10/06		99	%	80 - 120
A373740	STI	QC Standard		Total Phosphorus (P)	2021/10/04		90	%	N/A
A373740	STI	Spiked Blank		Total Phosphorus (P)	2021/10/04		100	%	80 - 120
A373740	STI	Method Blank		Total Phosphorus (P)	2021/10/04	<0.0010		mg/L	
A373740	STI	RPD [AGW996-06]		Total Phosphorus (P)	2021/10/06	1.8		%	20
A373745	FM0	Matrix Spike [AGW998-06]		Total Phosphorus (P)	2021/10/06		89	%	80 - 120
A373745	FM0	QC Standard		Total Phosphorus (P)	2021/10/06		88	%	80 - 120
A373745	FM0	Spiked Blank		Total Phosphorus (P)	2021/10/06		90	%	80 - 120
A373745	FM0	Method Blank		Total Phosphorus (P)	2021/10/06	<0.0010		mg/L	
A373745	FM0	RPD [AGW998-06]		Total Phosphorus (P)	2021/10/06	9.6		%	20
A373819	JFH	Matrix Spike [AGW999-19]		Total Ammonia (N)	2021/10/03		107	%	80 - 120
A373819	JFH	Spiked Blank		Total Ammonia (N)	2021/10/03		102	%	80 - 120
A373819	JFH	Method Blank		Total Ammonia (N)	2021/10/03	<0.015		mg/L	
A373819	JFH	RPD [AGW999-19]		Total Ammonia (N)	2021/10/03	NC		%	20
A374080	JC7	Spiked Blank		2,3,4-trichlorophenol	2021/10/03		100	%	50 - 140
				2,4,6-TRIBROMOPHENOL (sur.)	2021/10/03		111	%	50 - 140
				2,4-DIBROMOPHENOL (sur.)	2021/10/03		107	%	50 - 140
				Phenol	2021/10/03		48	%	30 - 130
				3 & 4-chlorophenol	2021/10/03		90	%	50 - 140
				2,3,5,6-tetrachlorophenol	2021/10/03		92	%	50 - 140
				2,3,4,6-tetrachlorophenol	2021/10/03		104	%	50 - 140
				2,4,5-trichlorophenol	2021/10/03		104	%	50 - 140
				2,4,6-trichlorophenol	2021/10/03		104	%	50 - 140
				2,3,5-trichlorophenol	2021/10/03		92	%	50 - 140
				2,4-dichlorophenol	2021/10/03		96	%	50 - 140
				2,4-dimethylphenol	2021/10/03		88	%	50 - 140
				2,4-dinitrophenol	2021/10/03		80	%	30 - 130
				2,6-dichlorophenol	2021/10/03		104	%	50 - 140
				2-chlorophenol	2021/10/03		84	%	50 - 140
				2-methylphenol	2021/10/03		72	%	50 - 140
				2-nitrophenol	2021/10/03		76	%	50 - 140
				3 & 4-methylphenol	2021/10/03		72	%	50 - 140
				4,6-dinitro-2-methylphenol	2021/10/03		84	%	30 - 130
				4-chloro-3-methylphenol	2021/10/03		88	%	50 - 140
				4-nitrophenol	2021/10/03		44 (1)	%	50 - 140
				Pentachlorophenol	2021/10/03		76	%	50 - 140
A374080	JC7	Method Blank		2,3,4-trichlorophenol	2021/10/03	<0.00010		mg/L	
				2,4,6-TRIBROMOPHENOL (sur.)	2021/10/03		116	%	50 - 140
				2,4-DIBROMOPHENOL (sur.)	2021/10/03		112	%	50 - 140
				Phenol	2021/10/03	<0.00010		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			3 & 4-chlorophenol	2021/10/03	<0.00010		mg/L	
			2,3,5,6-tetrachlorophenol	2021/10/03	<0.00010		mg/L	
			2,3,4,6-tetrachlorophenol	2021/10/03	<0.00010		mg/L	
			2,4,5-trichlorophenol	2021/10/03	<0.00010		mg/L	
			2,4,6-trichlorophenol	2021/10/03	<0.00010		mg/L	
			2,3,5-trichlorophenol	2021/10/03	<0.00010		mg/L	
			2,4-dichlorophenol	2021/10/03	<0.00010		mg/L	
			2,4-dimethylphenol	2021/10/03	<0.00010		mg/L	
			2,4-dinitrophenol	2021/10/03	<0.0010		mg/L	
			2,6-dichlorophenol	2021/10/03	<0.00010		mg/L	
			2-chlorophenol	2021/10/03	<0.00010		mg/L	
			2-methylphenol	2021/10/03	<0.00010		mg/L	
			2-nitrophenol	2021/10/03	<0.0010		mg/L	
			3 & 4-methylphenol	2021/10/03	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/10/03	<0.0010		mg/L	
			4-chloro-3-methylphenol	2021/10/03	<0.00010		mg/L	
			4-nitrophenol	2021/10/03	<0.0010		mg/L	
			Pentachlorophenol	2021/10/03	<0.00010		mg/L	
A375452	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		99	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		99	%	80 - 120
A375452	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		100	%	80 - 120
A375452	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375452	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	NC		%	20
			Dissolved Sulphate (SO4)	2021/10/05	NC		%	20
A375463	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		112	%	80 - 120
A375463	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		101	%	80 - 120
A375463	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375463	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	2.6		%	20
			Dissolved Sulphate (SO4)	2021/10/05	3.9		%	20
A375470	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		93	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		101	%	80 - 120
A375470	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		100	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		100	%	80 - 120
A375470	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375470	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	4.1		%	20
			Dissolved Sulphate (SO4)	2021/10/05	NC		%	20
A375682	STI	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		NC	%	80 - 120
A375682	STI	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		96	%	80 - 120
A375682	STI	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375682	STI	RPD	Dissolved Chloride (Cl)	2021/10/05	2.1		%	20
			Dissolved Sulphate (SO4)	2021/10/05	2.1		%	20
A376285	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		NC	%	80 - 120
A376285	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
A376285	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
A376285	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	0.64		%	20
A376671	ANE	Matrix Spike	Dissolved Aluminum (Al)	2021/10/07		105	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Dissolved Antimony (Sb)	2021/10/07		106	%	80 - 120
				Dissolved Arsenic (As)	2021/10/07		105	%	80 - 120
				Dissolved Barium (Ba)	2021/10/07		NC	%	80 - 120
				Dissolved Beryllium (Be)	2021/10/07		87	%	80 - 120
				Dissolved Bismuth (Bi)	2021/10/07		102	%	80 - 120
				Dissolved Boron (B)	2021/10/07		97	%	80 - 120
				Dissolved Cadmium (Cd)	2021/10/07		99	%	80 - 120
				Dissolved Chromium (Cr)	2021/10/07		120	%	80 - 120
				Dissolved Cobalt (Co)	2021/10/07		116	%	80 - 120
				Dissolved Copper (Cu)	2021/10/07		116	%	80 - 120
				Dissolved Iron (Fe)	2021/10/07		105	%	80 - 120
				Dissolved Lead (Pb)	2021/10/07		102	%	80 - 120
				Dissolved Lithium (Li)	2021/10/07		94	%	80 - 120
				Dissolved Manganese (Mn)	2021/10/07		111	%	80 - 120
				Dissolved Molybdenum (Mo)	2021/10/07		105	%	80 - 120
				Dissolved Nickel (Ni)	2021/10/07		118	%	80 - 120
				Dissolved Selenium (Se)	2021/10/07		101	%	80 - 120
				Dissolved Silicon (Si)	2021/10/07		75 (1)	%	80 - 120
				Dissolved Silver (Ag)	2021/10/07		98	%	80 - 120
				Dissolved Strontium (Sr)	2021/10/07		NC	%	80 - 120
				Dissolved Thallium (Tl)	2021/10/07		99	%	80 - 120
				Dissolved Tin (Sn)	2021/10/07		101	%	80 - 120
				Dissolved Titanium (Ti)	2021/10/07		117	%	80 - 120
				Dissolved Uranium (U)	2021/10/07		107	%	80 - 120
				Dissolved Vanadium (V)	2021/10/07		116	%	80 - 120
				Dissolved Zinc (Zn)	2021/10/07		96	%	80 - 120
				Dissolved Zirconium (Zr)	2021/10/07		113	%	80 - 120
A376671	ANE	Spiked Blank		Dissolved Aluminum (Al)	2021/10/07		105	%	80 - 120
				Dissolved Antimony (Sb)	2021/10/07		104	%	80 - 120
				Dissolved Arsenic (As)	2021/10/07		101	%	80 - 120
				Dissolved Barium (Ba)	2021/10/07		99	%	80 - 120
				Dissolved Beryllium (Be)	2021/10/07		92	%	80 - 120
				Dissolved Bismuth (Bi)	2021/10/07		104	%	80 - 120
				Dissolved Boron (B)	2021/10/07		100	%	80 - 120
				Dissolved Cadmium (Cd)	2021/10/07		102	%	80 - 120
				Dissolved Chromium (Cr)	2021/10/07		112	%	80 - 120
				Dissolved Cobalt (Co)	2021/10/07		110	%	80 - 120
				Dissolved Copper (Cu)	2021/10/07		110	%	80 - 120
				Dissolved Iron (Fe)	2021/10/07		105	%	80 - 120
				Dissolved Lead (Pb)	2021/10/07		103	%	80 - 120
				Dissolved Lithium (Li)	2021/10/07		94	%	80 - 120
				Dissolved Manganese (Mn)	2021/10/07		106	%	80 - 120
				Dissolved Molybdenum (Mo)	2021/10/07		104	%	80 - 120
				Dissolved Nickel (Ni)	2021/10/07		113	%	80 - 120
				Dissolved Selenium (Se)	2021/10/07		97	%	80 - 120
				Dissolved Silicon (Si)	2021/10/07		74 (1)	%	80 - 120
				Dissolved Silver (Ag)	2021/10/07		100	%	80 - 120
				Dissolved Strontium (Sr)	2021/10/07		99	%	80 - 120
				Dissolved Thallium (Tl)	2021/10/07		99	%	80 - 120
				Dissolved Tin (Sn)	2021/10/07		100	%	80 - 120
				Dissolved Titanium (Ti)	2021/10/07		108	%	80 - 120
				Dissolved Uranium (U)	2021/10/07		105	%	80 - 120
				Dissolved Vanadium (V)	2021/10/07		108	%	80 - 120
				Dissolved Zinc (Zn)	2021/10/07		109	%	80 - 120
				Dissolved Zirconium (Zr)	2021/10/07		104	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376671	ANE	Method Blank		Dissolved Aluminum (Al)	2021/10/07	<0.50		ug/L	
				Dissolved Antimony (Sb)	2021/10/07	<0.020		ug/L	
				Dissolved Arsenic (As)	2021/10/07	<0.020		ug/L	
				Dissolved Barium (Ba)	2021/10/07	<0.020		ug/L	
				Dissolved Beryllium (Be)	2021/10/07	<0.010		ug/L	
				Dissolved Bismuth (Bi)	2021/10/07	<0.0050		ug/L	
				Dissolved Boron (B)	2021/10/07	<10		ug/L	
				Dissolved Cadmium (Cd)	2021/10/07	<0.0050		ug/L	
				Dissolved Chromium (Cr)	2021/10/07	<0.10		ug/L	
				Dissolved Cobalt (Co)	2021/10/07	<0.0050		ug/L	
				Dissolved Copper (Cu)	2021/10/07	<0.050		ug/L	
				Dissolved Iron (Fe)	2021/10/07	<1.0		ug/L	
				Dissolved Lead (Pb)	2021/10/07	<0.0050		ug/L	
				Dissolved Lithium (Li)	2021/10/07	<0.50		ug/L	
				Dissolved Manganese (Mn)	2021/10/07	<0.050		ug/L	
				Dissolved Molybdenum (Mo)	2021/10/07	<0.050		ug/L	
				Dissolved Nickel (Ni)	2021/10/07	<0.020		ug/L	
				Dissolved Selenium (Se)	2021/10/07	<0.040		ug/L	
				Dissolved Silicon (Si)	2021/10/07	<50		ug/L	
				Dissolved Silver (Ag)	2021/10/07	<0.0050		ug/L	
				Dissolved Strontium (Sr)	2021/10/07	<0.050		ug/L	
				Dissolved Thallium (Tl)	2021/10/07	<0.0020		ug/L	
				Dissolved Tin (Sn)	2021/10/07	<0.20		ug/L	
				Dissolved Titanium (Ti)	2021/10/07	<0.50		ug/L	
				Dissolved Uranium (U)	2021/10/07	<0.0020		ug/L	
				Dissolved Vanadium (V)	2021/10/07	<0.20		ug/L	
				Dissolved Zinc (Zn)	2021/10/07	<0.10		ug/L	
				Dissolved Zirconium (Zr)	2021/10/07	<0.10		ug/L	
A376671	ANE	RPD		Dissolved Aluminum (Al)	2021/10/07	2.4		%	20
				Dissolved Antimony (Sb)	2021/10/07	NC		%	20
				Dissolved Arsenic (As)	2021/10/07	NC		%	20
				Dissolved Barium (Ba)	2021/10/07	0.67		%	20
				Dissolved Beryllium (Be)	2021/10/07	NC		%	20
				Dissolved Bismuth (Bi)	2021/10/07	NC		%	20
				Dissolved Boron (B)	2021/10/07	NC		%	20
				Dissolved Cadmium (Cd)	2021/10/07	NC		%	20
				Dissolved Chromium (Cr)	2021/10/07	NC		%	20
				Dissolved Cobalt (Co)	2021/10/07	5.3		%	20
				Dissolved Copper (Cu)	2021/10/07	NC		%	20
				Dissolved Lead (Pb)	2021/10/07	NC		%	20
				Dissolved Lithium (Li)	2021/10/07	3.5		%	20
				Dissolved Manganese (Mn)	2021/10/07	4.8		%	20
				Dissolved Molybdenum (Mo)	2021/10/07	3.0		%	20
				Dissolved Nickel (Ni)	2021/10/07	1.9		%	20
				Dissolved Selenium (Se)	2021/10/07	1.8		%	20
				Dissolved Silicon (Si)	2021/10/07	1.4		%	20
				Dissolved Silver (Ag)	2021/10/07	NC		%	20
				Dissolved Strontium (Sr)	2021/10/07	2.6		%	20
				Dissolved Thallium (Tl)	2021/10/07	NC		%	20
				Dissolved Tin (Sn)	2021/10/07	NC		%	20
				Dissolved Titanium (Ti)	2021/10/07	NC		%	20
				Dissolved Uranium (U)	2021/10/07	6.4		%	20
				Dissolved Vanadium (V)	2021/10/07	NC		%	20
				Dissolved Zinc (Zn)	2021/10/07	52 (1)		%	20
				Dissolved Zirconium (Zr)	2021/10/07	NC		%	20





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376677	ANE	Matrix Spike [AGW995-10]	Total Aluminum (Al)	2021/10/07		102	%	80 - 120
			Total Antimony (Sb)	2021/10/07		101	%	80 - 120
			Total Arsenic (As)	2021/10/07		102	%	80 - 120
			Total Barium (Ba)	2021/10/07		96	%	80 - 120
			Total Beryllium (Be)	2021/10/07		80	%	80 - 120
			Total Bismuth (Bi)	2021/10/07		92	%	80 - 120
			Total Boron (B)	2021/10/07		NC	%	80 - 120
			Total Cadmium (Cd)	2021/10/07		92	%	80 - 120
			Total Chromium (Cr)	2021/10/07		111	%	80 - 120
			Total Cobalt (Co)	2021/10/07		106	%	80 - 120
			Total Copper (Cu)	2021/10/07		102	%	80 - 120
			Total Iron (Fe)	2021/10/07		95	%	80 - 120
			Total Lead (Pb)	2021/10/07		94	%	80 - 120
			Total Lithium (Li)	2021/10/07		88	%	80 - 120
			Total Manganese (Mn)	2021/10/07		101	%	80 - 120
			Total Molybdenum (Mo)	2021/10/07		NC	%	80 - 120
			Total Nickel (Ni)	2021/10/07		105	%	80 - 120
			Total Selenium (Se)	2021/10/07		94	%	80 - 120
			Total Silicon (Si)	2021/10/07		75 (1)	%	80 - 120
			Total Silver (Ag)	2021/10/07		94	%	80 - 120
			Total Strontium (Sr)	2021/10/07		NC	%	80 - 120
			Total Thallium (Tl)	2021/10/07		92	%	80 - 120
			Total Tin (Sn)	2021/10/07		99	%	80 - 120
			Total Titanium (Ti)	2021/10/07		116	%	80 - 120
			Total Uranium (U)	2021/10/07		99	%	80 - 120
			Total Vanadium (V)	2021/10/07		NC	%	80 - 120
			Total Zinc (Zn)	2021/10/07		96	%	80 - 120
			Total Zirconium (Zr)	2021/10/07		118	%	80 - 120
A376677	ANE	Spiked Blank	Total Aluminum (Al)	2021/10/07		102	%	80 - 120
			Total Antimony (Sb)	2021/10/07		106	%	80 - 120
			Total Arsenic (As)	2021/10/07		98	%	80 - 120
			Total Barium (Ba)	2021/10/07		98	%	80 - 120
			Total Beryllium (Be)	2021/10/07		82	%	80 - 120
			Total Bismuth (Bi)	2021/10/07		99	%	80 - 120
			Total Boron (B)	2021/10/07		98	%	80 - 120
			Total Cadmium (Cd)	2021/10/07		99	%	80 - 120
			Total Chromium (Cr)	2021/10/07		113	%	80 - 120
			Total Cobalt (Co)	2021/10/07		110	%	80 - 120
			Total Copper (Cu)	2021/10/07		111	%	80 - 120
			Total Iron (Fe)	2021/10/07		101	%	80 - 120
			Total Lead (Pb)	2021/10/07		99	%	80 - 120
			Total Lithium (Li)	2021/10/07		87	%	80 - 120
			Total Manganese (Mn)	2021/10/07		104	%	80 - 120
			Total Molybdenum (Mo)	2021/10/07		103	%	80 - 120
			Total Nickel (Ni)	2021/10/07		112	%	80 - 120
			Total Selenium (Se)	2021/10/07		95	%	80 - 120
			Total Silicon (Si)	2021/10/07		71 (1)	%	80 - 120
			Total Silver (Ag)	2021/10/07		98	%	80 - 120
			Total Strontium (Sr)	2021/10/07		96	%	80 - 120
			Total Thallium (Tl)	2021/10/07		96	%	80 - 120
			Total Tin (Sn)	2021/10/07		99	%	80 - 120
			Total Titanium (Ti)	2021/10/07		106	%	80 - 120
			Total Uranium (U)	2021/10/07		101	%	80 - 120
			Total Vanadium (V)	2021/10/07		108	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376677	ANE	Method Blank	Total Zinc (Zn)	2021/10/07		121 (1)	%	80 - 120
			Total Zirconium (Zr)	2021/10/07		105	%	80 - 120
			Total Aluminum (Al)	2021/10/08	0.68, RDL=0.50 (4)		ug/L	
			Total Antimony (Sb)	2021/10/08	<0.020		ug/L	
			Total Arsenic (As)	2021/10/08	<0.020		ug/L	
			Total Barium (Ba)	2021/10/08	<0.020		ug/L	
			Total Beryllium (Be)	2021/10/08	<0.010		ug/L	
			Total Bismuth (Bi)	2021/10/08	<0.0050		ug/L	
			Total Boron (B)	2021/10/08	<10		ug/L	
			Total Cadmium (Cd)	2021/10/08	<0.0050		ug/L	
			Total Chromium (Cr)	2021/10/08	<0.10		ug/L	
			Total Cobalt (Co)	2021/10/08	<0.0050		ug/L	
			Total Copper (Cu)	2021/10/08	<0.050		ug/L	
			Total Iron (Fe)	2021/10/08	<1.0		ug/L	
			Total Lead (Pb)	2021/10/08	<0.0050		ug/L	
			Total Lithium (Li)	2021/10/08	<0.50		ug/L	
			Total Manganese (Mn)	2021/10/08	<0.050		ug/L	
			Total Molybdenum (Mo)	2021/10/08	<0.050		ug/L	
			Total Nickel (Ni)	2021/10/08	<0.020		ug/L	
			Total Selenium (Se)	2021/10/08	<0.040		ug/L	
			Total Silicon (Si)	2021/10/08	<50		ug/L	
			Total Silver (Ag)	2021/10/08	<0.0050		ug/L	
			Total Strontium (Sr)	2021/10/08	<0.050		ug/L	
			Total Thallium (Tl)	2021/10/08	<0.0020		ug/L	
			Total Tin (Sn)	2021/10/08	<0.20		ug/L	
			Total Titanium (Ti)	2021/10/08	<0.50		ug/L	
			Total Uranium (U)	2021/10/08	<0.0020		ug/L	
			Total Vanadium (V)	2021/10/08	<0.20		ug/L	
			Total Zinc (Zn)	2021/10/08	0.64, RDL=0.10		ug/L	
A376677	ANE	RPD [AGW995-10]	Total Zirconium (Zr)	2021/10/08	<0.10		ug/L	
			Total Aluminum (Al)	2021/10/08	13		%	20
			Total Antimony (Sb)	2021/10/08	8.8		%	20
			Total Arsenic (As)	2021/10/08	0.25		%	20
			Total Barium (Ba)	2021/10/08	0.83		%	20
			Total Beryllium (Be)	2021/10/08	NC		%	20
			Total Bismuth (Bi)	2021/10/08	NC		%	20
			Total Boron (B)	2021/10/08	4.7		%	20
			Total Cadmium (Cd)	2021/10/08	NC		%	20
			Total Chromium (Cr)	2021/10/08	NC		%	20
			Total Cobalt (Co)	2021/10/08	2.3		%	20
			Total Copper (Cu)	2021/10/08	4.6		%	20
			Total Iron (Fe)	2021/10/08	3.9		%	20
			Total Lead (Pb)	2021/10/08	2.3		%	20
			Total Lithium (Li)	2021/10/08	0.79		%	20
			Total Manganese (Mn)	2021/10/08	3.6		%	20
			Total Molybdenum (Mo)	2021/10/08	2.7		%	20
			Total Nickel (Ni)	2021/10/08	2.0		%	20
			Total Selenium (Se)	2021/10/08	2.0		%	20
			Total Silicon (Si)	2021/10/08	4.1		%	20
			Total Silver (Ag)	2021/10/08	NC		%	20
			Total Strontium (Sr)	2021/10/08	1.0		%	20
			Total Thallium (Tl)	2021/10/08	NC		%	20
			Total Tin (Sn)	2021/10/08	NC		%	20





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Titanium (Ti)	2021/10/08	13		%	20
			Total Uranium (U)	2021/10/08	3.6		%	20
			Total Vanadium (V)	2021/10/08	1.1		%	20
			Total Zinc (Zn)	2021/10/08	7.7		%	20
			Total Zirconium (Zr)	2021/10/08	NC		%	20
A380555	TMU	Matrix Spike	Total Inorganic Carbon (C)	2021/10/08		86	%	80 - 120
A380555	TMU	Spiked Blank	Total Inorganic Carbon (C)	2021/10/08		110	%	80 - 120
A380555	TMU	Method Blank	Total Inorganic Carbon (C)	2021/10/08	<1.0		mg/L	
A387831	ZWU	Matrix Spike [AGW993-06]	Total Organic Carbon (C)	2021/10/15		97	%	80 - 120
A387831	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/10/15		105	%	80 - 120
A387831	ZWU	Method Blank	Total Organic Carbon (C)	2021/10/15	<0.50		mg/L	
A387831	ZWU	RPD [AGW993-06]	Total Organic Carbon (C)	2021/10/15	1.3		%	20
A389389	KGR	Spiked Blank	Alkalinity (Total as CaCO <sub>3</sub> )	2021/10/16		98	%	80 - 120
A389389	KGR	Method Blank	Alkalinity (PP as CaCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Bicarbonate (HCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Carbonate (CO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Hydroxide (OH)	2021/10/16	<1.0		mg/L	
A389389	KGR	RPD	Alkalinity (PP as CaCO <sub>3</sub> )	2021/10/16	NC		%	20
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/10/16	0.80		%	20
			Bicarbonate (HCO <sub>3</sub> )	2021/10/16	0.80		%	20
			Carbonate (CO <sub>3</sub> )	2021/10/16	NC		%	20
			Hydroxide (OH)	2021/10/16	NC		%	20
A389391	KGR	Spiked Blank	Conductivity	2021/10/16		102	%	90 - 110
A389391	KGR	Method Blank	Conductivity	2021/10/16	<2.0		uS/cm	
A389391	KGR	RPD	Conductivity	2021/10/16	0.89		%	10
A390092	STI	Matrix Spike [AGW993-08]	Dissolved Phosphorus (P)	2021/10/17		93	%	80 - 120
A390092	STI	QC Standard	Dissolved Phosphorus (P)	2021/10/17		89	%	80 - 120
A390092	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/10/17		96	%	80 - 120
A390092	STI	Method Blank	Dissolved Phosphorus (P)	2021/10/17	0.0017, RDL=0.0010 (5)		mg/L	
A390092	STI	RPD [AGW993-08]	Dissolved Phosphorus (P)	2021/10/17	2.7		%	20
A390968	BFE	Matrix Spike	Dissolved Sulphate (SO <sub>4</sub> )	2021/10/18		NC	%	80 - 120
A390968	BFE	Spiked Blank	Dissolved Sulphate (SO <sub>4</sub> )	2021/10/18		100	%	80 - 120
A390968	BFE	Method Blank	Dissolved Sulphate (SO <sub>4</sub> )	2021/10/18	<1.0		mg/L	
A390968	BFE	RPD	Dissolved Sulphate (SO <sub>4</sub> )	2021/10/18	3.9		%	20
A391105	PK8	Matrix Spike [AGW993-06]	Chemical Oxygen Demand	2021/10/18		101	%	80 - 120
A391105	PK8	Spiked Blank	Chemical Oxygen Demand	2021/10/18		101	%	80 - 120
A391105	PK8	Method Blank	Chemical Oxygen Demand	2021/10/18	<10		mg/L	
A391105	PK8	RPD [AGW993-06]	Chemical Oxygen Demand	2021/10/18	5.4		%	20
A391916	PC5	Matrix Spike	Dissolved Cadmium (Cd)	2021/10/19		85	%	80 - 120
A391916	PC5	Spiked Blank	Dissolved Cadmium (Cd)	2021/10/19		92	%	80 - 120
A391916	PC5	Method Blank	Dissolved Cadmium (Cd)	2021/10/19	<0.0050		ug/L	
A391916	PC5	RPD	Dissolved Cadmium (Cd)	2021/10/19	NC		%	20
A392634	FM0	Matrix Spike	Total Phosphorus (P)	2021/10/19		89	%	80 - 120
A392634	FM0	QC Standard	Total Phosphorus (P)	2021/10/19		84	%	80 - 120
A392634	FM0	Spiked Blank	Total Phosphorus (P)	2021/10/19		87	%	80 - 120
A392634	FM0	Method Blank	Total Phosphorus (P)	2021/10/19	<0.0010		mg/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
A392634	FM0	RPD	Total Phosphorus (P)	2021/10/19	NC		%	20
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <math>\leq 2 \times</math> RDL).</p> <p>(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.</p> <p>(2) Method blank above criteria. Data inspected. All data &lt; RDL or greater than 10x Method Blank.</p> <p>(3) Method Blank &lt;2X RDL.</p> <p>(4) Method blank &lt;2XRDL</p> <p>(5) Method blank above criteria and less than 2X RDL. Data inspected.</p>								





### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Luba Shymushovska, B.Sc., QP, Senior Analyst, Organics

Qiliang (Alex) Wu, Analyst II

Sandy Yuan, M.Sc., QP, Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics





Bureau Veritas Job #: C172489  
Report Date: 2021/10/20

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### **VALIDATION SIGNATURE PAGE(CONT'D)**

The analytical data and all QC contained in this report were reviewed and validated by:

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



## CHAIN OF CUSTODY RECORD

<b>INVOICE TO:</b>		<b>REPORT TO:</b>		<b>PROJECT INFORMATION:</b>		<b>Laboratory Use Only:</b>	
Company Name: #11052 HATFIELD CONSULTANTS Attention: Zach Mueller Address: Suite A, 300 MacKenzie Blvd FORT MCMURRAY AB T9H 4C4 Tel: (250) 893-4939 Fax: Email: zmueller@hatfieldgroup.com		Company Name: Zach Mueller Attention: Suite A, 300 MacKenzie Blvd Address: FORT MCMURRAY AB T9H 4C4 Tel: (250) 893-4939 Fax: Email: zmueller@hatfieldgroup.com		Quotation #: C10909 P.O. #: Syncrude mesocosm experiment Project Name: Site #: Sampled By:		Bottle Order #: 644187 COC #: <u>C172489</u> Project Manager: Amanda L'Hirondelle CPS44187-J1-Q1	
<b>Regulatory Criteria:</b>		<b>Special Instructions</b>		<b>ANALYSIS REQUESTED (PLEASE BE SPECIFIC)</b>			
<input type="checkbox"/> ATI <input type="checkbox"/> CCME <input type="checkbox"/> Other				Turnaround Time (TAT) Required: Please provide advance notice for rush projects			
				<b>Regular (Standard) TAT:</b> (will be applied if Rush TAT is not specified) Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details.			
				<b>Job Specific Rush TAT (if applies to entire submission)</b> Date Required: _____ Rush Confirmation Number: _____ (call lab for #)			
				# of Bottles _____ Comments _____			
SAMPLES MUST BE KEPT COOL (-5°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS		Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	
1	River water tank		21/09/24	16:20	W	X	
2	Mesocosm Table1			11:10		X	
3	Mesocosm Table2			11:45		X	
4	Mesocosm Table3			11:45		X	
5	Mesocosm Table4			12:30		X	
6	Mesocosm Table5			11:10		X	
7	Mesocosm Table6			11:10		X	
8	Mesocosm Table7			12:30		X	
9	Mesocosm Table8			11:10		X	
10	Treated OSPW tank		V	14:00		X	
* RELINQUISHED BY: (Signature/Print) <u>MATCHAN EDWARDS</u>		Date: (YY/MM/DD) <u>21/09/27</u>		RECEIVED BY: (Signature/Print) <u>Reem Philippos, PCN</u>		Date: (YY/MM/DD) <u>2021/09/28</u>	
						Temperature (°C) on Receipt <u>See ACTR</u>	
						Custody Seal Intact on Cooler? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
						White: BV Labs Yellow: Client	

UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT [www.bvlabs.ca](#). IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. IF ALL SAMPLES ARE HELD FOR PLANNED AFTER-SAMPLE RECENT, FOR SELECTION, PLEASE CONTACT YOUR PROJECT MANAGER.

Received in Full today

By: (Signature)

SEP 27 2021  
@ 9:00am  
Temp: 115/51 see ACTR.  
100-465 05-00





Sent to: Bureau Veritas Vancouver  
4606 Canada Way  
Burnaby, BC, V5G 1K5  
Tel: (604) 734-2276

BV / ARS INTERLAB CHAIN OF CUSTODY RECORD

Page 01 of 01

COC # C172489-MVAN-01-01



REPORT INFORMATION

Company: Bureau Veritas Laboratories  
Address: 4000 19th N.E., Calgary, Alberta, T2E 6P8  
Contact Name: Amanda L'Hirondelle  
Email: Amanda.Lhirondelle@bureauveritas.com, Customersolutionswest@bureauveritas.com  
Phone: (780) 577-7117  
BV Labs Project #: C172489  
Client Invoice To: HATFIELD CONSULTANTS (11052)  
Client Report To: HATFIELD CONSULTANTS (11052)

Incl. on Report? Yes / No

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.
1	AGW993-RIVER WATER TANK	W	2021/09/24	16:20		2
2	AGW994-MESOCOSM TABLE 1	W	2021/09/24	11:10		2
3	AGW995-MESOCOSM TABLE 2	W	2021/09/24	11:45		2
4	AGW996-MESOCOSM TABLE 3	W	2021/09/24	11:45		2
5	AGW997-MESOCOSM TABLE 4	W	2021/09/24	12:30		2
6	AGW998-MESOCOSM TABLE 5	W	2021/09/24	11:10		2
7	AGW999-MESOCOSM TABLE 6	W	2021/09/24	11:10		2
8	AGW000-MESOCOSM TABLE 7	W	2021/09/24	12:30		2
9	AGW001-MESOCOSM TABLE 8	W	2021/09/24	11:10		2
10	AGW002-TREATED OSPW TANK	W	2021/09/24	14:00		2

SITE LOCATION:

REGULATORY CRITERIA

SPECIAL INSTRUCTIONS

Please inform BV Labs immediately if you are not accredited for the requested test(s).  
\*\*Please return a copy of this form with the report.\*\*

REQUIRED EDDS

National Excel (N001)  
Suncor Erims (A037)

TURNAROUND TIME

☐ Rush Required

2021/10/04

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

YES	NO	Temp: (°C)

RELINQUISHED BY: (SIGN & PRINT)

*[Signature]* Robert McNaughton

DATE: (YYYY/MM/DD)

2021/09/28 14:46

RECEIVED BY: (SIGN & PRINT)

DATE: (YYYY/MM/DD)

TIME: (HH:MM)

TIME: (HH:MM)

Labels Verified By:

Labels Verified By:

QUESTED

C172489\_COC

Job Barcode Label



C172489

ADDITIONAL SAMPLE INFORMATION

(P: 16, 17)

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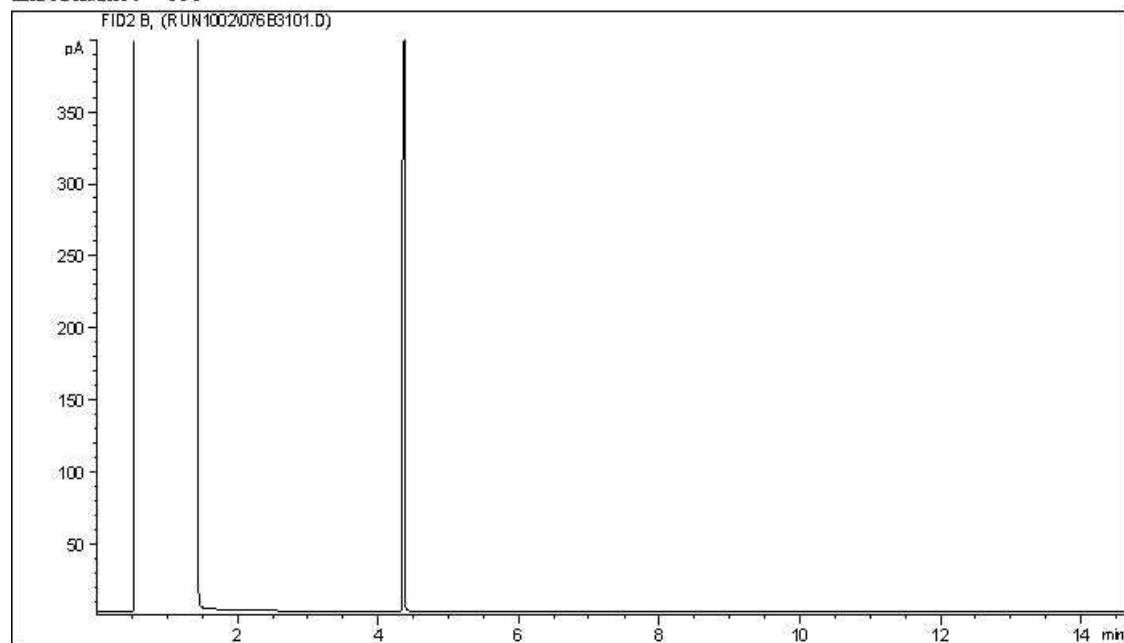
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(P: 16, 17)

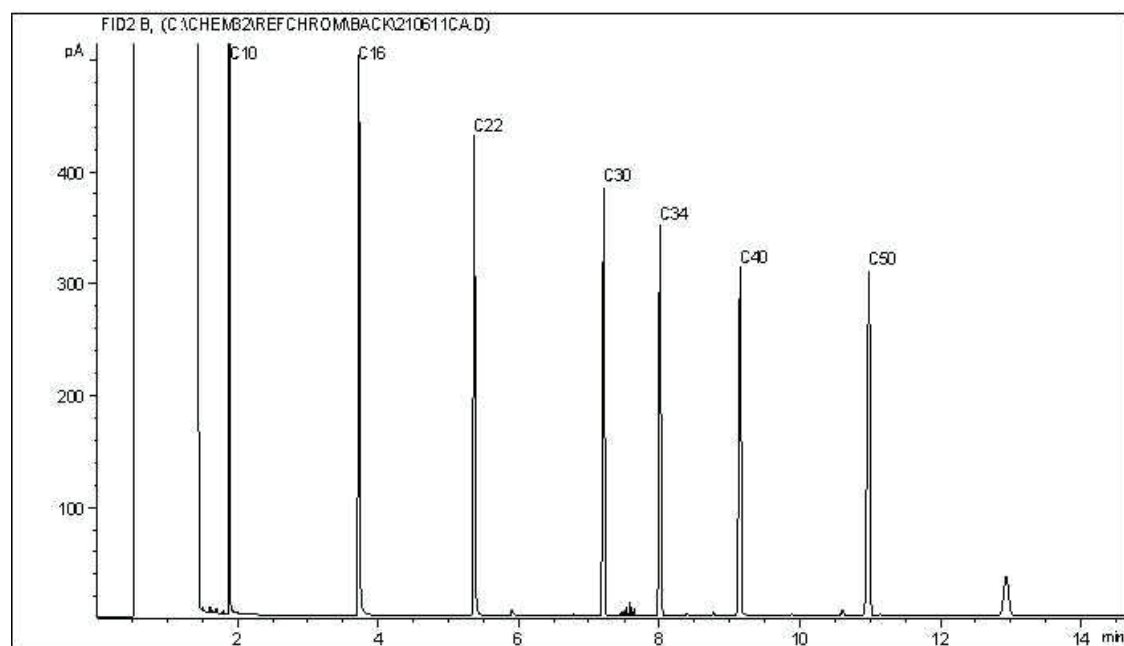


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

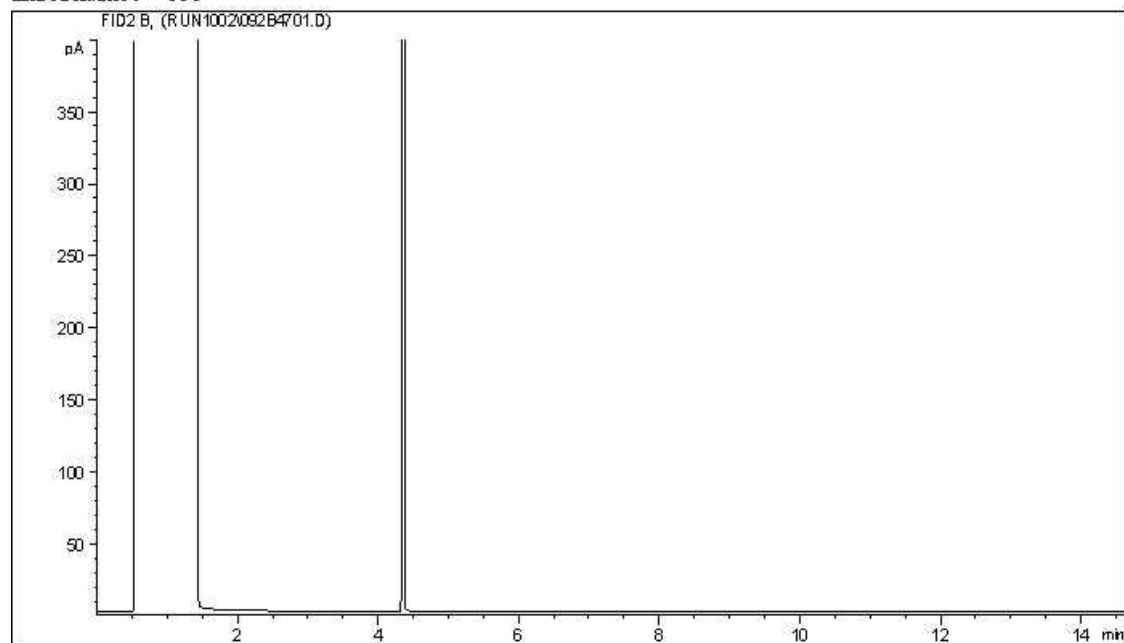
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

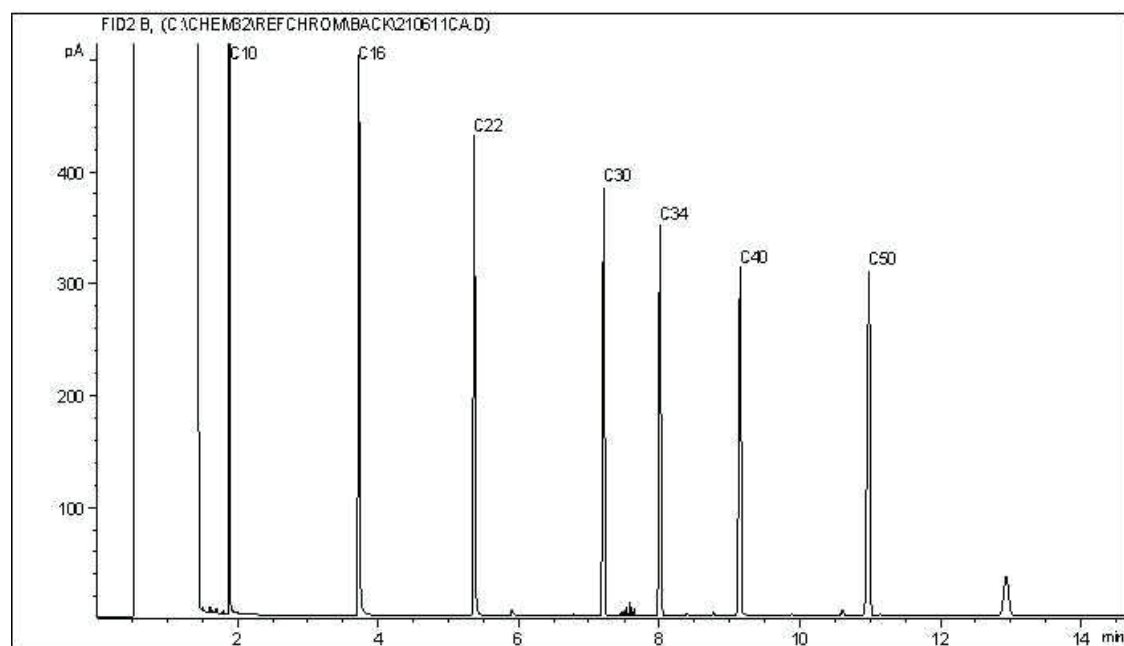


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

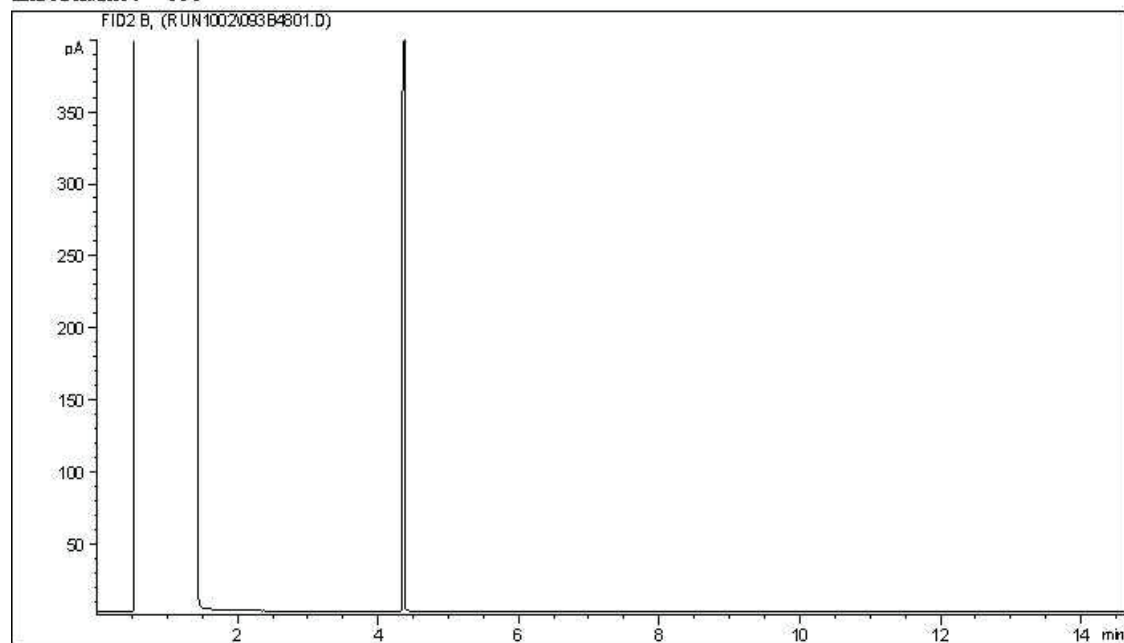
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

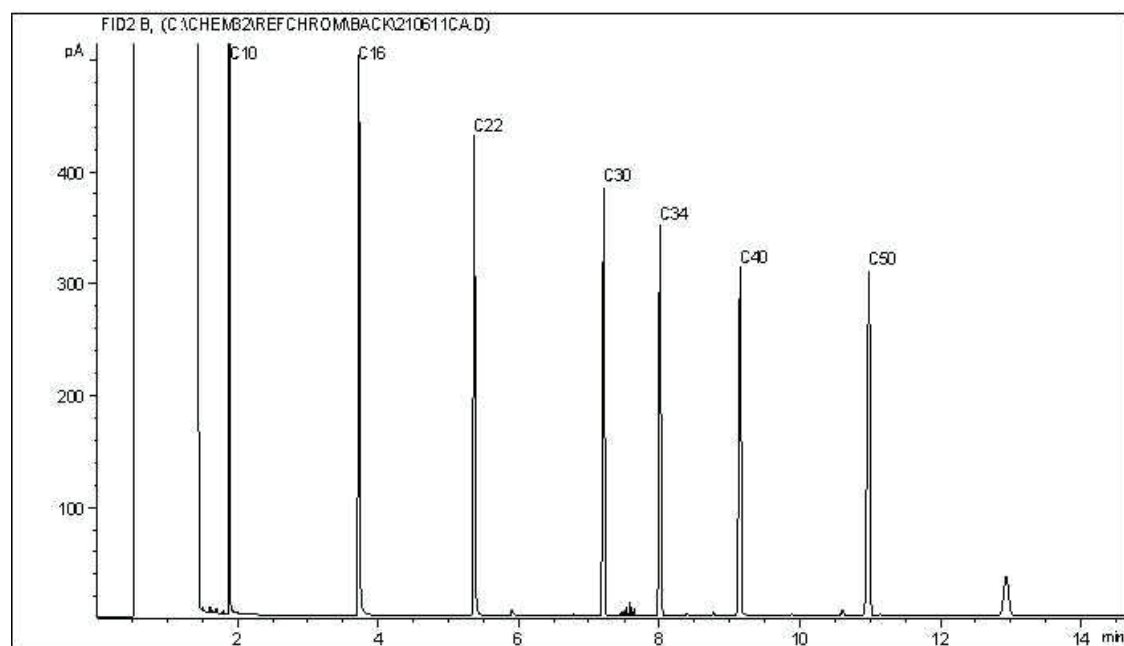


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

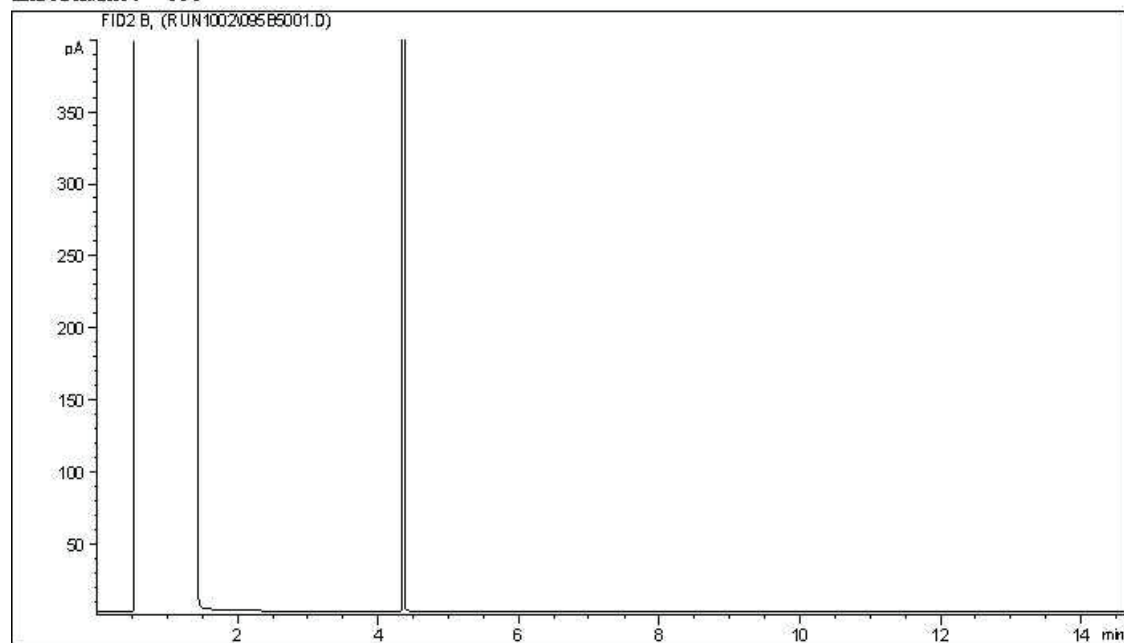
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

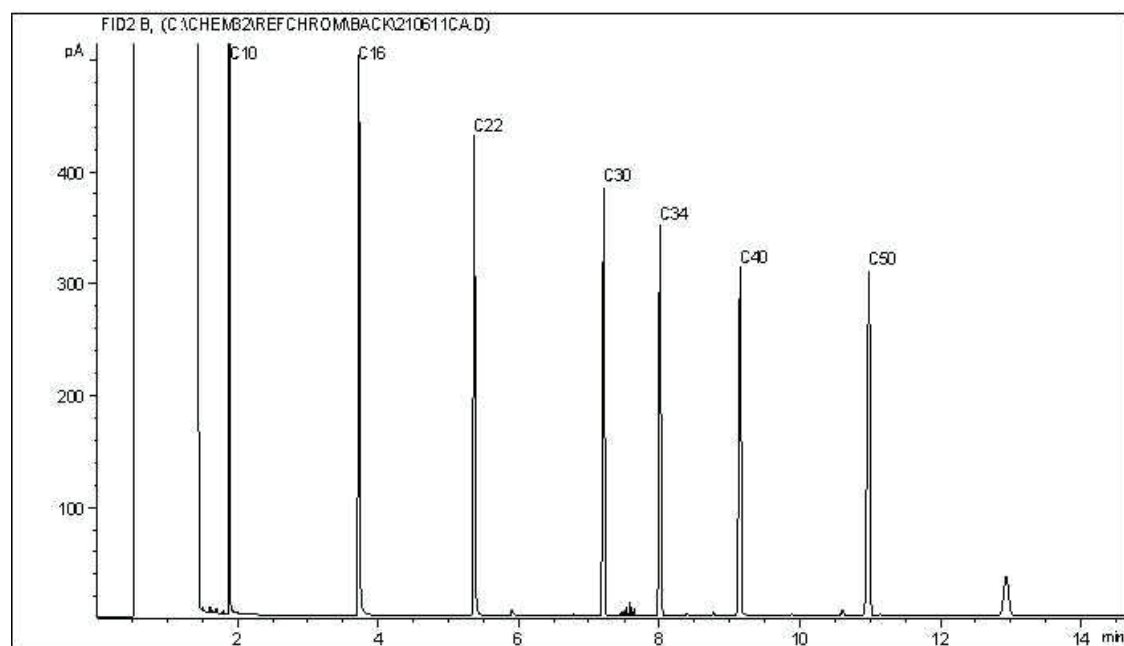


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

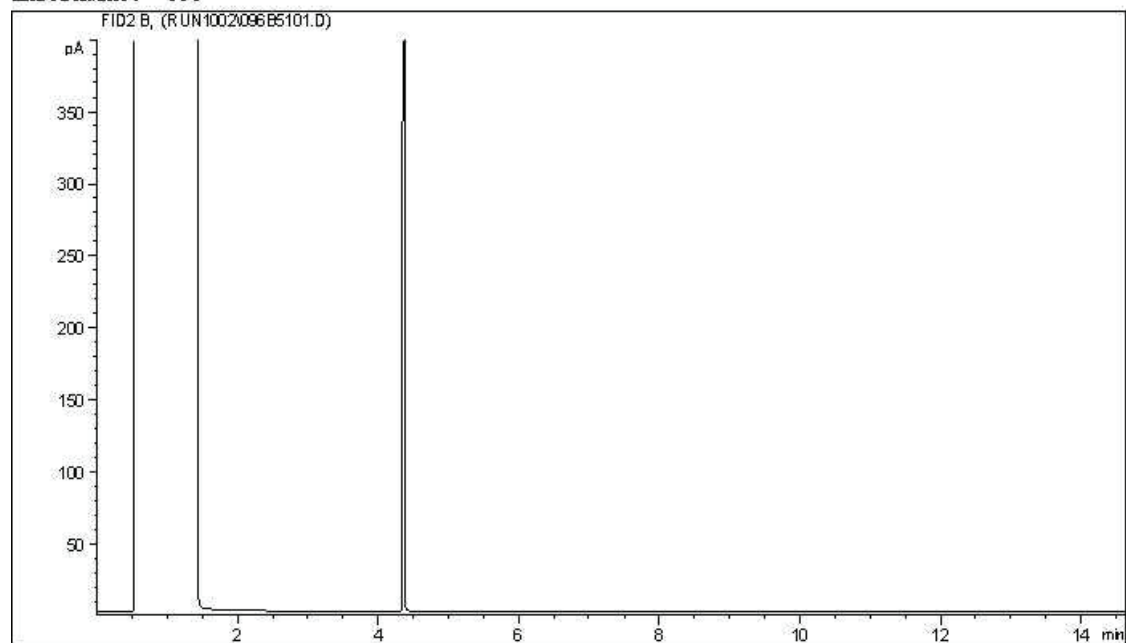
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

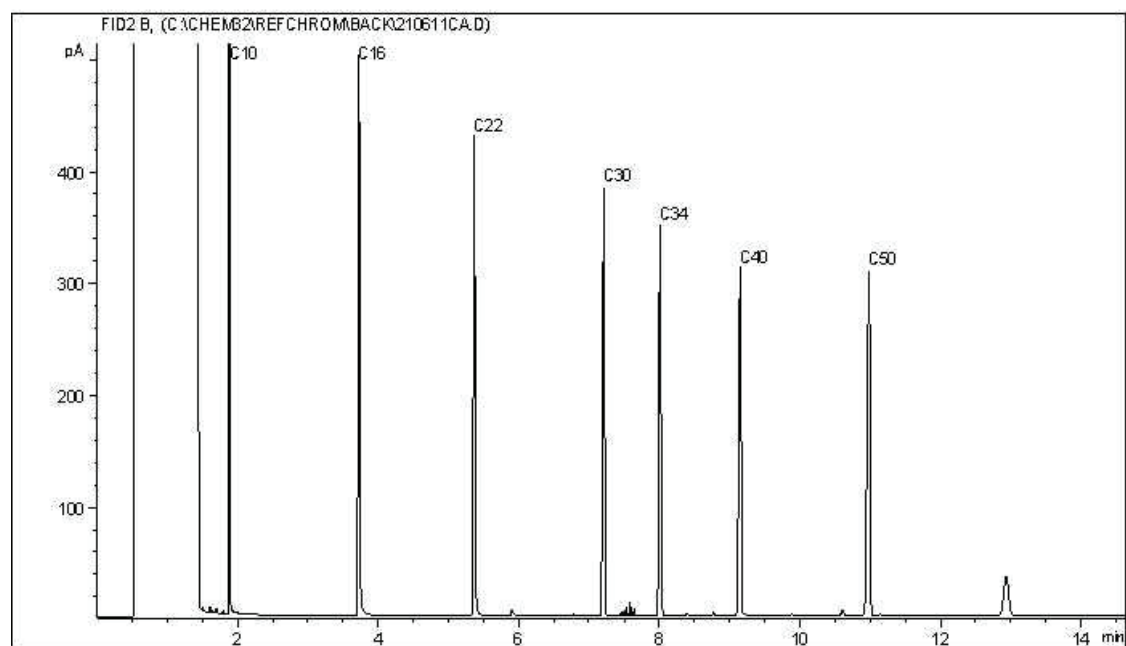


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

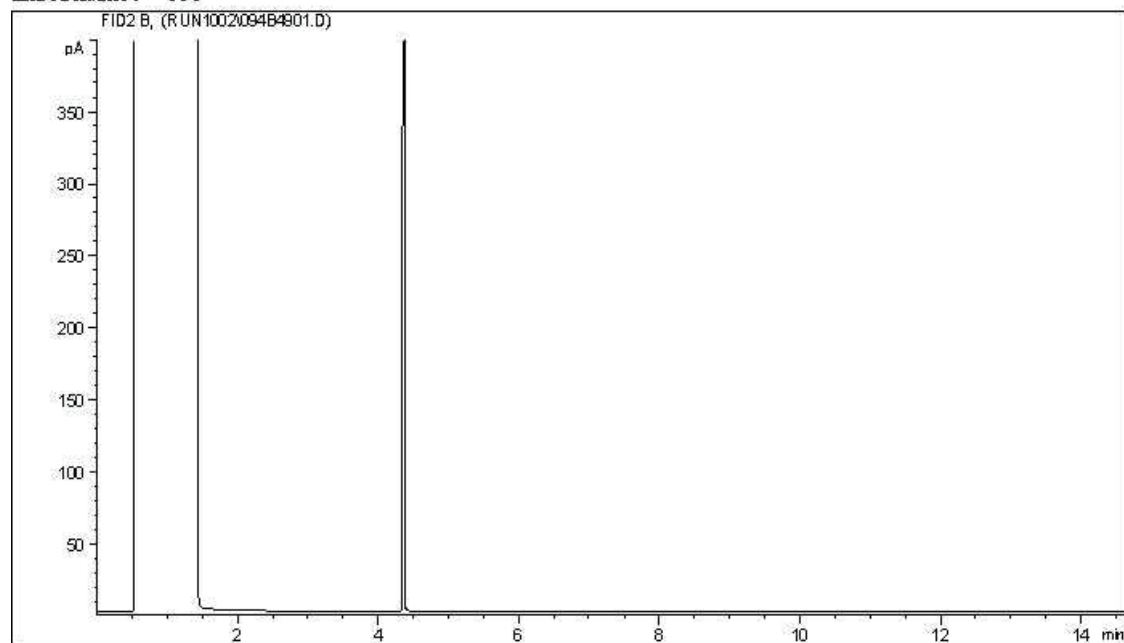
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

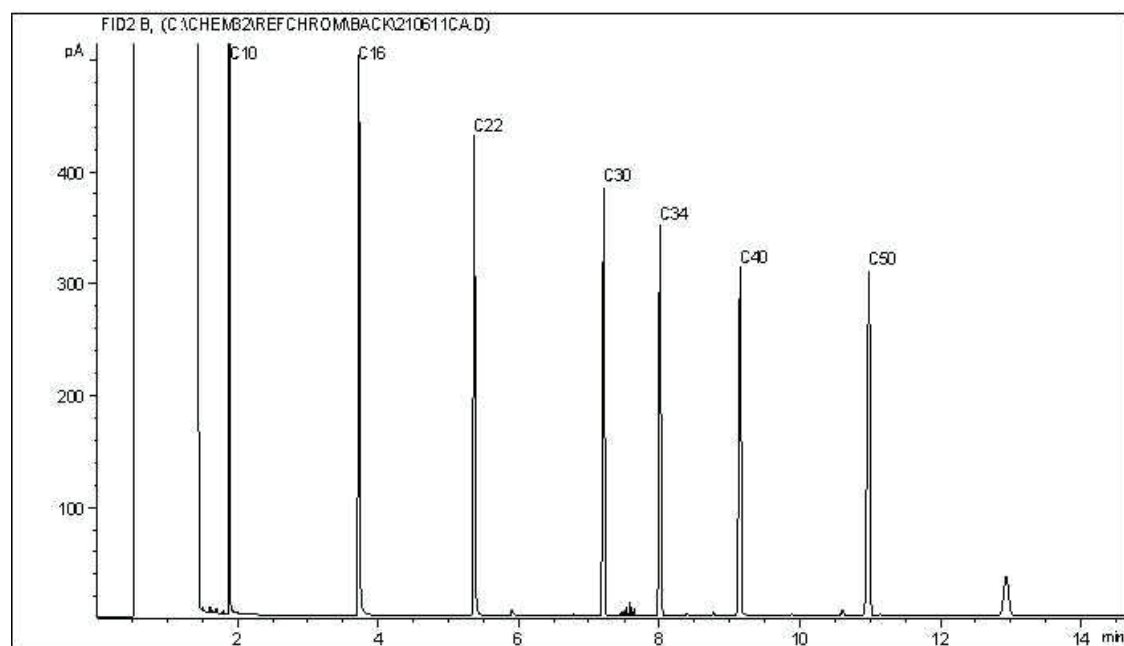


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

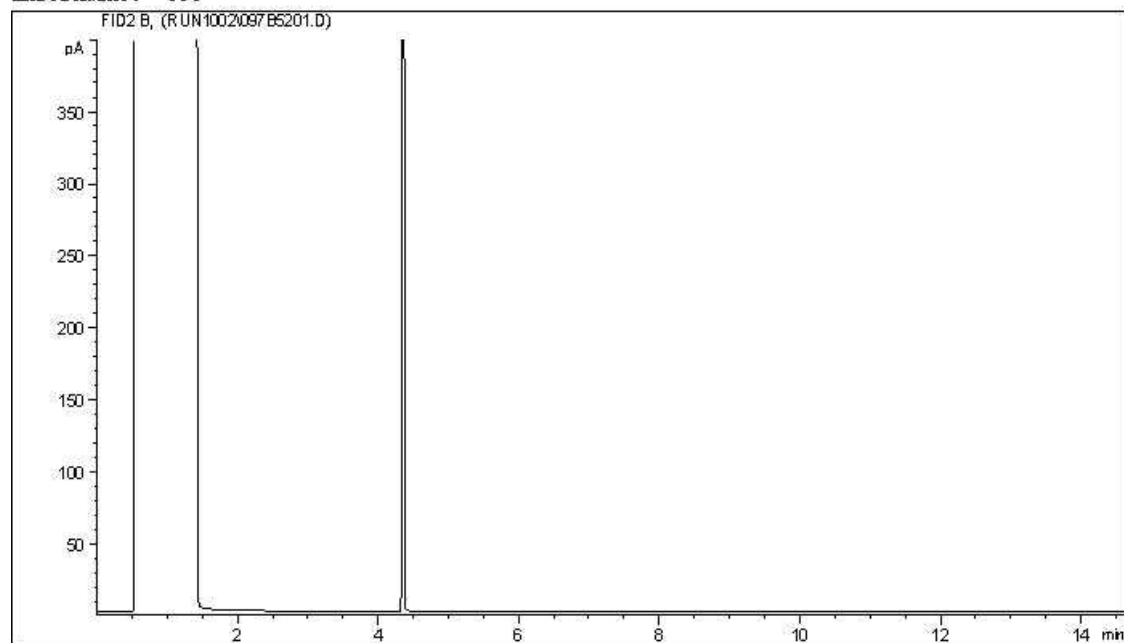
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

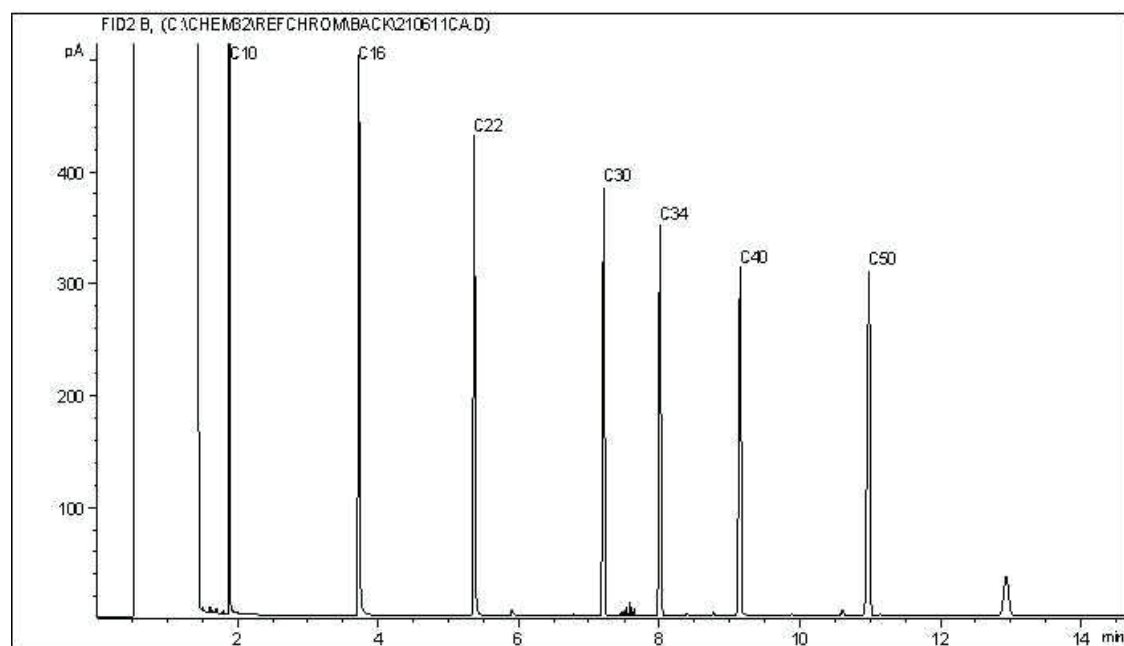


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

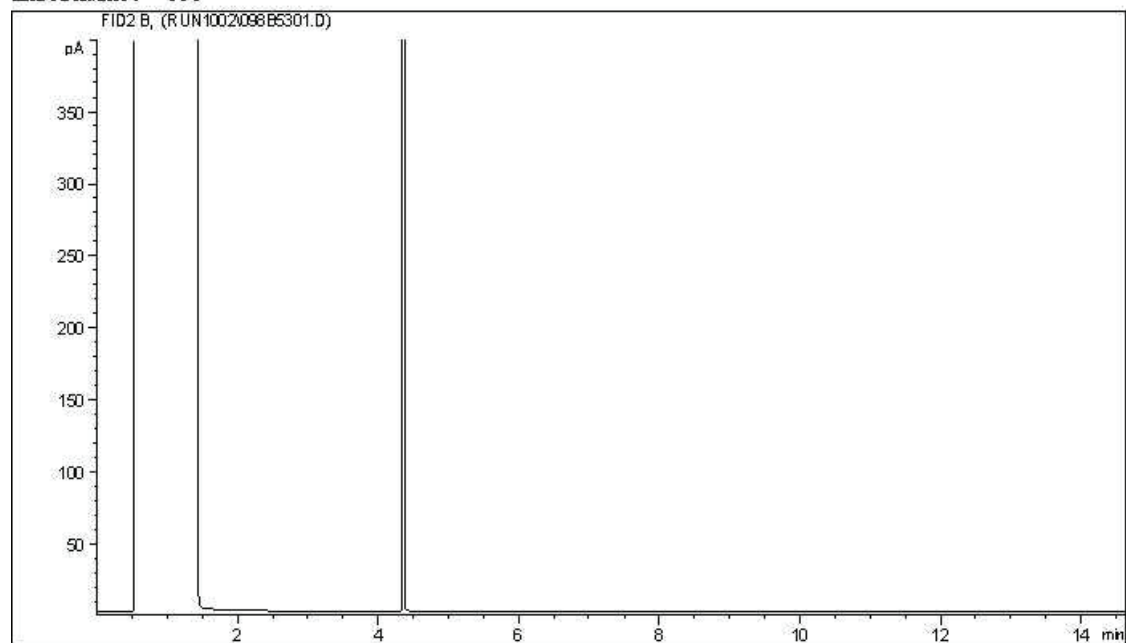
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

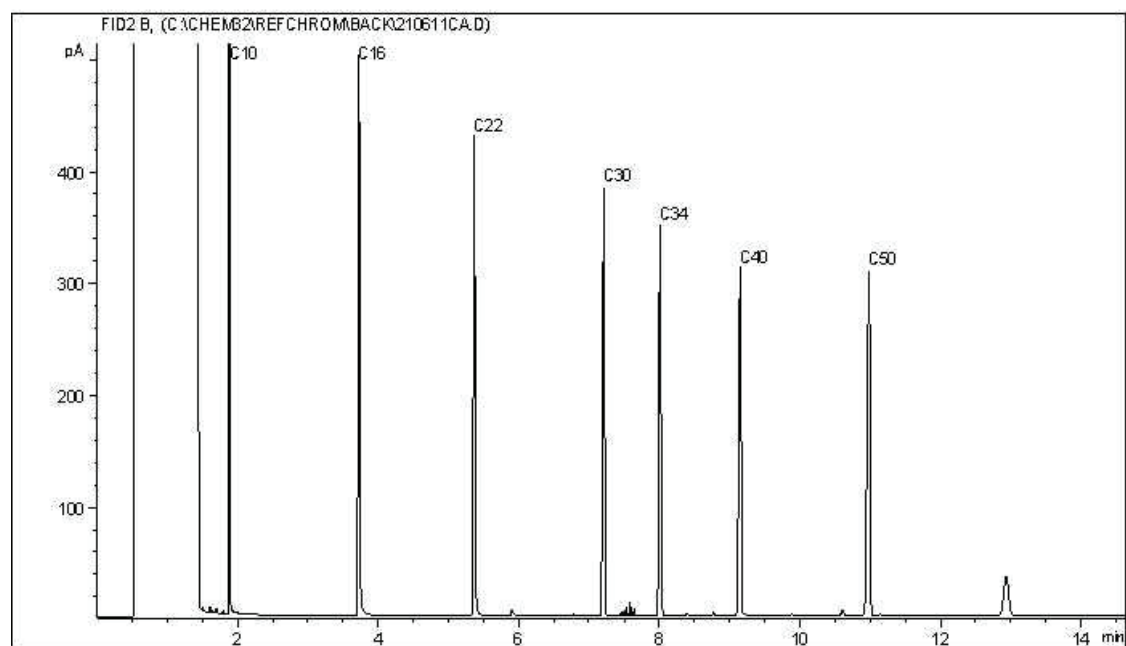


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

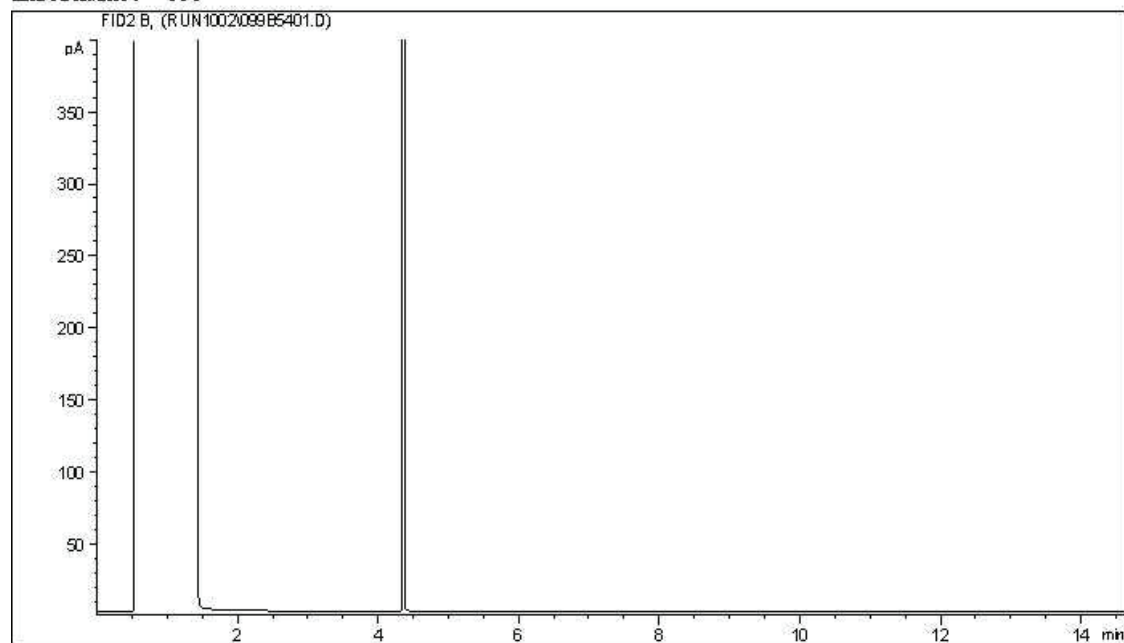
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

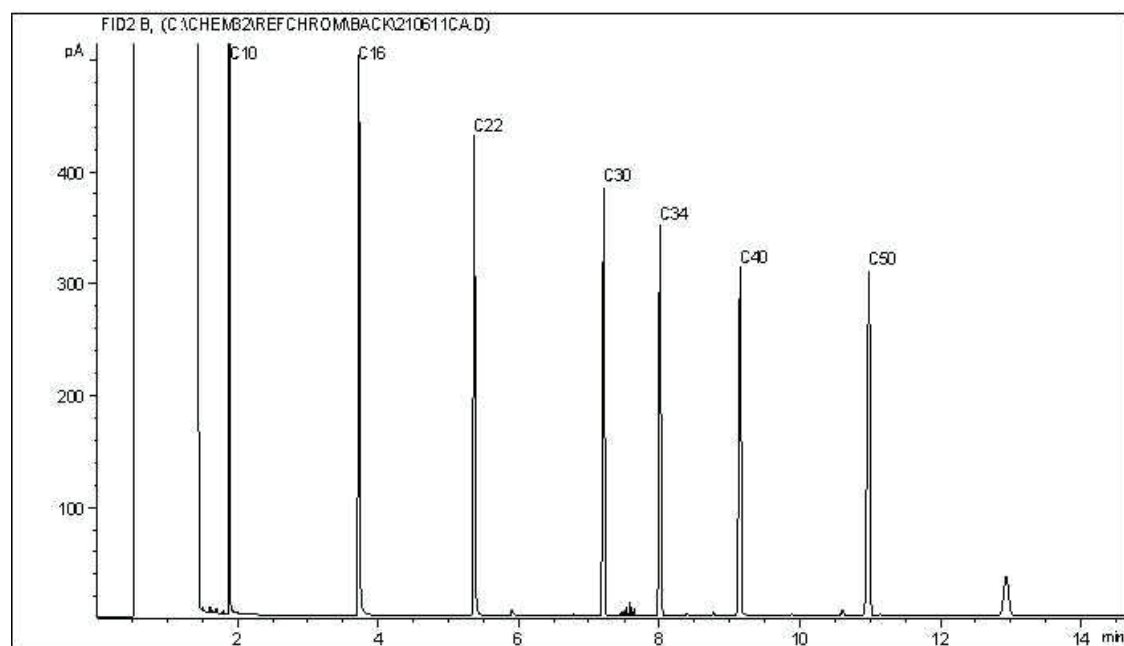


**CCME Hydrocarbons (F2-F4 in water) Chromatogram**

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



**TYPICAL PRODUCT CARBON NUMBER RANGES**

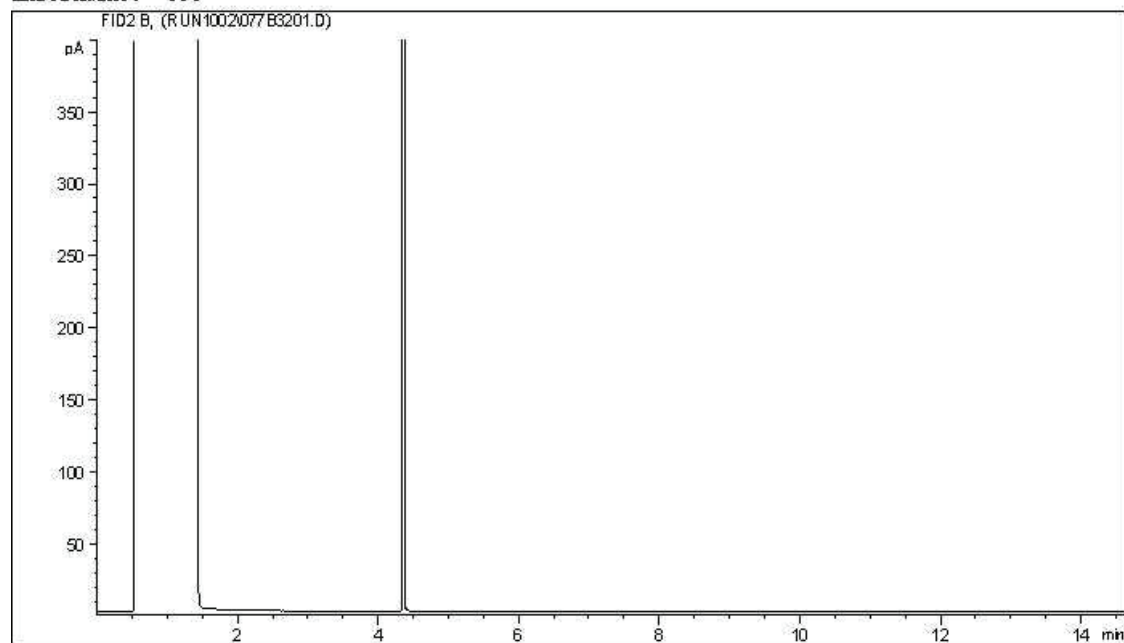
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

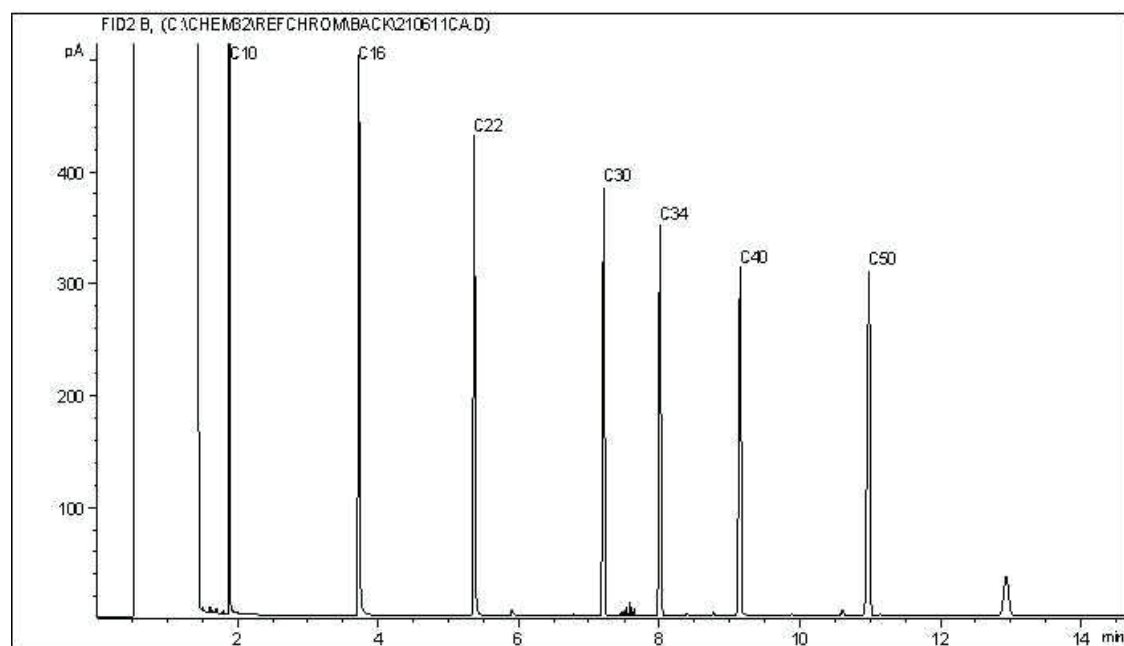


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



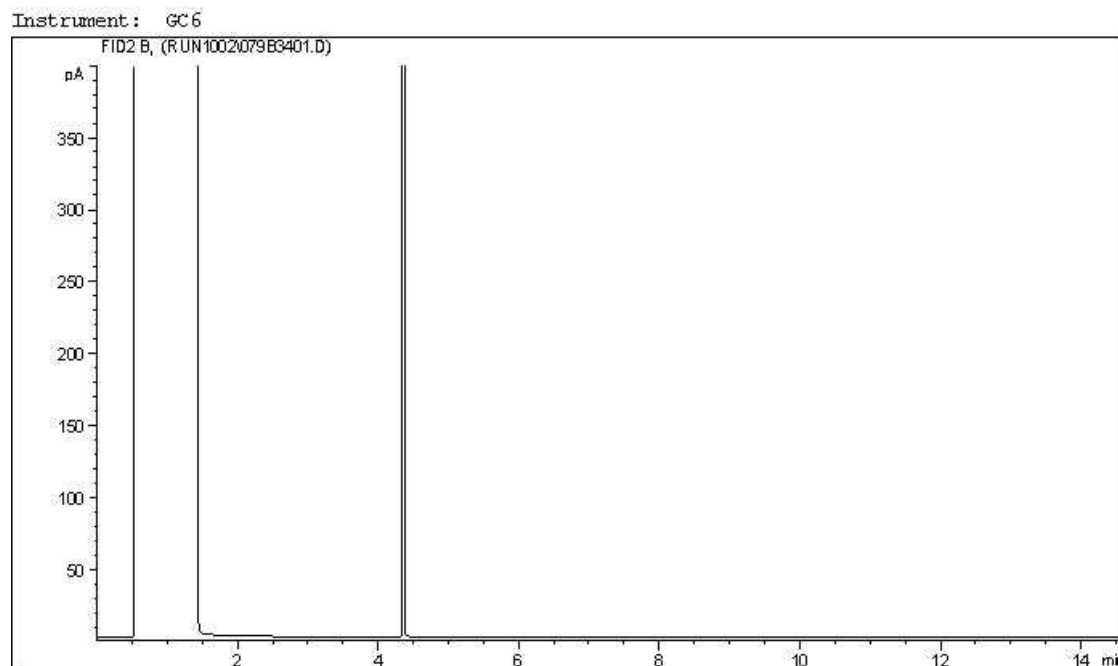
## TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

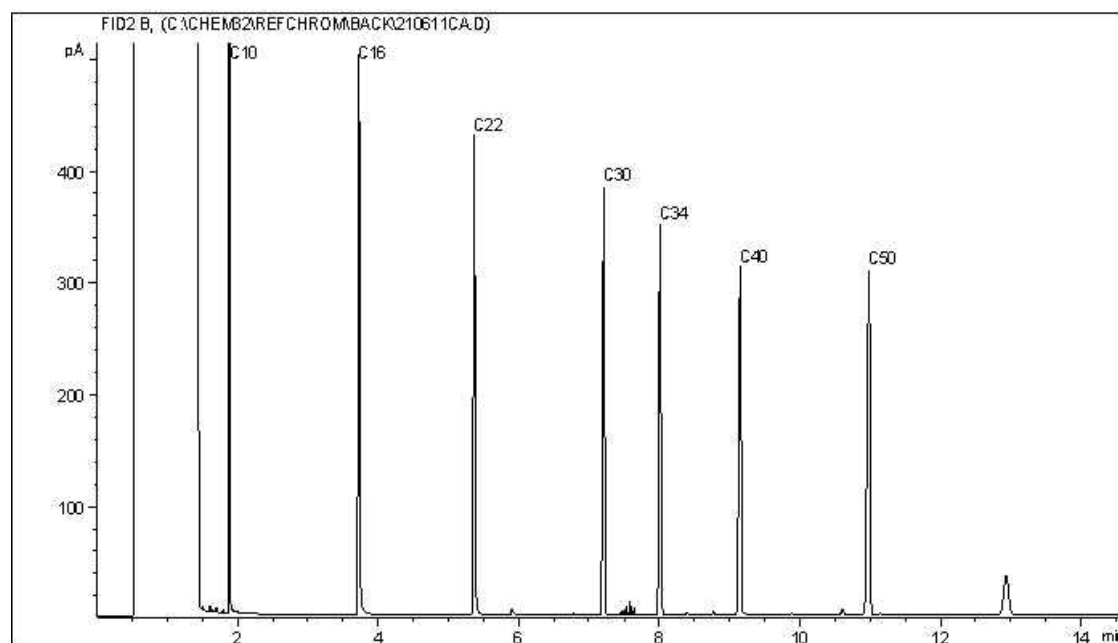
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**



# CCME Hydrocarbons (F2-F4 in water) Chromatogram



## Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**

Report #: R3090636

Version: 3 - Revision

## CERTIFICATE OF ANALYSIS – REVISED REPORT

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO <sub>3</sub> ,HCO <sub>3</sub> ,OH	2	N/A	2021/09/30	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	2	2021/09/29	2021/10/04	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	2	N/A	2021/10/01	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	2	N/A	2021/10/02		Auto Calc
Chloride/Sulphate by Auto Colourimetry	2	N/A	2021/10/05	AB SOP-00020	SM23-4500-Cl/SO4-E m
COD by Colorimeter	2	N/A	2021/09/29	AB SOP-00016	SM 23 5220D m
True Colour	2	N/A	2021/09/29	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	2	N/A	2021/10/07		Auto Calc
Carbon (DOC) (2)	2	N/A	2021/10/02	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	2	N/A	2021/09/30	AB SOP-00005	SM 23 2510 B m
Fluoride	2	N/A	2021/09/30	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (3)	2	2021/10/01	2021/10/03	AB SOP-00037	CCME PHC-CWS m
Hardness	2	N/A	2021/10/01		Auto Calc
Hardness Total (calculated as CaCO <sub>3</sub> ) (4)	2	N/A	2021/10/09	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO <sub>3</sub> )	2	N/A	2021/10/01	BBY WI-00033	Auto Calc
Ultra Low Mercury - Diss, field filtered (1)	2	N/A	2021/09/30	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	2	2021/09/30	2021/09/30	BBY7SOP-00022	EPA 1631E m
Elements by ICP - Dissolved (5)	2	N/A	2021/09/30	AB SOP-00042	EPA 6010d R5 m
Ion Balance	2	N/A	2021/10/05		Auto Calc
Sum of cations, anions	2	N/A	2021/10/01		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	2	N/A	2021/10/08	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (5)	2	N/A	2021/10/07	CAL SOP-00265	EPA 6020 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	2	N/A	2021/10/09	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	2	N/A	2021/10/08	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	2	2021/10/01	2021/10/04	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH <sub>3</sub> ) as N @ 15C	1	2021/10/01	2021/10/05		Auto Calc
Un-Ionized Ammonia (NH <sub>3</sub> ) as N	1	N/A	2021/10/03		Auto Calc
Ammonia-N (Total)	2	N/A	2021/10/03	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate and Nitrite	2	N/A	2021/10/01		Auto Calc
NO <sub>2</sub> (N); NO <sub>2</sub> (N) + NO <sub>3</sub> (N) in Water	2	N/A	2021/09/29	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	2	2021/09/28	2021/10/01		Auto Calc





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**

Report #: R3090636

Version: 3 - Revision

## **CERTIFICATE OF ANALYSIS – REVISED REPORT**

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 2

<b>Analyses</b>	<b>Quantity</b>	<b>Date Extracted</b>	<b>Date Analyzed</b>	<b>Laboratory Method</b>	<b>Analytical Method</b>
Target & Alkylated PAH in Water by GC/MS (6)	2	2021/10/01	2021/10/02	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (7)	2	N/A	2021/10/13		Auto Calc
Filter and HNO3 Preserve for Metals	2	N/A	2021/09/28		
pH measured @ 15 C (12, 8)	1	N/A	2021/10/05	EENVSOP-00159	SM 23 4500 H+ B m
pH @25°C (8)	2	N/A	2021/09/30	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	1	N/A	2021/10/01	Field Test	Field Test
Orthophosphate by Konelab (low level) (9)	2	N/A	2021/09/29	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	2	2021/10/05	2021/10/05	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	2	2021/10/01	2021/10/01	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	2	N/A	2021/10/05		Auto Calc
Temperature (Field)	1	N/A	2021/10/01		
Total Trihalomethanes Calculation	2	N/A	2021/10/05		Auto Calc
Carbon (Inorganic)	2	N/A	2021/10/03	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	1	2021/09/30	2021/10/04	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	1	2021/09/30	2021/10/05	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (10)	2	N/A	2021/10/01	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/02	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/10/02	2021/10/06	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	2	2021/10/01	2021/10/01	AB SOP-00061	SM 23 2540 D m
Turbidity	2	N/A	2021/09/28	CAL SOP-00081	SM 23 2130 B m
VOCs in Water by HS GC/MS (Std List)	2	N/A	2021/10/02	AB SOP-00056	EPA 5021a/8260d m

Sample Matrix: Water  
# Samples Received: 10

<b>Analyses</b>	<b>Quantity</b>	<b>Date Extracted</b>	<b>Date Analyzed</b>	<b>Laboratory Method</b>	<b>Analytical Method</b>
Alkalinity @25C (pp, total), CO3,HCO3,OH	8	N/A	2021/09/30	AB SOP-00005	SM 23 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2021/10/02	AB SOP-00005	SM 23 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2021/10/16	AB SOP-00005	SM 23 2320 B m
Biochemical Oxygen Demand	5	2021/09/28	2021/10/03	AB SOP-00017	SM 23 5210B m





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

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Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**

Report #: R3090636

Version: 3 - Revision

## CERTIFICATE OF ANALYSIS – REVISED REPORT

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Biochemical Oxygen Demand	5	2021/09/29	2021/10/04	AB SOP-00017	SM 23 5210B m
BTEX/F1 in Water by HS GC/MS/FID	10	N/A	2021/10/01	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX	10	N/A	2021/10/02		Auto Calc
Chloride/Sulphate by Auto Colourimetry	1	N/A	2021/10/04	AB SOP-00020	SM23-4500-Cl/SO4-E m
Chloride/Sulphate by Auto Colourimetry	9	N/A	2021/10/05	AB SOP-00020	SM23-4500-Cl/SO4-E m
COD by Colorimeter	9	N/A	2021/10/02	AB SOP-00016	SM 23 5220D m
COD by Colorimeter	1	N/A	2021/10/18	AB SOP-00016	SM 23 5220D m
True Colour	10	N/A	2021/09/30	CAL SOP-00049	SM 23 2120 C m
Total Cresols Calculation	10	N/A	2021/10/04		Auto Calc
Carbon (DOC) (2)	9	N/A	2021/10/02	AB SOP-00087	MMCW 119 1996 m
Carbon (DOC) (2)	1	N/A	2021/10/03	AB SOP-00087	MMCW 119 1996 m
Conductivity @25C	8	N/A	2021/09/30	AB SOP-00005	SM 23 2510 B m
Conductivity @25C	1	N/A	2021/10/02	AB SOP-00005	SM 23 2510 B m
Conductivity @25C	1	N/A	2021/10/16	AB SOP-00005	SM 23 2510 B m
Fluoride	9	N/A	2021/09/30	AB SOP-00005	SM 23 4500-F C m
Fluoride	1	N/A	2021/10/02	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (3)	2	2021/09/30	2021/10/02	AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in water) (3)	8	2021/09/30	2021/10/03	AB SOP-00037	CCME PHC-CWS m
Hardness	10	N/A	2021/10/01		Auto Calc
Hardness Total (calculated as CaCO3) (4)	4	N/A	2021/10/06	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO3) (4)	6	N/A	2021/10/09	BBY WI-00033	Auto Calc
Hardness (calculated as CaCO3)	10	N/A	2021/10/01	BBY WI-00033	Auto Calc
Ultra Low Mercury - Diss, field filtered (1)	10	N/A	2021/09/30	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	9	2021/09/30	2021/09/30	BBY7SOP-00022	EPA 1631E m
Ultra Low Level Mercury - Total (1)	1	2021/09/30	2021/10/01	BBY7SOP-00022	EPA 1631E m
Elements by ICP - Dissolved (5)	8	N/A	2021/09/30	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Dissolved (5)	2	N/A	2021/10/01	AB SOP-00042	EPA 6010d R5 m
Ion Balance	10	N/A	2021/10/05		Auto Calc
Sum of cations, anions	10	N/A	2021/10/01		Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	10	N/A	2021/10/08	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (dissolved) (5)	10	N/A	2021/10/07	CAL SOP-00265	EPA 6020 m
Elements by ICPMS Digested LL (total)	4	2021/09/30	2021/09/30	CAL SOP-00265	EPA 6020 m





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**

Report #: R3090636

Version: 3 - Revision

## CERTIFICATE OF ANALYSIS – REVISED REPORT

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Na, K, Ca, Mg, S by CRC ICPMS (total)	4	N/A	2021/10/06	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	6	N/A	2021/10/09	BBY WI-00033	Auto Calc
Elements by ICPMS Low Level (total)	6	N/A	2021/10/08	CAL SOP-00265	EPA 6020 m
Naphthenic Acids by IR	1	2021/09/30	2021/10/01	AB SOP-00060	EPA 3510C R3 / FTIR
Naphthenic Acids by IR	9	2021/10/01	2021/10/04	AB SOP-00060	EPA 3510C R3 / FTIR
Un-Ionized Ammonia (NH3) as N	10	N/A	2021/10/03		Auto Calc
Ammonia-N (Total)	10	N/A	2021/10/03	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate and Nitrite	9	N/A	2021/09/29		Auto Calc
Nitrate and Nitrite	1	N/A	2021/10/01		Auto Calc
NO2 (N); NO2 (N) + NO3 (N) in Water	9	N/A	2021/09/28	AB SOP-00091	SM 23 4500 NO3m
NO2 (N); NO2 (N) + NO3 (N) in Water	1	N/A	2021/09/29	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	9	2021/09/28	2021/09/29		Auto Calc
Nitrate (as N)	1	2021/09/28	2021/10/01		Auto Calc
Target & Alkylated PAH in Water by GC/MS (6)	10	2021/10/01	2021/10/02	AB SOP-00037 CAL SOP-00250	EPA 8270e m
Benzo[a]pyrene Equivalency (7)	10	N/A	2021/10/13		Auto Calc
Filter and HNO3 Preserve for Metals (1)	10	N/A	2021/10/04	BBY7 WI-00004	SM 23 3030B m
pH @25°C (8)	9	N/A	2021/09/30	AB SOP-00005	SM 23 4500-H+B m
pH @25°C (8)	1	N/A	2021/10/02	AB SOP-00005	SM 23 4500-H+B m
pH (Field)	10	N/A	2021/10/01	Field Test	Field Test
Orthophosphate by Konelab (low level) (9)	10	N/A	2021/09/29	AB SOP-00025	SM 23 4500-P A, F m
Phenols (semivolatile)	10	2021/10/03	2021/10/03	CAL SOP-00164	EPA 8270e m
Total Dissolved Solids (Filt. Residue)	10	2021/10/01	2021/10/01	AB SOP-00065	SM 23 2540 C m
Total Dissolved Solids (Calculated)	10	N/A	2021/10/05		Auto Calc
Temperature (Field)	10	N/A	2021/10/01		
Total Trihalomethanes Calculation	10	N/A	2021/10/02		Auto Calc
Carbon (Inorganic)	10	N/A	2021/10/08	CAL SOP-00076	Modified AE 2411
Nitrogen (Total)	1	2021/09/29	2021/09/30	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	8	2021/09/30	2021/10/04	AB SOP-00093	SM 23 4500-N C m
Nitrogen (Total)	1	2021/09/30	2021/10/05	AB SOP-00093	SM 23 4500-N C m
Carbon (Total Organic) (10)	10	N/A	2021/10/15	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

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Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**

Report #: R3090636

Version: 3 - Revision

## CERTIFICATE OF ANALYSIS – REVISED REPORT

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

Sample Matrix: Water  
# Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Phosphorus Low Level Dissolved (11)	7	2021/10/01	2021/10/02	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/01	2021/10/04	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Dissolved (11)	1	2021/10/17	2021/10/17	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	5	2021/10/01	2021/10/01	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	2	2021/10/02	2021/10/04	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	2	2021/10/02	2021/10/06	AB SOP-00024	SM 23 4500-P A,B,F m
Total Phosphorus Low Level Total	1	2021/10/19	2021/10/19	AB SOP-00024	SM 23 4500-P A,B,F m
Total Suspended Solids (NFR)	10	2021/10/01	2021/10/01	AB SOP-00061	SM 23 2540 D m
Turbidity	10	N/A	2021/09/28	CAL SOP-00081	SM 23 2130 B m
VOCs in Water by HS GC/MS (Std List)	10	N/A	2021/10/01	AB SOP-00056	EPA 5021a/8260d m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Bureau Veritas Vancouver, 4606 Canada Way, Burnaby, BC, V5G 1K5

(2) DOC present in the sample should be considered as non-purgeable DOC. Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data





Your Project #: Syncrude mesocosm experiment  
Your C.O.C. #: 644187-01-01, 644187-02-01

**Attention: Zach Mueller**

HATFIELD CONSULTANTS  
Suite A, 300 MacKenzie Blvd  
FORT MCMURRAY, AB  
CANADA T9H 4C4

**Report Date: 2021/10/27**  
Report #: R3090636  
Version: 3 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**BV LABS JOB #: C172489**

**Received: 2021/09/27, 09:00**

quality meets acceptable levels unless otherwise noted.

(3) Silica gel clean up employed.

(4) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(5) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

(6) Alkylated PAH results are semiquantitative

(7) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

(8) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

(9) Orthophosphate > Total Phosphorus Imbalance: When applicable, Orthophosphate, Total Phosphorus and dissolved Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(10) TOC present in the sample should be considered as non-purgeable TOC.

(11) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

(12) This test was performed by Bureau Veritas Edmonton Environmental, 9331 - 48 St. , Edmonton, AB, T6B 2R4

Encryption Key

Amanda L'Hirondelle  
Key Account Specialist  
27 Oct 2021 08:31:01

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Amanda L'Hirondelle, Key Account Specialist

Email: [Amanda.lhirondelle@bureauveritas.com](mailto:Amanda.lhirondelle@bureauveritas.com)

Phone# (780)577-7117

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX293			AGX294		
<b>Sampling Date</b>		2021/09/24 12:05			2021/09/24 12:25		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	0.0000	N/A	A368921	12	N/A	A367828
Cation Sum	meq/L	0.0090	N/A	A368921	12	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		ONSITE	FIELD		ONSITE
Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A368525	120	0.50	A368525
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A368392	121	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	<0.50	0.50	A368391	99.7	0.50	A368391
Ion Balance (% Difference)	%	NC	N/A	A368979	0.67	N/A	A368527
Dissolved Nitrate (N)	mg/L	<0.010	0.010	A368696	0.021	0.010	A368696
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	<0.044	0.044	A369126	0.092	0.044	A368695
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A369126	<0.033	0.033	A368695
Calculated Total Dissolved Solids	mg/L	<10	10	A369197	700	10	A368697
Un-Ionized Ammonia	mg/L				0.0016	0.0013	A368397
Un-Ionized Ammonia @ 15 °C	mg/L	<0.00050	0.00050	A372471			
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A369277	<2.0	2.0	A369277
Chemical Oxygen Demand	mg/L	<10	10	A369936	55	10	A369936
<b>Field Parameters</b>							
Field pH	pH				8.8	N/A	ONSITE
Field Temperature (Fd)	deg. C				7.4	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	<2.0	2.0	A371239	1200	2.0	A371239
Dissolved Organic Carbon (C)	mg/L	<0.50	0.50	A372370	9.9	0.50	A372370
pH	pH	5.07	N/A	A371238	8.72	N/A	A371238
Total Organic Carbon (C)	mg/L	<0.50	0.50	A372365	10	0.50	A372365
Total Dissolved Solids	mg/L	<10	10	A372069	680	10	A372069
Total Suspended Solids	mg/L	<1.0	1.0	A372084	9.3	0.99	A372084
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371237	10	1.0	A371237
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371237	190	1.0	A371237
Bicarbonate (HCO <sub>3</sub> )	mg/L	<1.0	1.0	A371237	200	1.0	A371237
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371237	12	1.0	A371237
Dissolved Fluoride (F)	mg/L	<0.050	0.050	A371232	0.79	0.050	A371232
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX293			AGX294		
<b>Sampling Date</b>		2021/09/24 12:05			2021/09/24 12:25		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371237	<1.0	1.0	A371237
Orthophosphate (P)	mg/L	<0.0010	0.0010	A369383	0.0040	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	<1.0	1.0	A375463	130	1.0	A375470
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	A375463	200	2.0	A375470
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	0.018	0.015	A373819
Total Inorganic Carbon (C)	mg/L	<1.0	1.0	A373099	51	1.0	A373099
Dissolved Phosphorus (P)	mg/L	0.0010	0.0010	A372557	0.0037	0.0010	A372555
Total Phosphorus (P)	mg/L	0.0020	0.0010	A372554	0.023	0.0010	A373745
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A370177	<0.010	0.010	A370177
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	A370177	0.021	0.010	A370177
Total Nitrogen (N)	mg/L	<0.020	0.020	A371102	0.75	0.020	A371158
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	<2.0	2.0	A369980	16	2.0	A369980
pH (15 C)	pH	5.26		A376687			
<b>Physical Properties</b>							
Turbidity	NTU	<0.10	0.10	A369034	8.4	0.10	A369034
RDL = Reportable Detection Limit							





### PETROLEUM HYDROCARBONS (CCME)

<b>Bureau Veritas ID</b>		AGX293	AGX294		
<b>Sampling Date</b>		2021/09/24 12:05	2021/09/24 12:25		
<b>COC Number</b>		644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Ext. Pet. Hydrocarbon</b>					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	A370623
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	A370623
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	0.20	A370623
<b>Surrogate Recovery (%)</b>					
O-TERPHENYL (sur.)	%	98	111		A370623
RDL = Reportable Detection Limit					





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX293	AGX294		
Sampling Date		2021/09/24 12:05	2021/09/24 12:25		
COC Number		644187-02-01	644187-02-01		
	UNITS	BLANK	DUPLICATE	RDL	QC Batch
<b>Polycyclic Aromatics</b>					
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	0.020	A367343
C1-fluorene	ug/L	<0.050	<0.050	0.050	A367343
RDL = Reportable Detection Limit					





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX293	AGX294		
Sampling Date		2021/09/24 12:05	2021/09/24 12:25		
COC Number		644187-02-01	644187-02-01		
	UNITS	BLANK	DUPLICATE	RDL	QC Batch
C2-fluorene	ug/L	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	0.027	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	0.10	A367343
<b>Phenols</b>					
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
Cresols	mg/L	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	0.00020 (1)	<0.00010	0.00010	A375833
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
RDL = Reportable Detection Limit					
(1) Qualifying ion outside of acceptance criteria. Results are tentatively identified and potentially biased high.					





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX293	AGX294		
<b>Sampling Date</b>		2021/09/24 12:05	2021/09/24 12:25		
<b>COC Number</b>		644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	0.0010	A375833
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2-chlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A375833
2-nitrophenol	mg/L	<0.0010	<0.0010	0.0010	A375833
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A375833
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	0.0010	A375833
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	0.00010	A375833
4-nitrophenol	mg/L	<0.0010	<0.0010	0.0010	A375833
Pentachlorophenol	mg/L	<0.00010	<0.00010	0.00010	A375833
<b>Surrogate Recovery (%)</b>					
D10-ANTHRACENE (sur.)	%	105	105		A367343
D8-ACENAPHTHYLENE (sur.)	%	88	84		A367343
D8-NAPHTHALENE (sur.)	%	75	71		A367343
TERPHENYL-D14 (sur.)	%	115	117		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	112	110		A375833
2,4-DIBROMOPHENOL (sur.)	%	113	109		A375833
RDL = Reportable Detection Limit					





### MERCURY BY COLD VAPOR (WATER)

<b>Bureau Veritas ID</b>		AGX293	AGX294		
<b>Sampling Date</b>		2021/09/24 12:05	2021/09/24 12:25		
<b>COC Number</b>		644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>					
Dissolved Mercury (Hg)	ug/L	0.00013	0.00106	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00016	0.00154	0.00010	A371757
RDL = Reportable Detection Limit					



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

<b>Bureau Veritas ID</b>		AGX293			AGX294		
<b>Sampling Date</b>		2021/09/24 12:05			2021/09/24 12:25		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	<0.30	0.30	A370547	30	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A370547	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	<0.20	0.20	A370547	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A370547	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	<0.30	0.30	A370547	4.4	0.30	A370547
Dissolved Sodium (Na)	mg/L	<0.50	0.50	A370547	210	0.50	A370547
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	2.90	0.50	A376671	32.1	2.5	A376671
Dissolved Antimony (Sb)	ug/L	<0.020	0.020	A376671	0.32	0.10	A376671
Dissolved Arsenic (As)	ug/L	<0.020	0.020	A376671	3.37	0.10	A376671
Dissolved Barium (Ba)	ug/L	<0.10	0.10	A391916	45.6	0.10	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A376671	<0.050	0.050	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A376671	<0.025	0.025	A376671
Dissolved Boron (B)	ug/L	<10	10	A376671	731	50	A376671
Dissolved Cadmium (Cd)	ug/L	<0.0050	0.0050	A376671	0.030	0.025	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	A376671	<0.50	0.50	A376671
Dissolved Cobalt (Co)	ug/L	0.0059	0.0050	A376671	0.155	0.025	A376671
Dissolved Copper (Cu)	ug/L	<0.050	0.050	A376671	<0.25	0.25	A376671
Dissolved Iron (Fe)	ug/L	2.0	1.0	A376671	23.1	5.0	A376671
Dissolved Lead (Pb)	ug/L	0.0063	0.0050	A376671	<0.025	0.025	A376671
Dissolved Lithium (Li)	ug/L	<0.50	0.50	A376671	31.3	2.5	A376671
Dissolved Manganese (Mn)	ug/L	<0.25	0.25	A391916	1.83	0.25	A376671
Dissolved Molybdenum (Mo)	ug/L	<0.050	0.050	A376671	228	0.25	A376671
Dissolved Nickel (Ni)	ug/L	0.22	0.10	A391916	2.02	0.10	A376671
Dissolved Selenium (Se)	ug/L	<0.040	0.040	A376671	0.93	0.20	A376671
Dissolved Silicon (Si)	ug/L	<50	50	A376671	1220	250	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A376671	<0.025	0.025	A376671
Dissolved Strontium (Sr)	ug/L	0.101	0.050	A376671	307	0.25	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	0.0020	A376671	<0.010	0.010	A376671
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A376671	<1.0	1.0	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A376671	<2.5	2.5	A376671
Dissolved Uranium (U)	ug/L	0.0028	0.0020	A376671	2.46	0.010	A376671
Dissolved Vanadium (V)	ug/L	<0.20	0.20	A376671	528	1.0	A376671
RDL = Reportable Detection Limit							



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

<b>Bureau Veritas ID</b>		AGX293			AGX294		
<b>Sampling Date</b>		2021/09/24 12:05			2021/09/24 12:25		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Zinc (Zn)	ug/L	<0.50	0.50	A391916	2.67	0.50	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A376671	<0.50	0.50	A376671
Dissolved Calcium (Ca)	mg/L	<0.25	0.25	A368394	26.6	0.25	A368394
Dissolved Magnesium (Mg)	mg/L	<0.25	0.25	A368394	10.3	0.25	A368394
Dissolved Potassium (K)	mg/L	<0.25	0.25	A368394	3.90	0.25	A368394
Dissolved Sodium (Na)	mg/L	<0.25	0.25	A368394	202	0.25	A368394
Dissolved Sulphur (S)	mg/L	<15	15	A368394	49	15	A368394
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	1.17	0.50	A376677	159	0.50	A376677
Total Antimony (Sb)	ug/L	<0.020	0.020	A376677	0.249	0.020	A376677
Total Arsenic (As)	ug/L	<0.020	0.020	A376677	2.98	0.020	A376677
Total Barium (Ba)	ug/L	<0.020	0.020	A376677	41.9	0.020	A376677
Total Beryllium (Be)	ug/L	<0.010	0.010	A376677	<0.010	0.010	A376677
Total Bismuth (Bi)	ug/L	<0.0050	0.0050	A376677	<0.0050	0.0050	A376677
Total Boron (B)	ug/L	<10	10	A376677	654	10	A376677
Total Cadmium (Cd)	ug/L	<0.0050	0.0050	A376677	<0.0050	0.0050	A376677
Total Chromium (Cr)	ug/L	<0.10	0.10	A376677	0.32	0.10	A376677
Total Cobalt (Co)	ug/L	<0.0050	0.0050	A376677	0.219	0.0050	A376677
Total Copper (Cu)	ug/L	<0.050	0.050	A376677	0.629	0.050	A376677
Total Iron (Fe)	ug/L	<1.0	1.0	A376677	331	1.0	A376677
Total Lead (Pb)	ug/L	<0.0050	0.0050	A376677	0.116	0.0050	A376677
Total Lithium (Li)	ug/L	<0.50	0.50	A376677	30.3	0.50	A376677
Total Manganese (Mn)	ug/L	<0.050	0.050	A376677	15.4	0.050	A376677
Total Molybdenum (Mo)	ug/L	<0.050	0.050	A376677	190	0.050	A376677
Total Nickel (Ni)	ug/L	<0.020	0.020	A376677	1.84	0.020	A376677
Total Selenium (Se)	ug/L	<0.040	0.040	A376677	0.813	0.040	A376677
Total Silicon (Si)	ug/L	<50	50	A376677	1480	50	A376677
Total Silver (Ag)	ug/L	<0.0050	0.0050	A376677	<0.0050	0.0050	A376677
Total Strontium (Sr)	ug/L	<0.050	0.050	A376677	269	0.050	A376677
Total Thallium (Tl)	ug/L	<0.0020	0.0020	A376677	0.0052	0.0020	A376677
Total Tin (Sn)	ug/L	<0.20	0.20	A376677	<0.20	0.20	A376677
Total Titanium (Ti)	ug/L	<0.50	0.50	A376677	5.19	0.50	A376677
Total Uranium (U)	ug/L	<0.0020	0.0020	A376677	2.14	0.0020	A376677
Total Vanadium (V)	ug/L	<0.20	0.20	A376677	443	0.20	A376677
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGX293			AGX294		
<b>Sampling Date</b>		2021/09/24 12:05			2021/09/24 12:25		
<b>COC Number</b>		644187-02-01			644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
Total Zinc (Zn)	ug/L	<0.10	0.10	A393408	2.89	0.10	A376677
Total Zirconium (Zr)	ug/L	<0.10	0.10	A376677	0.38	0.10	A376677
Total Calcium (Ca)	mg/L	<0.050	0.050	A368395	26.6	0.050	A368395
Total Magnesium (Mg)	mg/L	<0.050	0.050	A368395	8.09	0.050	A368395
Total Potassium (K)	mg/L	<0.050	0.050	A368395	3.51	0.050	A368395
Total Sodium (Na)	mg/L	<0.050	0.050	A368395	166	0.050	A368395
Total Sulphur (S)	mg/L	<3.0	3.0	A368395	42.6	3.0	A368395
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX293	AGX294		
Sampling Date		2021/09/24 12:05	2021/09/24 12:25		
COC Number		644187-02-01	644187-02-01		
	UNITS	BLANK	DUPLICATE	RDL	QC Batch
<b>Volatiles</b>					
Total Trihalomethanes	ug/L	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	0.40	A371386
Bromodichloromethane	ug/L	<0.50	<0.50	0.50	A371398
Toluene	ug/L	<0.40	<0.40	0.40	A371386
Bromoform	ug/L	<0.50	<0.50	0.50	A371398
Ethylbenzene	ug/L	<0.40	<0.40	0.40	A371386
Bromomethane	ug/L	<2.0	<2.0	2.0	A371398
m & p-Xylene	ug/L	<0.80	<0.80	0.80	A371386
Carbon tetrachloride	ug/L	<0.50	<0.50	0.50	A371398
o-Xylene	ug/L	<0.40	<0.40	0.40	A371386
Chlorobenzene	ug/L	<0.50	<0.50	0.50	A371398
Dibromochloromethane	ug/L	<1.0	<1.0	1.0	A371398
Xylenes (Total)	ug/L	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	1.0	A371398
F1 (C6-C10) - BTEX	ug/L	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	0.50	A371398
Chloromethane	ug/L	<2.0	<2.0	2.0	A371398
F1 (C6-C10)	ug/L	<100	<100	100	A371386
1,2-dibromoethane	ug/L	<0.20	<0.20	0.20	A371398
1,2-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A371398
1,3-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A371398
1,4-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A371398
1,1-dichloroethane	ug/L	<0.50	<0.50	0.50	A371398
1,2-dichloroethane	ug/L	<0.50	<0.50	0.50	A371398
1,1-dichloroethene	ug/L	<0.50	<0.50	0.50	A371398
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A371398
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A371398
Dichloromethane	ug/L	<2.0	<2.0	2.0	A371398
1,2-dichloropropane	ug/L	<0.50	<0.50	0.50	A371398
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A371398
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A371398
Methyl methacrylate	ug/L	<0.50	<0.50	0.50	A371398
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	0.50	A371398
RDL = Reportable Detection Limit					





### VOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX293	AGX294		
<b>Sampling Date</b>		2021/09/24 12:05	2021/09/24 12:25		
<b>COC Number</b>		644187-02-01	644187-02-01		
	<b>UNITS</b>	<b>BLANK</b>	<b>DUPLICATE</b>	<b>RDL</b>	<b>QC Batch</b>
Styrene	ug/L	<0.50	<0.50	0.50	A371398
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	1.0	A371398
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	2.0	A371398
Tetrachloroethene	ug/L	<0.50	<0.50	0.50	A371398
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A371398
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A371398
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	0.50	A371398
1,1,1-trichloroethane	ug/L	<0.50	<0.50	0.50	A371398
1,1,2-trichloroethane	ug/L	<0.50	<0.50	0.50	A371398
Trichloroethene	ug/L	<0.50	<0.50	0.50	A371398
Trichlorofluoromethane	ug/L	<0.50	<0.50	0.50	A371398
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A371398
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A371398
Vinyl chloride	ug/L	<0.50	<0.50	0.50	A371398
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene (sur.)	%	99	100		A371386
4-Bromofluorobenzene (sur.)	%	93	94		A371386
D4-1,2-Dichloroethane (sur.)	%	91	89		A371386
1,4-Difluorobenzene (sur.)	%	97	97		A371398
4-Bromofluorobenzene (sur.)	%	99	99		A371398
D4-1,2-Dichloroethane (sur.)	%	106	108		A371398
RDL = Reportable Detection Limit					





### RESULTS OF CHEMICAL ANALYSES OF WATER

Bureau Veritas ID		AGW993			AGW994		
Sampling Date		2021/09/24 16:20			2021/09/24 11:10		
COC Number		644187-01-01			644187-01-01		
	UNITS	RIVER WATER TANK	RDL	QC Batch	MESOCOSM TABLE 1	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.7	N/A	A367828	30	N/A	A367828
Cation Sum	meq/L	3.2	N/A	A367828	31	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	82	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A368392	82.4	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	120	0.50	A368391	71.2	0.50	A368391
Ion Balance (% Difference)	%	6.6	N/A	A367827	2.3	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.017	0.010	A367830	0.020	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.074	0.044	A367829	0.089	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	1800	10	A367831
Un-Ionized Ammonia	mg/L	<0.00082	0.00082	A368397	0.0039	0.0024	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	46 (1)	10	A369277	4.8	2.0	A367832
Chemical Oxygen Demand	mg/L	19	10	A391105	102	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.43	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	11.9	N/A	ONSITE	7.4	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	300	2.0	A371045	3100	2.0	A371045
Dissolved Organic Carbon (C)	mg/L	5.7	0.50	A372370	23	0.50	A372370
pH	pH	7.96	N/A	A371043	9.09	N/A	A371043
Total Organic Carbon (C)	mg/L	4.5	0.50	A387831	19	0.50	A387831
Total Dissolved Solids	mg/L	170	10	A372069	1900	10	A372069
Total Suspended Solids	mg/L	9.5	1.0	A372083	14	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	110	1.0	A371036
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A371036	370	1.0	A371036
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A371036	180	1.0	A371036
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	140	1.0	A371036
RDL = Reportable Detection Limit N/A = Not Applicable (1) Detection limit raised based on sample volume used for analysis.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW993			AGW994		
<b>Sampling Date</b>		2021/09/24 16:20			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 1</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Fluoride (F)	mg/L	0.078	0.050	A371046	2.3	0.050	A371046
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371036
Orthophosphate (P)	mg/L	0.0030	0.0010	A369383	0.0059	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	4.5	1.0	A375682	400	5.0	A375682
Dissolved Sulphate (SO4)	mg/L	40	1.0	A390968	510	5.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	0.024	0.015	A373819
Total Inorganic Carbon (C)	mg/L	30	1.0	A380555	93	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0030	0.0010	A390092	0.0097	0.0010	A372557
Total Phosphorus (P)	mg/L	0.0089	0.0010	A392634	0.067	0.0010	A372554
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.017	0.010	A369130	0.020	0.010	A369130
Total Nitrogen (N)	mg/L	0.25	0.020	A371102	1.9 (1)	0.10	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A368930	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	13	2.0	A369972	15	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	10	0.10	A369027	8.2	0.10	A369027
RDL = Reportable Detection Limit							
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.							



**RESULTS OF CHEMICAL ANALYSES OF WATER**

<b>Bureau Veritas ID</b>		AGW995			AGW996		
<b>Sampling Date</b>		2021/09/24 11:45			2021/09/24 11:45		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	13	N/A	A367828	7.4	N/A	A367828
Cation Sum	meq/L	12	N/A	A367828	5.9	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	120	0.50	A367826	130	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	122	0.50	A368392	133	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	113	0.50	A368391	115	0.50	A368391
Ion Balance (% Difference)	%	3.4	N/A	A367827	11	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.020	0.010	A367830	0.013	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.087	0.044	A367829	0.057	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	730	10	A367831	390	10	A367831
Un-ionized Ammonia	mg/L	0.0015	0.0013	A368397	<0.00070	0.00070	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A367832	<2.0	2.0	A367832
Chemical Oxygen Demand	mg/L	43	10	A373642	23	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.8	N/A	ONSITE	8.5	N/A	ONSITE
Field Temperature (Fd)	deg. C	7.4	N/A	ONSITE	7.6	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	1200	2.0	A371045	590	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	12	0.50	A372370	6.8	0.50	A372370
pH	pH	8.73	N/A	A371043	8.14	N/A	A371050
Total Organic Carbon (C)	mg/L	10	0.50	A387831	6.5	0.50	A387831
Total Dissolved Solids	mg/L	710	10	A372069	340	10	A372069
Total Suspended Solids	mg/L	11	1.0	A372083	8.4	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	8.5	1.0	A371036	<1.0	1.0	A371052
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	240	1.0	A371036	200	1.0	A371052
Bicarbonate (HCO <sub>3</sub> )	mg/L	270	1.0	A371036	240	1.0	A371052
Carbonate (CO <sub>3</sub> )	mg/L	10	1.0	A371036	<1.0	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.76	0.050	A371046	0.30	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW995			AGW996		
<b>Sampling Date</b>		2021/09/24 11:45			2021/09/24 11:45		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0022	0.0010	A369383	0.0015	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	130	1.0	A376285	54	1.0	A375682
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	190	2.0	A390968	92	1.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	0.017	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	50	1.0	A380555	36	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0080	0.0010	A372557	0.0025	0.0010	A372557
Total Phosphorus (P)	mg/L	0.030	0.0010	A372554	0.015	0.0010	A373740
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369135
Dissolved Nitrate plus Nitrite (N)	mg/L	0.020 (1)	0.010	A369130	0.013	0.010	A369135
Total Nitrogen (N)	mg/L	0.77	0.020	A371102	0.41	0.020	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	14	2.0	A369972	13	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	7.9	0.10	A369034	7.4	0.10	A369034
RDL = Reportable Detection Limit							
(1) Matrix spike exceeds acceptance limits due to probable matrix interference.							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW997			AGW998		
<b>Sampling Date</b>		2021/09/24 12:30			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	4.5	N/A	A367828	4.0	N/A	A367828
Cation Sum	meq/L	4.0	N/A	A367828	3.5	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	140	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	137	0.50	A368392	138	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	124	0.50	A368391	133	0.50	A368391
Ion Balance (% Difference)	%	5.1	N/A	A367827	6.3	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.012	0.010	A367830	0.011	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.052	0.044	A367829	0.048	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	240	10	A367831	200	10	A367831
Un-Ionized Ammonia	mg/L	<0.00058	0.00058	A368397	<0.00050	0.00050	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A369277	<2.6	2.0	A367832
Chemical Oxygen Demand	mg/L	18	10	A373642	16	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.4	N/A	ONSITE	8.3	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.1	N/A	ONSITE	8.1	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	390	2.0	A371045	340	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	6.6	0.50	A372370	5.1	0.50	A372370
pH	pH	8.11	N/A	A371043	8.04	N/A	A371050
Total Organic Carbon (C)	mg/L	5.0	0.50	A387831	4.4	0.50	A387831
Total Dissolved Solids	mg/L	240	10	A372069	200	10	A372069
Total Suspended Solids	mg/L	6.5	1.0	A372083	8.0	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A371036	140	1.0	A371052
Bicarbonate (HCO <sub>3</sub> )	mg/L	170	1.0	A371036	170	1.0	A371052
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.15	0.050	A371046	0.19	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW997			AGW998		
<b>Sampling Date</b>		2021/09/24 12:30			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371036	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0021	0.0010	A369383	0.0020	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	16	1.0	A375452	8.7	1.0	A375682
Dissolved Sulphate (SO4)	mg/L	57	1.0	A375452	44	1.0	A375682
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	30	1.0	A380555	30	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0023	0.0010	A372557	0.0014	0.0010	A372555
Total Phosphorus (P)	mg/L	0.015	0.0010	A373740	0.011	0.0010	A373745
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369130	<0.010	0.010	A369135
Dissolved Nitrate plus Nitrite (N)	mg/L	0.012	0.010	A369130	0.011	0.010	A369135
Total Nitrogen (N)	mg/L	0.29	0.020	A371102	0.24	0.020	A371158
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	14	2.0	A369972	12	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	7.1	0.10	A369034	8.0	0.10	A369034
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW999			AGX000		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 12:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.9	N/A	A367828	3.2	N/A	A367828
Cation Sum	meq/L	3.3	N/A	A367828	3.2	N/A	A367828
Filter and HNO <sub>3</sub> Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO <sub>3</sub> )	mg/L	140	0.50	A367826	140	0.50	A367826
Dissolved Hardness (CaCO <sub>3</sub> )	mg/L	138	0.50	A368392	138	0.50	A368392
Total Hardness (CaCO <sub>3</sub> )	mg/L	121	0.50	A368391	135	0.50	A368391
Ion Balance (% Difference)	%	9.0	N/A	A367827	0.38	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.014	0.010	A367830	0.011	0.010	A367830
Dissolved Nitrate (NO <sub>3</sub> )	mg/L	0.062	0.044	A367829	0.048	0.044	A367829
Dissolved Nitrite (NO <sub>2</sub> )	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	170	10	A367831
Un-Ionized Ammonia	mg/L	<0.00050	0.00050	A368397	<0.00065	0.00065	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A367832	<2.0	2.0	A369277
Chemical Oxygen Demand	mg/L	16	10	A373642	17	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.13	N/A	ONSITE	8.43	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.9	N/A	ONSITE	8.7	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	310	2.0	A373007	290	2.0	A389391
Dissolved Organic Carbon (C)	mg/L	4.5	0.50	A372370	5.0	0.50	A372370
pH	pH	8.20	N/A	A373005	8.01	N/A	A371043
Total Organic Carbon (C)	mg/L	4.6	0.50	A387831	4.3	0.50	A387831
Total Dissolved Solids	mg/L	180	10	A372069	170	10	A372069
Total Suspended Solids	mg/L	8.0	0.99	A372083	7.5	1.0	A372083
<b>Anions</b>							
Alkalinity (PP as CaCO <sub>3</sub> )	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	140	1.0	A373006	110	1.0	A389389
Bicarbonate (HCO <sub>3</sub> )	mg/L	180	1.0	A373006	140	1.0	A389389
Carbonate (CO <sub>3</sub> )	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Dissolved Fluoride (F)	mg/L	0.11	0.050	A373002	0.095	0.050	A371046
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGW999			AGX000		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 12:30		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A373006	<1.0	1.0	A389389
Orthophosphate (P)	mg/L	0.0030	0.0010	A369383	0.0030	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	5.3	1.0	A375470	4.6	1.0	A375452
Dissolved Sulphate (SO4)	mg/L	42	1.0	A375470	40	2.0	A390968
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	<0.015	0.015	A373819
Total Inorganic Carbon (C)	mg/L	32	1.0	A380555	28	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0018	0.0010	A372557	<0.0010	0.0010	A372557
Total Phosphorus (P)	mg/L	0.016	0.0010	A372554	0.014	0.0010	A373740
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A370177	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.014	0.010	A370177	0.011	0.010	A369130
Total Nitrogen (N)	mg/L	0.28	0.020	A371102	0.25	0.020	A371102
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	12	2.0	A369972	11	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	5.6	0.10	A369034	7.6	0.10	A369034
RDL = Reportable Detection Limit							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX001			AGX002		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 14:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	meq/L	3.7	N/A	A367828	30	N/A	A367828
Cation Sum	meq/L	3.2	N/A	A367828	30	N/A	A367828
Filter and HNO3 Preservation	N/A	FIELD		A369990	FIELD		A369990
Hardness (CaCO3)	mg/L	140	0.50	A367826	83	0.50	A367826
Dissolved Hardness (CaCO3)	mg/L	139	0.50	A368392	83.1	0.50	A368392
Total Hardness (CaCO3)	mg/L	134	0.50	A368391	82.6	0.50	A368391
Ion Balance (% Difference)	%	7.1	N/A	A367827	0.023	N/A	A367827
Dissolved Nitrate (N)	mg/L	0.011	0.010	A367830	0.020	0.010	A367830
Dissolved Nitrate (NO3)	mg/L	0.048	0.044	A367829	0.088	0.044	A367829
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	A367829	<0.033	0.033	A367829
Calculated Total Dissolved Solids	mg/L	190	10	A367831	1900	10	A367831
Un-Ionized Ammonia	mg/L	<0.00050	0.00050	A368397	0.0031	0.0026	A368397
<b>Demand Parameters</b>							
Biochemical Oxygen Demand	mg/L	<2.0	2.0	A369277	6.2	2.0	A369277
Chemical Oxygen Demand	mg/L	20	10	A373642	107	10	A373642
<b>Field Parameters</b>							
Field pH	pH	8.3	N/A	ONSITE	9.1	N/A	ONSITE
Field Temperature (Fd)	deg. C	8.9	N/A	ONSITE	8.6	N/A	ONSITE
<b>Misc. Inorganics</b>							
Conductivity	uS/cm	300	2.0	A371053	3100	2.0	A371053
Dissolved Organic Carbon (C)	mg/L	5.4	0.50	A372370	23	0.50	A372370
pH	pH	8.00	N/A	A371050	9.05	N/A	A371050
Total Organic Carbon (C)	mg/L	4.6	0.50	A387831	19	0.50	A387831
Total Dissolved Solids	mg/L	180	10	A372069	1900	10	A372069
Total Suspended Solids	mg/L	14	1.0	A372083	17	1.0	A372084
<b>Anions</b>							
Alkalinity (PP as CaCO3)	mg/L	<1.0	1.0	A371052	84	1.0	A371052
Alkalinity (Total as CaCO3)	mg/L	140	1.0	A371052	370	1.0	A371052
Bicarbonate (HCO3)	mg/L	170	1.0	A371052	250	1.0	A371052
Carbonate (CO3)	mg/L	<1.0	1.0	A371052	100	1.0	A371052
Dissolved Fluoride (F)	mg/L	0.078	0.050	A371054	2.3	0.050	A371054
RDL = Reportable Detection Limit N/A = Not Applicable							





### RESULTS OF CHEMICAL ANALYSES OF WATER

<b>Bureau Veritas ID</b>		AGX001			AGX002		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 14:00		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>RDL</b>	<b>QC Batch</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
Hydroxide (OH)	mg/L	<1.0	1.0	A371052	<1.0	1.0	A371052
Orthophosphate (P)	mg/L	0.0021	0.0010	A369383	0.0067	0.0010	A369383
Dissolved Chloride (Cl)	mg/L	4.4	1.0	A375463	410	5.0	A375463
Dissolved Sulphate (SO4)	mg/L	40	1.0	A375463	550	5.0	A375463
<b>Nutrients</b>							
Total Ammonia (N)	mg/L	<0.015	0.015	A373819	0.018	0.015	A373819
Total Inorganic Carbon (C)	mg/L	35	1.0	A380555	91	1.0	A380555
Dissolved Phosphorus (P)	mg/L	0.0014	0.0010	A372557	0.0097	0.0010	A372557
Total Phosphorus (P)	mg/L	0.017	0.0010	A372554	0.097	0.0010	A372544
Dissolved Nitrite (N)	mg/L	<0.010	0.010	A369135	<0.010	0.010	A369130
Dissolved Nitrate plus Nitrite (N)	mg/L	0.011	0.010	A369135	0.020	0.010	A369130
Total Nitrogen (N)	mg/L	0.24	0.020	A371136	1.9	0.040	A369840
<b>Misc. Organics</b>							
Naphthenic Acids	mg/L	<2.0	2.0	A369013	<2.0	2.0	A369013
<b>Physical Properties</b>							
True Colour	PtCo units	13	2.0	A369972	17	2.0	A369972
<b>Physical Properties</b>							
Turbidity	NTU	12	0.10	A369034	14	0.10	A369034
RDL = Reportable Detection Limit							





### PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	99	110	105	105		A368849
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RDL = Reportable Detection Limit

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	108	101	103	99		A368849
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RDL = Reportable Detection Limit

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch

#### Ext. Pet. Hydrocarbon

F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	A368849
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	0.13	0.10	A368849
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	0.20	A368849

#### Surrogate Recovery (%)

O-TERPHENYL (sur.)	%	105	107		A368849
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RDL = Reportable Detection Limit





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	0.068	0.031	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	0.024	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	101	109	114		A367343
D8-ACENAPHTHYLENE (sur.)	%	79	94	89		A367343
D8-NAPHTHALENE (sur.)	%	63	75	69		A367343
TERPHENYL-D14 (sur.)	%	110	117	128		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	120	130	126		A374080
2,4-DIBROMOPHENOL (sur.)	%	115	107	121		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW996	AGW997	AGW998		
Sampling Date		2021/09/24 11:45	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 3	MESOCOSM TABLE 4	MESOCOSM TABLE 5	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	104	102	107		A367343
D8-ACENAPHTHYLENE (sur.)	%	102	77	84		A367343
D8-NAPHTHALENE (sur.)	%	86	63	71		A367343
TERPHENYL-D14 (sur.)	%	118	114	116		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	122	123	124		A374080
2,4-DIBROMOPHENOL (sur.)	%	119	114	118		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
<b>Polycyclic Aromatics</b>						
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	<0.010	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Acridine	ug/L	<0.040	<0.040	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Perylene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	<0.20	<0.20	0.20	A367343
Retene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C3-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	<0.020	<0.020	0.020	A367343
RDL = Reportable Detection Limit						



**SEMIVOLATILE ORGANICS BY GC-MS (WATER)**

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
C1-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	<0.050	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	<0.020	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	<0.0085	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	<0.0075	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	<0.10	<0.10	0.10	A367343
<b>Phenols</b>						
2,3,4-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	<0.00014	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW999	AGX000	AGX001		
Sampling Date		2021/09/24 11:10	2021/09/24 12:30	2021/09/24 11:10		
COC Number		644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 6	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	QC Batch
2,3,5-trichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	<0.0010	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	<0.00010	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>						
D10-ANTHRACENE (sur.)	%	102	105	101		A367343
D8-ACENAPHTHYLENE (sur.)	%	82	83	83		A367343
D8-NAPHTHALENE (sur.)	%	72	75	71		A367343
TERPHENYL-D14 (sur.)	%	110	115	111		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	112	121	116		A374080
2,4-DIBROMOPHENOL (sur.)	%	104	113	111		A374080
RDL = Reportable Detection Limit						





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Polycyclic Aromatics</b>				
B[a]P TPE Total Potency Equivalents	ug/L	<0.010	0.010	A368014
Acenaphthene	ug/L	<0.10	0.10	A367343
Acenaphthylene	ug/L	<0.10	0.10	A367343
Acridine	ug/L	<0.040	0.040	A367343
Anthracene	ug/L	<0.010	0.010	A367343
Benzo(a)anthracene	ug/L	<0.0085	0.0085	A367343
Benzo(b&j)fluoranthene	ug/L	<0.0085	0.0085	A367343
Benzo(k)fluoranthene	ug/L	<0.0085	0.0085	A367343
Benzo(g,h,i)perylene	ug/L	<0.0085	0.0085	A367343
Benzo(c)phenanthrene	ug/L	<0.050	0.050	A367343
Benzo(a)pyrene	ug/L	<0.0075	0.0075	A367343
Benzo(e)pyrene	ug/L	<0.050	0.050	A367343
Chrysene	ug/L	<0.0085	0.0085	A367343
Dibenz(a,h)anthracene	ug/L	<0.0075	0.0075	A367343
Fluoranthene	ug/L	<0.010	0.010	A367343
Fluorene	ug/L	<0.050	0.050	A367343
Indeno(1,2,3-cd)pyrene	ug/L	<0.0085	0.0085	A367343
Indeno(1,2,3-cd)fluoranthene	ug/L	<0.0085	0.0085	A367343
2-Methylnaphthalene	ug/L	<0.10	0.10	A367343
Naphthalene	ug/L	<0.10	0.10	A367343
Phenanthrene	ug/L	<0.050	0.050	A367343
Perylene	ug/L	<0.050	0.050	A367343
Pyrene	ug/L	<0.020	0.020	A367343
Quinoline	ug/L	<0.20	0.20	A367343
Retene	ug/L	<0.050	0.050	A367343
C1-Naphthalene	ug/L	<0.10	0.10	A367343
C3-Naphthalene	ug/L	0.10	0.10	A367343
C4-Naphthalene	ug/L	<0.10	0.10	A367343
C2-Naphthalene	ug/L	<0.10	0.10	A367343
Biphenyl	ug/L	<0.020	0.020	A367343
C1-biphenyl	ug/L	<0.020	0.020	A367343
C2-biphenyl	ug/L	<0.020	0.020	A367343
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
C1-fluorene	ug/L	<0.050	0.050	A367343
C2-fluorene	ug/L	<0.050	0.050	A367343
C3-fluorene	ug/L	<0.050	0.050	A367343
Dibenzothiophene	ug/L	<0.020	0.020	A367343
C1-dibenzothiophene	ug/L	0.039	0.020	A367343
C2-dibenzothiophene	ug/L	0.098	0.020	A367343
C3-dibenzothiophene	ug/L	0.029	0.020	A367343
C4-dibenzothiophene	ug/L	<0.020	0.020	A367343
C1 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C2 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C3 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C4 phenanthrene/anthracene	ug/L	<0.050	0.050	A367343
C1 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C2 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C3 fluoranthene/pyrene	ug/L	0.036	0.020	A367343
C4 fluoranthene/pyrene	ug/L	<0.020	0.020	A367343
C1 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C2 benzo(a)anthracene/chrysene	ug/L	0.011	0.0085	A367343
C3 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C4 benzo(a)anthracene/chrysene	ug/L	<0.0085	0.0085	A367343
C1benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	0.0075	A367343
C2benzobjkfluoranthene/benzoapyrene	ug/L	<0.0075	0.0075	A367343
C1-Acenaphthene	ug/L	<0.10	0.10	A367343
1-Methylnaphthalene	ug/L	<0.10	0.10	A367343
<b>Phenols</b>				
2,3,4-trichlorophenol	mg/L	<0.00010	0.00010	A374080
Cresols	mg/L	<0.00014	0.00014	A368389
Phenol	mg/L	<0.00010	0.00010	A374080
3 & 4-chlorophenol	mg/L	<0.00010	0.00010	A374080
2,3,5,6-tetrachlorophenol	mg/L	<0.00010	0.00010	A374080
2,3,4,6-tetrachlorophenol	mg/L	<0.00010	0.00010	A374080
2,4,5-trichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4,6-trichlorophenol	mg/L	<0.00010	0.00010	A374080
RDL = Reportable Detection Limit				





### SEMIVOLATILE ORGANICS BY GC-MS (WATER)

<b>Bureau Veritas ID</b>		AGX002		
<b>Sampling Date</b>		2021/09/24 14:00		
<b>COC Number</b>		644187-01-01		
	<b>UNITS</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>
2,3,5-trichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4-dichlorophenol	mg/L	<0.00010	0.00010	A374080
2,4-dimethylphenol	mg/L	<0.00010	0.00010	A374080
2,4-dinitrophenol	mg/L	<0.0010	0.0010	A374080
2,6-dichlorophenol	mg/L	<0.00010	0.00010	A374080
2-chlorophenol	mg/L	<0.00010	0.00010	A374080
2-methylphenol	mg/L	0.00010	0.00010	A374080
2-nitrophenol	mg/L	<0.0010	0.0010	A374080
3 & 4-methylphenol	mg/L	<0.00010	0.00010	A374080
4,6-dinitro-2-methylphenol	mg/L	<0.0010	0.0010	A374080
4-chloro-3-methylphenol	mg/L	<0.00010	0.00010	A374080
4-nitrophenol	mg/L	<0.0010	0.0010	A374080
Pentachlorophenol	mg/L	<0.00010	0.00010	A374080
<b>Surrogate Recovery (%)</b>				
D10-ANTHRACENE (sur.)	%	109		A367343
D8-ACENAPHTHYLENE (sur.)	%	93		A367343
D8-NAPHTHALENE (sur.)	%	74		A367343
TERPHENYL-D14 (sur.)	%	119		A367343
2,4,6-TRIBROMOPHENOL (sur.)	%	126		A374080
2,4-DIBROMOPHENOL (sur.)	%	125		A374080
RDL = Reportable Detection Limit				





### MERCURY BY COLD VAPOR (WATER)

<b>Bureau Veritas ID</b>		AGW993	AGW994	AGW995	AGW996		
<b>Sampling Date</b>		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
<b>COC Number</b>		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>MESOCOSM TABLE 1</b>	<b>MESOCOSM TABLE 2</b>	<b>MESOCOSM TABLE 3</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Elements</b>							
Dissolved Mercury (Hg)	ug/L	0.00094	0.00127	0.00087	0.00106	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00142	0.00220	0.00169	0.00149	0.00010	A371757

RDL = Reportable Detection Limit

<b>Bureau Veritas ID</b>		AGW997	AGW998	AGW999	AGX000		
<b>Sampling Date</b>		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
<b>COC Number</b>		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 4</b>	<b>MESOCOSM TABLE 5</b>	<b>MESOCOSM TABLE 6</b>	<b>MESOCOSM TABLE 7</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Elements</b>							
Dissolved Mercury (Hg)	ug/L	0.00079	0.00087	0.00076	0.00104	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00173	0.00143	0.00131	0.00133	0.00010	A371757

RDL = Reportable Detection Limit

<b>Bureau Veritas ID</b>		AGX001	AGX002		
<b>Sampling Date</b>		2021/09/24 11:10	2021/09/24 14:00		
<b>COC Number</b>		644187-01-01	644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 8</b>	<b>TREATED OSPW TANK</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Elements</b>					
Dissolved Mercury (Hg)	ug/L	0.00072	0.00122	0.00010	A371324
Total Mercury (Hg)	ug/L	0.00122	0.00262	0.00010	A371757

RDL = Reportable Detection Limit





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGW993		AGW994		AGW995		
Sampling Date		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
<b>Elements</b>								
Dissolved Calcium (Ca)	mg/L	37	0.30	16	0.30	31	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	0.060	0.070	0.060	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	0.20	10	0.20	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	0.0040	0.0040	0.0044	0.0040	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	0.30	12	0.30	4.4	0.30	A370547
Dissolved Sodium (Na)	mg/L	9.7	0.50	670	2.5	210	0.50	A370547
<b>Dissolved Metals by ICPMS</b>								
Dissolved Aluminum (Al)	ug/L	7.24	0.50	76.0	2.5	29.3	2.5	A376671
Dissolved Antimony (Sb)	ug/L	0.055	0.020	0.82	0.10	0.33	0.10	A376671
Dissolved Arsenic (As)	ug/L	0.280	0.020	9.87	0.10	3.57	0.10	A376671
Dissolved Barium (Ba)	ug/L	48.7	0.020	38.5	0.10	45.8	0.10	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	<0.050	0.050	<0.050	0.050	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Boron (B)	ug/L	30	10	1930	50	634	50	A376671
Dissolved Cadmium (Cd)	ug/L	0.0078	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	<0.50	0.50	<0.50	0.50	A376671
Dissolved Cobalt (Co)	ug/L	0.0963	0.0050	0.364	0.025	0.184	0.025	A376671
Dissolved Copper (Cu)	ug/L	0.612	0.050	<0.25	0.25	<0.25	0.25	A376671
Dissolved Iron (Fe)	ug/L	22.4	1.0	63.9	5.0	25.0	5.0	A376671
Dissolved Lead (Pb)	ug/L	0.0084	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Lithium (Li)	ug/L	4.71	0.50	90.9	2.5	31.4	2.5	A376671
Dissolved Manganese (Mn)	ug/L	3.34	0.050	4.86	0.25	1.70	0.25	A376671
Dissolved Molybdenum (Mo)	ug/L	0.977	0.050	750	0.25	228	0.25	A376671
Dissolved Nickel (Ni)	ug/L	1.00	0.020	4.75	0.10	3.38	0.10	A376671
Dissolved Selenium (Se)	ug/L	0.222	0.040	2.05	0.20	0.86	0.20	A376671
Dissolved Silicon (Si)	ug/L	1110	50	1260	250	1240	250	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376671
Dissolved Strontium (Sr)	ug/L	258	0.050	433	0.25	314	0.25	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	0.0020	<0.010	0.010	<0.010	0.010	A376671
Dissolved Tin (Sn)	ug/L	<0.20	0.20	<1.0	1.0	<1.0	1.0	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	<2.5	2.5	<2.5	2.5	A376671
Dissolved Uranium (U)	ug/L	0.423	0.0020	6.79	0.010	2.44	0.010	A376671
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGW993		AGW994		AGW995		
Sampling Date		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
COC Number		644187-01-01		644187-01-01		644187-01-01		
	UNITS	RIVER WATER TANK	RDL	MESOCOSM TABLE 1	RDL	MESOCOSM TABLE 2	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	<0.20	0.20	1680	1.0	540	1.0	A376671
Dissolved Zinc (Zn)	ug/L	0.94	0.10	5.64	0.50	3.59	0.50	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	0.57	0.50	<0.50	0.50	A376671
Dissolved Calcium (Ca)	mg/L	32.5	0.050	13.9	0.25	26.9	0.25	A368394
Dissolved Magnesium (Mg)	mg/L	10.4	0.050	9.64	0.25	10.6	0.25	A368394
Dissolved Potassium (K)	mg/L	1.04	0.050	10.2	0.25	4.00	0.25	A368394
Dissolved Sodium (Na)	mg/L	9.16	0.050	624	0.25	207	0.25	A368394
Dissolved Sulphur (S)	mg/L	9.6	3.0	179	15	47	15	A368394
<b>Total Metals by ICPMS</b>								
Total Aluminum (Al)	ug/L	96.3	0.50	146	2.5	164	2.5	A376677
Total Antimony (Sb)	ug/L	0.052	0.020	0.74	0.10	0.33	0.10	A376677
Total Arsenic (As)	ug/L	0.340	0.020	9.73	0.10	3.58	0.10	A376677
Total Barium (Ba)	ug/L	47.0	0.020	39.4	0.10	49.2	0.10	A376677
Total Beryllium (Be)	ug/L	0.011	0.010	<0.050	0.050	<0.050	0.050	A376677
Total Bismuth (Bi)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Boron (B)	ug/L	24	10	2090	50	618	50	A376677
Total Cadmium (Cd)	ug/L	0.0101	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Chromium (Cr)	ug/L	0.36	0.10	<0.50	0.50	<0.50	0.50	A376677
Total Cobalt (Co)	ug/L	0.177	0.0050	0.406	0.025	0.289	0.025	A376677
Total Copper (Cu)	ug/L	0.756	0.050	0.54	0.25	0.81	0.25	A376677
Total Iron (Fe)	ug/L	318	1.0	406	5.0	337	5.0	A376677
Total Lead (Pb)	ug/L	0.162	0.0050	0.093	0.025	0.131	0.025	A376677
Total Lithium (Li)	ug/L	4.73	0.50	86.1	2.5	32.9	2.5	A376677
Total Manganese (Mn)	ug/L	21.4	0.050	16.6	0.25	19.5	0.25	A376677
Total Molybdenum (Mo)	ug/L	0.843	0.050	668	0.25	242	0.25	A376677
Total Nickel (Ni)	ug/L	1.14	0.020	4.35	0.10	2.43	0.10	A376677
Total Selenium (Se)	ug/L	0.211	0.040	1.99	0.20	0.87	0.20	A376677
Total Silicon (Si)	ug/L	1280	50	1520	250	1540	250	A376677
Total Silver (Ag)	ug/L	<0.0050	0.0050	<0.025	0.025	<0.025	0.025	A376677
Total Strontium (Sr)	ug/L	226	0.050	415	0.25	338	0.25	A376677
Total Thallium (Tl)	ug/L	0.0059	0.0020	<0.010	0.010	<0.010	0.010	A376677
Total Tin (Sn)	ug/L	<0.20	0.20	<1.0	1.0	<1.0	1.0	A376677
Total Titanium (Ti)	ug/L	2.36	0.50	<2.5	2.5	4.2	2.5	A376677
RDL = Reportable Detection Limit								





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW993		AGW994		AGW995		
<b>Sampling Date</b>		2021/09/24 16:20		2021/09/24 11:10		2021/09/24 11:45		
<b>COC Number</b>		644187-01-01		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>RIVER WATER TANK</b>	<b>RDL</b>	<b>MESOCOSM TABLE 1</b>	<b>RDL</b>	<b>MESOCOSM TABLE 2</b>	<b>RDL</b>	<b>QC Batch</b>
Total Uranium (U)	ug/L	0.407	0.0020	6.63	0.010	2.52	0.010	A376677
Total Vanadium (V)	ug/L	<0.20	0.20	1490	1.0	525	1.0	A376677
Total Zinc (Zn)	ug/L	2.14	0.10	5.76	0.50	7.73	0.50	A376677
Total Zirconium (Zr)	ug/L	<0.10	0.10	0.72	0.50	<0.50	0.50	A376677
Total Calcium (Ca)	mg/L	33.4	0.050	13.9	0.25	28.2	0.25	A368395
Total Magnesium (Mg)	mg/L	8.83	0.050	8.86	0.25	10.3	0.25	A368395
Total Potassium (K)	mg/L	0.953	0.050	9.47	0.25	4.06	0.25	A368395
Total Sodium (Na)	mg/L	8.03	0.050	561	0.25	206	0.25	A368395
Total Sulphur (S)	mg/L	7.3	3.0	180	15	65	15	A368395
RDL = Reportable Detection Limit								



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>						
Dissolved Calcium (Ca)	mg/L	35	A370547	36	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	A370547	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	A370547	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	A370547	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	2.2	A370547	1.5	0.30	A370547
Dissolved Sodium (Na)	mg/L	74	A370547	29	0.50	A370547
<b>Dissolved Metals by ICPMS</b>						
Dissolved Aluminum (Al)	ug/L	14.4	A376671	8.84	0.50	A376671
Dissolved Antimony (Sb)	ug/L	0.145	A376671	0.080	0.020	A376671
Dissolved Arsenic (As)	ug/L	1.31	A376671	0.634	0.020	A376671
Dissolved Barium (Ba)	ug/L	48.0	A376671	48.6	0.020	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	A376671	<0.010	0.010	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Boron (B)	ug/L	202	A376671	80	10	A376671
Dissolved Cadmium (Cd)	ug/L	<0.0050	A391916	0.0059	0.0050	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	A376671	<0.10	0.10	A376671
Dissolved Cobalt (Co)	ug/L	0.119	A376671	0.0948	0.0050	A376671
Dissolved Copper (Cu)	ug/L	0.633	A376671	0.715	0.050	A376671
Dissolved Iron (Fe)	ug/L	24.2	A376671	21.5	1.0	A376671
Dissolved Lead (Pb)	ug/L	0.0228	A376671	0.0136	0.0050	A376671
Dissolved Lithium (Li)	ug/L	13.3	A376671	7.28	0.50	A376671
Dissolved Manganese (Mn)	ug/L	1.27	A376671	1.23	0.050	A376671
Dissolved Molybdenum (Mo)	ug/L	73.4	A376671	23.6	0.050	A376671
Dissolved Nickel (Ni)	ug/L	1.32	A376671	0.998	0.020	A376671
Dissolved Selenium (Se)	ug/L	0.408	A376671	0.265	0.040	A376671
Dissolved Silicon (Si)	ug/L	1130	A376671	943	50	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Strontium (Sr)	ug/L	285	A376671	266	0.050	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	A376671	<0.0020	0.0020	A376671
Dissolved Tin (Sn)	ug/L	<0.20	A376671	<0.20	0.20	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	A376671	<0.50	0.50	A376671
Dissolved Uranium (U)	ug/L	1.07	A376671	0.626	0.0020	A376671
RDL = Reportable Detection Limit						



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
Dissolved Vanadium (V)	ug/L	171	A376671	53.8	0.20	A376671
Dissolved Zinc (Zn)	ug/L	6.96	A376671	0.82	0.10	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	A376671	<0.10	0.10	A376671
Dissolved Calcium (Ca)	mg/L	31.1	A368394	32.1	0.050	A368394
Dissolved Magnesium (Mg)	mg/L	10.3	A368394	10.5	0.050	A368394
Dissolved Potassium (K)	mg/L	1.95	A368394	1.35	0.050	A368394
Dissolved Sodium (Na)	mg/L	69.3	A368394	28.7	0.050	A368394
Dissolved Sulphur (S)	mg/L	27.4	A368394	14.1	3.0	A368394
<b>Total Metals by ICPMS</b>						
Total Aluminum (Al)	ug/L	165	A376677	128	0.50	A376677
Total Antimony (Sb)	ug/L	0.117	A376677	0.090	0.020	A376677
Total Arsenic (As)	ug/L	1.21	A376677	0.742	0.020	A376677
Total Barium (Ba)	ug/L	45.7	A376677	51.5	0.020	A376677
Total Beryllium (Be)	ug/L	0.013	A376677	<0.010	0.010	A376677
Total Bismuth (Bi)	ug/L	<0.0050	A376677	<0.0050	0.0050	A376677
Total Boron (B)	ug/L	213	A376677	117	10	A376677
Total Cadmium (Cd)	ug/L	<0.0050	A376677	0.0126	0.0050	A376677
Total Chromium (Cr)	ug/L	0.27	A376677	0.23	0.10	A376677
Total Cobalt (Co)	ug/L	0.179	A376677	0.197	0.0050	A376677
Total Copper (Cu)	ug/L	0.724	A376677	0.871	0.050	A376677
Total Iron (Fe)	ug/L	315	A376677	292	1.0	A376677
Total Lead (Pb)	ug/L	0.145	A376677	0.174	0.0050	A376677
Total Lithium (Li)	ug/L	13.3	A376677	7.45	0.50	A376677
Total Manganese (Mn)	ug/L	17.1	A376677	20.4	0.050	A376677
Total Molybdenum (Mo)	ug/L	61.7	A376677	23.4	0.050	A376677
Total Nickel (Ni)	ug/L	1.23	A376677	1.36	0.020	A376677
Total Selenium (Se)	ug/L	0.438	A376677	0.258	0.040	A376677
Total Silicon (Si)	ug/L	1420	A376677	1350	50	A376677
Total Silver (Ag)	ug/L	<0.0050	A376677	<0.0050	0.0050	A376677
Total Strontium (Sr)	ug/L	244	A376677	268	0.050	A376677
Total Thallium (Tl)	ug/L	0.0058	A376677	0.0024	0.0020	A376677
Total Tin (Sn)	ug/L	<0.20	A376677	<0.20	0.20	A376677
Total Titanium (Ti)	ug/L	4.36	A376677	3.23	0.50	A376677
RDL = Reportable Detection Limit						





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW996		AGW997		
<b>Sampling Date</b>		2021/09/24 11:45		2021/09/24 12:30		
<b>COC Number</b>		644187-01-01		644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 3</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 4</b>	<b>RDL</b>	<b>QC Batch</b>
Total Uranium (U)	ug/L	0.982	A376677	0.636	0.0020	A376677
Total Vanadium (V)	ug/L	138	A376677	53.4	0.20	A376677
Total Zinc (Zn)	ug/L	1.42	A376677	3.37	0.10	A376677
Total Zirconium (Zr)	ug/L	0.22	A376677	0.23	0.10	A376677
Total Calcium (Ca)	mg/L	31.6	A368395	32.6	0.050	A368395
Total Magnesium (Mg)	mg/L	8.74	A368395	10.4	0.050	A368395
Total Potassium (K)	mg/L	1.73	A368395	1.35	0.050	A368395
Total Sodium (Na)	mg/L	59.6	A368395	28.1	0.050	A368395
Total Sulphur (S)	mg/L	20.3	A368395	10.2	3.0	A368395
RDL = Reportable Detection Limit						





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW998			AGW999		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	37	0.30	A370547	37	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	0.060	A370547	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	0.20	A370547	11	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	A370547	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	0.30	A370547	1.2	0.30	A370547
Dissolved Sodium (Na)	mg/L	17	0.50	A370547	11	0.50	A370547
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	7.11	0.50	A376671	7.84	0.50	A376671
Dissolved Antimony (Sb)	ug/L	0.064	0.020	A376671	0.052	0.020	A376671
Dissolved Arsenic (As)	ug/L	0.435	0.020	A376671	0.345	0.020	A376671
Dissolved Barium (Ba)	ug/L	48.2	0.020	A376671	48.4	0.020	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	0.010	A376671	<0.010	0.010	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Boron (B)	ug/L	45	10	A376671	29	10	A376671
Dissolved Cadmium (Cd)	ug/L	0.0078	0.0050	A376671	0.0125	0.0050	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	0.10	A376671	<0.10	0.10	A376671
Dissolved Cobalt (Co)	ug/L	0.0861	0.0050	A376671	0.0878	0.0050	A376671
Dissolved Copper (Cu)	ug/L	0.654	0.050	A376671	0.692	0.050	A376671
Dissolved Iron (Fe)	ug/L	25.2	1.0	A376671	24.9	1.0	A376671
Dissolved Lead (Pb)	ug/L	0.0103	0.0050	A376671	0.0147	0.0050	A376671
Dissolved Lithium (Li)	ug/L	5.65	0.50	A376671	4.88	0.50	A376671
Dissolved Manganese (Mn)	ug/L	1.39	0.050	A376671	1.38	0.050	A376671
Dissolved Molybdenum (Mo)	ug/L	8.59	0.050	A376671	2.61	0.050	A376671
Dissolved Nickel (Ni)	ug/L	0.951	0.020	A376671	0.918	0.020	A376671
Dissolved Selenium (Se)	ug/L	0.245	0.040	A376671	0.222	0.040	A376671
Dissolved Silicon (Si)	ug/L	875	50	A376671	896	50	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	0.0050	A376671	<0.0050	0.0050	A376671
Dissolved Strontium (Sr)	ug/L	255	0.050	A376671	257	0.050	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	0.0020	A376671	<0.0020	0.0020	A376671
Dissolved Tin (Sn)	ug/L	<0.20	0.20	A376671	<0.20	0.20	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	0.50	A376671	<0.50	0.50	A376671
Dissolved Uranium (U)	ug/L	0.498	0.0020	A376671	0.446	0.0020	A376671
RDL = Reportable Detection Limit							



**ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)**

Bureau Veritas ID		AGW998			AGW999		
Sampling Date		2021/09/24 11:10			2021/09/24 11:10		
COC Number		644187-01-01			644187-01-01		
	UNITS	MESOCOSM TABLE 5	RDL	QC Batch	MESOCOSM TABLE 6	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	17.6	0.20	A376671	3.95	0.20	A376671
Dissolved Zinc (Zn)	ug/L	0.87	0.10	A376671	1.05	0.10	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	0.10	A376671	<0.10	0.10	A376671
Dissolved Calcium (Ca)	mg/L	32.1	0.050	A368394	32.4	0.050	A368394
Dissolved Magnesium (Mg)	mg/L	10.2	0.050	A368394	10.6	0.050	A368394
Dissolved Potassium (K)	mg/L	1.13	0.050	A368394	1.07	0.050	A368394
Dissolved Sodium (Na)	mg/L	15.5	0.050	A368394	10.7	0.050	A368394
Dissolved Sulphur (S)	mg/L	12.2	3.0	A368394	9.6	3.0	A368394
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	157	3.0	A371010	73.1	2.5	A376677
Total Antimony (Sb)	ug/L	0.065	0.020	A371010	<0.10	0.10	A376677
Total Arsenic (As)	ug/L	0.517	0.020	A371010	0.34	0.10	A376677
Total Barium (Ba)	ug/L	52.3	0.050	A371010	49.1	0.10	A376677
Total Beryllium (Be)	ug/L	0.012	0.010	A371010	<0.050	0.050	A376677
Total Bismuth (Bi)	ug/L	<0.010	0.010	A371010	<0.025	0.025	A376677
Total Boron (B)	ug/L	53	10	A371010	<50	50	A376677
Total Cadmium (Cd)	ug/L	0.0132	0.0050	A371010	<0.025	0.025	A376677
Total Chromium (Cr)	ug/L	0.38	0.10	A371010	<0.50	0.50	A376677
Total Cobalt (Co)	ug/L	0.206	0.010	A371010	0.180	0.025	A376677
Total Copper (Cu)	ug/L	1.08	0.10	A371010	0.75	0.25	A376677
Total Iron (Fe)	ug/L	360	5.0	A371010	261	5.0	A376677
Total Lead (Pb)	ug/L	0.171	0.020	A371010	0.169	0.025	A376677
Total Lithium (Li)	ug/L	6.25	0.50	A371010	4.4	2.5	A376677
Total Manganese (Mn)	ug/L	22.2	0.10	A371010	19.7	0.25	A376677
Total Molybdenum (Mo)	ug/L	8.28	0.050	A371010	2.29	0.25	A376677
Total Nickel (Ni)	ug/L	1.30	0.10	A371010	0.87	0.10	A376677
Total Phosphorus (P)	ug/L	26.1	5.0	A371010			
Total Selenium (Se)	ug/L	0.300	0.040	A371010	0.23	0.20	A376677
Total Silicon (Si)	ug/L	1440	50	A371010	1100	250	A376677
Total Silver (Ag)	ug/L	<0.010	0.010	A371010	<0.025	0.025	A376677
Total Strontium (Sr)	ug/L	272	0.050	A371010	239	0.25	A376677
Total Thallium (Tl)	ug/L	0.0068	0.0020	A371010	<0.010	0.010	A376677
Total Tin (Sn)	ug/L	<0.20	0.20	A371010	<1.0	1.0	A376677
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

<b>Bureau Veritas ID</b>		AGW998			AGW999		
<b>Sampling Date</b>		2021/09/24 11:10			2021/09/24 11:10		
<b>COC Number</b>		644187-01-01			644187-01-01		
	<b>UNITS</b>	<b>MESOCOSM TABLE 5</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MESOCOSM TABLE 6</b>	<b>RDL</b>	<b>QC Batch</b>
Total Titanium (Ti)	ug/L	3.3	2.0	A371010	<2.5	2.5	A376677
Total Uranium (U)	ug/L	0.520	0.0050	A371010	0.448	0.010	A376677
Total Vanadium (V)	ug/L	18.8	0.20	A371010	2.0	1.0	A376677
Total Zinc (Zn)	ug/L	2.7	1.5	A371010	0.93	0.50	A376677
Total Zirconium (Zr)	ug/L	0.18	0.10	A371010	<0.50	0.50	A376677
Total Calcium (Ca)	mg/L	34.5	0.25	A368395	32.6	0.25	A368395
Total Magnesium (Mg)	mg/L	11.4	0.25	A368395	9.71	0.25	A368395
Total Potassium (K)	mg/L	1.21	0.25	A368395	0.99	0.25	A368395
Total Sodium (Na)	mg/L	16.6	0.25	A368395	9.63	0.25	A368395
Total Sulphur (S)	mg/L	6.2	3.0	A368395	<15	15	A368395
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
<b>Elements</b>							
Dissolved Calcium (Ca)	mg/L	37	37	0.30	16	0.30	A370547
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060	<0.060	0.060	A370547
Dissolved Magnesium (Mg)	mg/L	11	11	0.20	10	0.20	A370547
Dissolved Manganese (Mn)	mg/L	<0.0040	<0.0040	0.0040	<0.0040	0.0040	A370547
Dissolved Potassium (K)	mg/L	1.2	1.1	0.30	11	0.30	A370547
Dissolved Sodium (Na)	mg/L	9.7	9.7	0.50	660	2.5	A370547
<b>Dissolved Metals by ICPMS</b>							
Dissolved Aluminum (Al)	ug/L	7.38	8.65	0.50	72.3	2.5	A376671
Dissolved Antimony (Sb)	ug/L	0.053	0.051	0.020	0.93	0.10	A376671
Dissolved Arsenic (As)	ug/L	0.287	0.311	0.020	10.5	0.10	A376671
Dissolved Barium (Ba)	ug/L	48.3	48.6	0.020	38.3	0.10	A376671
Dissolved Beryllium (Be)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A376671
Dissolved Bismuth (Bi)	ug/L	<0.0050	<0.0050	0.0050	<0.025	0.025	A376671
Dissolved Boron (B)	ug/L	23	41	10	1950	50	A376671
Dissolved Cadmium (Cd)	ug/L	0.0096	0.0066	0.0050	<0.025	0.025	A376671
Dissolved Chromium (Cr)	ug/L	<0.10	<0.10	0.10	<0.50	0.50	A376671
Dissolved Cobalt (Co)	ug/L	0.0826	0.0840	0.0050	0.390	0.025	A376671
Dissolved Copper (Cu)	ug/L	0.719	0.705	0.050	<0.25	0.25	A376671
Dissolved Iron (Fe)	ug/L	25.6	25.9	1.0	73.3	5.0	A376671
Dissolved Lead (Pb)	ug/L	0.0134	0.0138	0.0050	<0.025	0.025	A376671
Dissolved Lithium (Li)	ug/L	4.70	4.66	0.50	92.2	2.5	A376671
Dissolved Manganese (Mn)	ug/L	1.56	1.52	0.050	4.99	0.25	A376671
Dissolved Molybdenum (Mo)	ug/L	0.978	1.01	0.050	755	0.25	A376671
Dissolved Nickel (Ni)	ug/L	0.867	0.903	0.020	4.81	0.10	A376671
Dissolved Selenium (Se)	ug/L	0.170	0.197	0.040	2.17	0.20	A376671
Dissolved Silicon (Si)	ug/L	848	900	50	1280	250	A376671
Dissolved Silver (Ag)	ug/L	<0.0050	<0.0050	0.0050	<0.025	0.025	A376671
Dissolved Strontium (Sr)	ug/L	257	253	0.050	450	0.25	A376671
Dissolved Thallium (Tl)	ug/L	<0.0020	<0.0020	0.0020	<0.010	0.010	A376671
Dissolved Tin (Sn)	ug/L	<0.20	<0.20	0.20	<1.0	1.0	A376671
Dissolved Titanium (Ti)	ug/L	<0.50	<0.50	0.50	<2.5	2.5	A376671
Dissolved Uranium (U)	ug/L	0.422	0.426	0.0020	6.96	0.010	A376671
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
Dissolved Vanadium (V)	ug/L	<0.20	<0.20	0.20	1700	1.0	A376671
Dissolved Zinc (Zn)	ug/L	0.80	1.01	0.10	4.38	0.50	A376671
Dissolved Zirconium (Zr)	ug/L	<0.10	<0.10	0.10	0.62	0.50	A376671
Dissolved Calcium (Ca)	mg/L	32.6	32.4	0.050	14.5	0.25	A368394
Dissolved Magnesium (Mg)	mg/L	10.5	10.4	0.050	9.73	0.25	A368394
Dissolved Potassium (K)	mg/L	1.06	1.03	0.050	10.4	0.25	A368394
Dissolved Sodium (Na)	mg/L	9.27	9.22	0.050	630	0.25	A368394
Dissolved Sulphur (S)	mg/L	9.9	10.3	3.0	178	15	A368394
<b>Total Metals by ICPMS</b>							
Total Aluminum (Al)	ug/L	142	183	3.0	176	15	A371010
Total Antimony (Sb)	ug/L	0.079	0.072	0.020	0.97	0.10	A371010
Total Arsenic (As)	ug/L	0.377	0.355	0.020	10.4	0.10	A371010
Total Barium (Ba)	ug/L	53.3	52.6	0.050	46.9	0.25	A371010
Total Beryllium (Be)	ug/L	0.014	0.021	0.010	0.058	0.050	A371010
Total Bismuth (Bi)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A371010
Total Boron (B)	ug/L	28	52	10	2150	50	A371010
Total Cadmium (Cd)	ug/L	0.0119	0.0110	0.0050	<0.025	0.025	A371010
Total Chromium (Cr)	ug/L	0.39	0.44	0.10	<0.50	0.50	A371010
Total Cobalt (Co)	ug/L	0.216	0.213	0.010	0.608	0.050	A371010
Total Copper (Cu)	ug/L	1.02	1.02	0.10	2.78	0.50	A371010
Total Iron (Fe)	ug/L	366	401	5.0	1050	25	A371010
Total Lead (Pb)	ug/L	0.187	0.184	0.020	0.26	0.10	A371010
Total Lithium (Li)	ug/L	5.40	5.41	0.50	102	2.5	A371010
Total Manganese (Mn)	ug/L	23.0	24.0	0.10	33.6	0.50	A371010
Total Molybdenum (Mo)	ug/L	0.895	0.928	0.050	740	0.25	A371010
Total Nickel (Ni)	ug/L	1.18	1.26	0.10	5.77	0.50	A371010
Total Phosphorus (P)	ug/L	25.2	27.1	5.0	122	25	A371010
Total Selenium (Se)	ug/L	0.239	0.269	0.040	2.34	0.20	A371010
Total Silicon (Si)	ug/L	1420	1470	50	1750	250	A371010
Total Silver (Ag)	ug/L	<0.010	<0.010	0.010	<0.050	0.050	A371010
Total Strontium (Sr)	ug/L	277	275	0.050	495	0.25	A371010
Total Thallium (Tl)	ug/L	0.0074	0.0082	0.0020	<0.010	0.010	A371010
Total Tin (Sn)	ug/L	<0.20	<0.20	0.20	<1.0	1.0	A371010
RDL = Reportable Detection Limit							





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		AGX000	AGX001		AGX002		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10		2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		644187-01-01		
	UNITS	MESOCOSM TABLE 7	MESOCOSM TABLE 8	RDL	TREATED OSPW TANK	RDL	QC Batch
Total Titanium (Ti)	ug/L	3.7	2.9	2.0	<10	10	A371010
Total Uranium (U)	ug/L	0.453	0.457	0.0050	7.16	0.025	A371010
Total Vanadium (V)	ug/L	0.73	0.86	0.20	1710	1.0	A371010
Total Zinc (Zn)	ug/L	4.1	4.3	1.5	11.4	7.5	A371010
Total Zirconium (Zr)	ug/L	0.50	0.21	0.10	0.80	0.50	A371010
Total Calcium (Ca)	mg/L	35.2	34.8	0.25	15.9	1.3	A368395
Total Magnesium (Mg)	mg/L	11.5	11.3	0.25	10.4	1.3	A368395
Total Potassium (K)	mg/L	1.14	1.14	0.25	10.9	1.3	A368395
Total Sodium (Na)	mg/L	9.88	9.70	0.25	647	1.3	A368395
Total Sulphur (S)	mg/L	7.5	6.8	3.0	171	15	A368395
RDL = Reportable Detection Limit							



**VOLATILE ORGANICS BY GC-MS (WATER)**

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch
<b>Volatiles</b>							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW993	AGW994	AGW995	AGW996		
Sampling Date		2021/09/24 16:20	2021/09/24 11:10	2021/09/24 11:45	2021/09/24 11:45		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	RIVER WATER TANK	MESOCOSM TABLE 1	MESOCOSM TABLE 2	MESOCOSM TABLE 3	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	108	106	106	107		A368854
4-Bromofluorobenzene (sur.)	%	99	98	98	99		A368854
D4-1,2-Dichloroethane (sur.)	%	98	98	97	99		A368854
1,4-Difluorobenzene (sur.)	%	97	97	97	97		A368866
4-Bromofluorobenzene (sur.)	%	98	97	98	98		A368866
D4-1,2-Dichloroethane (sur.)	%	109	109	108	110		A368866
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch

Volatiles							
Total Trihalomethanes	ug/L	<1.3	<1.3	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866

RDL = Reportable Detection Limit





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGW997	AGW998	AGW999	AGX000		
Sampling Date		2021/09/24 12:30	2021/09/24 11:10	2021/09/24 11:10	2021/09/24 12:30		
COC Number		644187-01-01	644187-01-01	644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 4	MESOCOSM TABLE 5	MESOCOSM TABLE 6	MESOCOSM TABLE 7	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene (sur.)	%	106	107	108	107		A368854
4-Bromofluorobenzene (sur.)	%	98	100	99	98		A368854
D4-1,2-Dichloroethane (sur.)	%	98	99	99	98		A368854
1,4-Difluorobenzene (sur.)	%	97	96	96	97		A368866
4-Bromofluorobenzene (sur.)	%	98	99	99	99		A368866
D4-1,2-Dichloroethane (sur.)	%	108	108	107	108		A368866
RDL = Reportable Detection Limit							





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch
<b>Volatiles</b>					
Total Trihalomethanes	ug/L	<1.3	<1.3	1.3	A367838
Benzene	ug/L	<0.40	<0.40	0.40	A368854
Bromodichloromethane	ug/L	<0.50	<0.50	0.50	A368866
Toluene	ug/L	<0.40	<0.40	0.40	A368854
Bromoform	ug/L	<0.50	<0.50	0.50	A368866
Ethylbenzene	ug/L	<0.40	<0.40	0.40	A368854
Bromomethane	ug/L	<2.0	<2.0	2.0	A368866
m & p-Xylene	ug/L	<0.80	<0.80	0.80	A368854
Carbon tetrachloride	ug/L	<0.50	<0.50	0.50	A368866
o-Xylene	ug/L	<0.40	<0.40	0.40	A368854
Chlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
Dibromochloromethane	ug/L	<1.0	<1.0	1.0	A368866
Xylenes (Total)	ug/L	<0.89	<0.89	0.89	A368318
Chloroethane	ug/L	<1.0	<1.0	1.0	A368866
F1 (C6-C10) - BTEX	ug/L	<100	<100	100	A368318
Chloroform	ug/L	<0.50	<0.50	0.50	A368866
Chloromethane	ug/L	<2.0	<2.0	2.0	A368866
F1 (C6-C10)	ug/L	<100	<100	100	A368854
1,2-dibromoethane	ug/L	<0.20	<0.20	0.20	A368866
1,2-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,3-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,4-dichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,1-dichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,2-dichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,1-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	0.50	A368866
Dichloromethane	ug/L	<2.0	<2.0	2.0	A368866
1,2-dichloropropane	ug/L	<0.50	<0.50	0.50	A368866
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A368866
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	0.50	A368866
Methyl methacrylate	ug/L	<0.50	<0.50	0.50	A368866
RDL = Reportable Detection Limit					





### VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		AGX001	AGX002		
Sampling Date		2021/09/24 11:10	2021/09/24 14:00		
COC Number		644187-01-01	644187-01-01		
	UNITS	MESOCOSM TABLE 8	TREATED OSPW TANK	RDL	QC Batch
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	0.50	A368866
Styrene	ug/L	<0.50	<0.50	0.50	A368866
1,1,1,2-tetrachloroethane	ug/L	<1.0	<1.0	1.0	A368866
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	2.0	A368866
Tetrachloroethene	ug/L	<0.50	<0.50	0.50	A368866
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A368866
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	1.0	A368866
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	0.50	A368866
1,1,1-trichloroethane	ug/L	<0.50	<0.50	0.50	A368866
1,1,2-trichloroethane	ug/L	<0.50	<0.50	0.50	A368866
Trichloroethene	ug/L	<0.50	<0.50	0.50	A368866
Trichlorofluoromethane	ug/L	<0.50	<0.50	0.50	A368866
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A368866
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	0.50	A368866
Vinyl chloride	ug/L	<0.50	<0.50	0.50	A368866
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene (sur.)	%	108	106		A368854
4-Bromofluorobenzene (sur.)	%	98	99		A368854
D4-1,2-Dichloroethane (sur.)	%	99	100		A368854
1,4-Difluorobenzene (sur.)	%	96	97		A368866
4-Bromofluorobenzene (sur.)	%	99	100		A368866
D4-1,2-Dichloroethane (sur.)	%	110	108		A368866
RDL = Reportable Detection Limit					





## GENERAL COMMENTS

Version #2: Samples moved from C172539 to this job as requested. 2021.10.22

Sample AGW993 [RIVER WATER TANK] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW994 [MESOCOSM TABLE 1] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW995 [MESOCOSM TABLE 2] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW996 [MESOCOSM TABLE 3] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW997 [MESOCOSM TABLE 4] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW998 [MESOCOSM TABLE 5] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGW999 [MESOCOSM TABLE 6] : Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGX000 [MESOCOSM TABLE 7] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour. Sample was analyzed past method specified hold time for Alkalinity @25C (pp, total), CO<sub>3</sub>,HCO<sub>3</sub>,OH.

Sample AGX001 [MESOCOSM TABLE 8] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGX002 [TREATED OSPW TANK] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for True Colour.

Sample AGX293 [BLANK] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. True Colour completed within five days of sampling. Data is satisfactory for compliance purposes. NO<sub>2</sub> (N); NO<sub>2</sub>





(N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes.

Sample AGX294 [DUPLICATE] : Turbidity completed within five days of sampling. Data is satisfactory for compliance purposes. Sample was analyzed past method specified hold time for Biochemical Oxygen Demand. Exceedance of hold time increases the uncertainty of test results but does not necessarily imply that results are compromised. NO<sub>2</sub> (N); NO<sub>2</sub> (N) + NO<sub>3</sub> (N) in Water completed within five days of sampling. Data is satisfactory for compliance purposes. True Colour completed within five days of sampling. Data is satisfactory for compliance purposes.

#### **ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments**

Sample AGX294 [DUPLICATE] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

#### **ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments**

Sample AGW994 [MESOCOSM TABLE 1] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

Sample AGW994 [MESOCOSM TABLE 1] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.

Sample AGW995 [MESOCOSM TABLE 2] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

Sample AGW995 [MESOCOSM TABLE 2] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.

Sample AGW999 [MESOCOSM TABLE 6] Elements by ICPMS Low Level (total): Detection limits raised due to sample matrix.

Sample AGX002 [TREATED OSPW TANK] Elements by ICPMS Low Level (dissolved): Detection limits raised due to sample matrix.

Sample AGX002 [TREATED OSPW TANK] Elements by ICPMS Digested LL (total): Detection limits raised due to sample matrix.

#### **VOLATILE ORGANICS BY GC-MS (WATER) Comments**

Sample AGW993 [RIVER WATER TANK] BTEX/F1 in Water by HS GC/MS/FID: Headspace in sample container was noted at the time of extraction

Sample AGX293, Elements by ICPMS Low Level (dissolved): Test repeated.

Sample AGX293, Elements by ICPMS Low Level (total): Test repeated.

Sample AGW993, Chloride/Sulphate by Auto Colourimetry: Test repeated.

Sample AGW995, Chloride/Sulphate by Auto Colourimetry: Test repeated.

Sample AGX000, Chloride/Sulphate by Auto Colourimetry: Test repeated.

Sample AGW996, Elements by ICPMS Low Level (dissolved): Test repeated.

**Results relate only to the items tested.**





### QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	Matrix Spike		D10-ANTHRACENE (sur.)	2021/10/02		121	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		105	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		76	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		133 (1)	%	50 - 130
				Acenaphthene	2021/10/02		114	%	50 - 130
				Acenaphthylene	2021/10/02		116	%	50 - 130
				Acridine	2021/10/02		96	%	50 - 130
				Anthracene	2021/10/02		93	%	50 - 130
				Benzo(a)anthracene	2021/10/02		99	%	50 - 130
				Benzo(b&j)fluoranthene	2021/10/02		97	%	50 - 130
				Benzo(k)fluoranthene	2021/10/02		97	%	50 - 130
				Benzo(g,h,i)perylene	2021/10/02		84	%	50 - 130
				Benzo(c)phenanthrene	2021/10/02		105	%	50 - 130
				Benzo(a)pyrene	2021/10/02		91	%	50 - 130
				Benzo(e)pyrene	2021/10/02		97	%	50 - 130
				Chrysene	2021/10/02		92	%	50 - 130
				Dibenz(a,h)anthracene	2021/10/02		89	%	50 - 130
				Fluoranthene	2021/10/02		118	%	50 - 130
				Fluorene	2021/10/02		122	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/10/02		91	%	50 - 130
				2-Methylnaphthalene	2021/10/02		105	%	50 - 130
				Naphthalene	2021/10/02		106	%	50 - 130
				Phenanthrene	2021/10/02		113	%	50 - 130
				Perylene	2021/10/02		92	%	50 - 130
				Pyrene	2021/10/02		116	%	50 - 130
				Quinoline	2021/10/02		126	%	50 - 130
				C1-Naphthalene	2021/10/02		103	%	50 - 130
				C3-Naphthalene	2021/10/02		115	%	50 - 130
				C2-Naphthalene	2021/10/02		107	%	50 - 130
				C1-biphenyl	2021/10/02		103	%	50 - 130
				C1 phenanthrene/anthracene	2021/10/02		116	%	50 - 130
				C2 phenanthrene/anthracene	2021/10/02		115	%	50 - 130
				C1 fluoranthene/pyrene	2021/10/02		111	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/10/02		21 (1)	%	30 - 130
				1-Methylnaphthalene	2021/10/02		103	%	50 - 130
A367343	JU2	Spiked Blank		D10-ANTHRACENE (sur.)	2021/10/02		103	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		81	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		63	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		116	%	50 - 130
				Acenaphthene	2021/10/02		89	%	50 - 130
				Acenaphthylene	2021/10/02		90	%	50 - 130
				Acridine	2021/10/02		84	%	50 - 130
				Anthracene	2021/10/02		84	%	50 - 130
				Benzo(a)anthracene	2021/10/02		104	%	50 - 130
				Benzo(b&j)fluoranthene	2021/10/02		109	%	50 - 130
				Benzo(k)fluoranthene	2021/10/02		108	%	50 - 130
				Benzo(g,h,i)perylene	2021/10/02		100	%	50 - 130
				Benzo(c)phenanthrene	2021/10/02		101	%	50 - 130
				Benzo(a)pyrene	2021/10/02		104	%	50 - 130
				Benzo(e)pyrene	2021/10/02		109	%	50 - 130
				Chrysene	2021/10/02		100	%	50 - 130
				Dibenz(a,h)anthracene	2021/10/02		106	%	50 - 130
				Fluoranthene	2021/10/02		110	%	50 - 130
				Fluorene	2021/10/02		94	%	50 - 130
				Indeno(1,2,3-cd)pyrene	2021/10/02		108	%	50 - 130





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	Method Blank		2-Methylnaphthalene	2021/10/02		83	%	50 - 130
				Naphthalene	2021/10/02		82	%	50 - 130
				Phenanthrene	2021/10/02		97	%	50 - 130
				Perylene	2021/10/02		108	%	50 - 130
				Pyrene	2021/10/02		110	%	50 - 130
				Quinoline	2021/10/02		119	%	50 - 130
				C1-Naphthalene	2021/10/02		79	%	50 - 130
				C3-Naphthalene	2021/10/02		84	%	50 - 130
				C2-Naphthalene	2021/10/02		81	%	50 - 130
				C1-biphenyl	2021/10/02		74	%	50 - 130
				C1 phenanthrene/anthracene	2021/10/02		108	%	50 - 130
				C2 phenanthrene/anthracene	2021/10/02		113	%	50 - 130
				C1 fluoranthene/pyrene	2021/10/02		113	%	50 - 130
				C2 benzo(a)anthracene/chrysene	2021/10/02		20 (1)	%	30 - 130
				1-Methylnaphthalene	2021/10/02		79	%	50 - 130
				D10-ANTHRACENE (sur.)	2021/10/02		100	%	50 - 130
				D8-ACENAPHTHYLENE (sur.)	2021/10/02		79	%	50 - 130
				D8-NAPHTHALENE (sur.)	2021/10/02		60	%	50 - 130
				TERPHENYL-D14 (sur.)	2021/10/02		117	%	50 - 130
				Acenaphthene	2021/10/02	<0.10		ug/L	
				Acenaphthylene	2021/10/02	<0.10		ug/L	
				Acridine	2021/10/02	<0.040		ug/L	
				Anthracene	2021/10/02	<0.010		ug/L	
				Benzo(a)anthracene	2021/10/02	<0.0085		ug/L	
				Benzo(b&j)fluoranthene	2021/10/02	<0.0085		ug/L	
				Benzo(k)fluoranthene	2021/10/02	<0.0085		ug/L	
				Benzo(g,h,i)perylene	2021/10/02	<0.0085		ug/L	
				Benzo(c)phenanthrene	2021/10/02	<0.050		ug/L	
				Benzo(a)pyrene	2021/10/02	<0.0075		ug/L	
				Benzo(e)pyrene	2021/10/02	<0.050		ug/L	
				Chrysene	2021/10/02	<0.0085		ug/L	
				Dibenz(a,h)anthracene	2021/10/02	<0.0075		ug/L	
				Fluoranthene	2021/10/02	<0.010		ug/L	
				Fluorene	2021/10/02	<0.050		ug/L	
				Indeno(1,2,3-cd)pyrene	2021/10/02	<0.0085		ug/L	
				Indeno(1,2,3-cd)fluoranthene	2021/10/02	<0.0085		ug/L	
				2-Methylnaphthalene	2021/10/02	<0.10		ug/L	
				Naphthalene	2021/10/02	<0.10		ug/L	
				Phenanthrene	2021/10/02	<0.050		ug/L	
				Perylene	2021/10/02	<0.050		ug/L	
				Pyrene	2021/10/02	<0.020		ug/L	
				Quinoline	2021/10/02	<0.20		ug/L	
				Retene	2021/10/02	<0.050		ug/L	
				C1-Naphthalene	2021/10/02	<0.10		ug/L	
				C3-Naphthalene	2021/10/02	<0.10		ug/L	
				C4-Naphthalene	2021/10/02	<0.10		ug/L	
				C2-Naphthalene	2021/10/02	<0.10		ug/L	
				Biphenyl	2021/10/02	<0.020		ug/L	
				C1-biphenyl	2021/10/02	<0.020		ug/L	
				C2-biphenyl	2021/10/02	<0.020		ug/L	
				C1-fluorene	2021/10/02	<0.050		ug/L	
				C2-fluorene	2021/10/02	<0.050		ug/L	
				C3-fluorene	2021/10/02	<0.050		ug/L	
				Dibenzothiophene	2021/10/02	<0.020		ug/L	
				C1-dibenzothiophene	2021/10/02	<0.020		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A367343	JU2	RPD		C2-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C3-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C4-dibenzothiophene	2021/10/02	<0.020		ug/L	
				C1 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C2 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C3 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C4 phenanthrene/anthracene	2021/10/02	<0.050		ug/L	
				C1 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C2 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C3 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C4 fluoranthene/pyrene	2021/10/02	<0.020		ug/L	
				C1 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C2 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C3 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C4 benzo(a)anthracene/chrysene	2021/10/02	<0.0085		ug/L	
				C1benzobkfluoranthene/benzoapyrene	2021/10/02	<0.0075		ug/L	
				C2benzobkfluoranthene/benzoapyrene	2021/10/02	<0.0075		ug/L	
				C1-Acenaphthene	2021/10/02	<0.10		ug/L	
				1-Methylnaphthalene	2021/10/02	<0.10		ug/L	
				Acenaphthene	2021/10/02	NC		%	30
				Acenaphthylene	2021/10/02	NC		%	30
				Acridine	2021/10/02	NC		%	30
				Anthracene	2021/10/02	NC		%	30
				Benzo(a)anthracene	2021/10/02	NC		%	30
				Benzo(b&j)fluoranthene	2021/10/02	NC		%	30
				Benzo(k)fluoranthene	2021/10/02	NC		%	30
				Benzo(g,h,i)perylene	2021/10/02	NC		%	30
				Benzo(c)phenanthrene	2021/10/02	NC		%	30
				Benzo(a)pyrene	2021/10/02	NC		%	30
				Benzo(e)pyrene	2021/10/02	NC		%	30
				Chrysene	2021/10/02	NC		%	30
				Dibenz(a,h)anthracene	2021/10/02	NC		%	30
				Fluoranthene	2021/10/02	NC		%	30
				Fluorene	2021/10/02	NC		%	30
				Indeno(1,2,3-cd)pyrene	2021/10/02	NC		%	30
				Indeno(1,2,3-cd)fluoranthene	2021/10/02	NC		%	30
				2-Methylnaphthalene	2021/10/02	NC		%	30
				Naphthalene	2021/10/02	NC		%	30
				Phenanthrene	2021/10/02	8.6		%	30
				Perylene	2021/10/02	NC		%	30
				Pyrene	2021/10/02	NC		%	30
				Quinoline	2021/10/02	NC		%	30
				Retene	2021/10/02	NC		%	30
				C1-Naphthalene	2021/10/02	NC		%	30
				C3-Naphthalene	2021/10/02	NC		%	30
				C4-Naphthalene	2021/10/02	NC		%	30
				C2-Naphthalene	2021/10/02	NC		%	30
				Biphenyl	2021/10/02	NC		%	30
				C1-biphenyl	2021/10/02	NC		%	30
				C2-biphenyl	2021/10/02	93 (1)		%	30
				C1-fluorene	2021/10/02	0.60		%	30
				C2-fluorene	2021/10/02	24		%	30
				C3-fluorene	2021/10/02	5.9		%	30
				Dibenzothiophene	2021/10/02	NC		%	30
				C1-dibenzothiophene	2021/10/02	3.9		%	30





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			C2-dibenzothiophene	2021/10/02	12		%	30
			C3-dibenzothiophene	2021/10/02	17		%	30
			C4-dibenzothiophene	2021/10/02	NC		%	30
			C1 phenanthrene/anthracene	2021/10/02	14		%	30
			C2 phenanthrene/anthracene	2021/10/02	14		%	30
			C3 phenanthrene/anthracene	2021/10/02	18		%	30
			C4 phenanthrene/anthracene	2021/10/02	NC		%	30
			C1 fluoranthene/pyrene	2021/10/02	NC		%	30
			C2 fluoranthene/pyrene	2021/10/02	NC		%	30
			C3 fluoranthene/pyrene	2021/10/02	NC		%	30
			C4 fluoranthene/pyrene	2021/10/02	NC		%	30
			C1 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
			C2 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
			C3 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
			C4 benzo(a)anthracene/chrysene	2021/10/02	NC		%	30
			C1benzobkfluoranthene/benzoapyrene	2021/10/02	NC		%	30
			C2benzobkfluoranthene/benzoapyrene	2021/10/02	NC		%	30
			C1-Acenaphthene	2021/10/02	NC		%	30
			1-Methylnaphthalene	2021/10/02	NC		%	30
A367832	BYM	Spiked Blank	Biochemical Oxygen Demand	2021/10/03		89	%	85 - 115
A367832	BYM	Method Blank	Biochemical Oxygen Demand	2021/10/03	<2.0		mg/L	
A367832	BYM	RPD	Biochemical Oxygen Demand	2021/10/03	0.54		%	20
A368849	MHF	Matrix Spike [AGW993-14]	O-TERPHENYL (sur.)	2021/10/02		97	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/02		96	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/10/02		97	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/10/02		98	%	60 - 140
A368849	MHF	Spiked Blank	O-TERPHENYL (sur.)	2021/10/02		109	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/02		106	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/10/02		109	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/10/02		108	%	60 - 140
A368849	MHF	Method Blank	O-TERPHENYL (sur.)	2021/10/02		100	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/02	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2021/10/02	<0.10		mg/L	
			F4 (C34-C50 Hydrocarbons)	2021/10/02	<0.20		mg/L	
A368849	MHF	RPD [AGX002-14]	F2 (C10-C16 Hydrocarbons)	2021/10/02	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2021/10/02	29		%	30
			F4 (C34-C50 Hydrocarbons)	2021/10/02	NC		%	30
A368854	DO1	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/01		93	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		95	%	50 - 140
			Benzene	2021/10/01		89	%	50 - 140
			Toluene	2021/10/01		84	%	50 - 140
			Ethylbenzene	2021/10/01		88	%	50 - 140
			m & p-Xylene	2021/10/01		88	%	50 - 140
			o-Xylene	2021/10/01		89	%	50 - 140
			F1 (C6-C10)	2021/10/01		93	%	60 - 140
A368854	DO1	Spiked Blank	1,4-Difluorobenzene (sur.)	2021/10/01		94	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		96	%	50 - 140
			Benzene	2021/10/01		89	%	60 - 130
			Toluene	2021/10/01		83	%	60 - 130
			Ethylbenzene	2021/10/01		88	%	60 - 130
			m & p-Xylene	2021/10/01		87	%	60 - 130
			o-Xylene	2021/10/01		89	%	60 - 130





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A368854	DO1	Method Blank	F1 (C6-C10)	2021/10/01		101	%	60 - 140
			1,4-Difluorobenzene (sur.)	2021/10/01		107	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		100	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		99	%	50 - 140
			Benzene	2021/10/01	<0.40		ug/L	
			Toluene	2021/10/01	<0.40		ug/L	
			Ethylbenzene	2021/10/01	<0.40		ug/L	
			m & p-Xylene	2021/10/01	<0.80		ug/L	
			o-Xylene	2021/10/01	<0.40		ug/L	
			F1 (C6-C10)	2021/10/01	<100		ug/L	
A368854	DO1	RPD	Benzene	2021/10/01	NC		%	30
			Toluene	2021/10/01	NC		%	30
			Ethylbenzene	2021/10/01	NC		%	30
			m & p-Xylene	2021/10/01	NC		%	30
			o-Xylene	2021/10/01	NC		%	30
			F1 (C6-C10)	2021/10/01	NC		%	30
A368866	QW1	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/01		104	%	50 - 140
			4-Bromofluorobenzene (sur.)	2021/10/01		104	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2021/10/01		99	%	50 - 140
			Bromodichloromethane	2021/10/01		99	%	50 - 140
			Bromoform	2021/10/01		97	%	50 - 140
			Bromomethane	2021/10/01		112	%	50 - 140
			Carbon tetrachloride	2021/10/01		102	%	50 - 140
			Chlorobenzene	2021/10/01		100	%	50 - 140
			Dibromochloromethane	2021/10/01		104	%	50 - 140
			Chloroethane	2021/10/01		91	%	50 - 140
			Chloroform	2021/10/01		96	%	50 - 140
			Chloromethane	2021/10/01		122	%	50 - 140
			1,2-dibromoethane	2021/10/01		94	%	50 - 140
			1,2-dichlorobenzene	2021/10/01		105	%	50 - 140
			1,3-dichlorobenzene	2021/10/01		101	%	50 - 140
			1,4-dichlorobenzene	2021/10/01		101	%	50 - 140
			1,1-dichloroethane	2021/10/01		95	%	50 - 140
			1,2-dichloroethane	2021/10/01		105	%	50 - 140
			1,1-dichloroethene	2021/10/01		99	%	50 - 140
			cis-1,2-dichloroethene	2021/10/01		102	%	50 - 140
			trans-1,2-dichloroethene	2021/10/01		92	%	50 - 140
			Dichloromethane	2021/10/01		95	%	50 - 140
			1,2-dichloropropane	2021/10/01		103	%	50 - 140
			cis-1,3-dichloropropene	2021/10/01		127	%	50 - 140
			trans-1,3-dichloropropene	2021/10/01		139	%	50 - 140
			Methyl methacrylate	2021/10/01		106	%	50 - 140
			Methyl-tert-butylether (MTBE)	2021/10/01		102	%	50 - 140
			Styrene	2021/10/01		93	%	50 - 140
			1,1,1,2-tetrachloroethane	2021/10/01		96	%	50 - 140
			1,1,2,2-tetrachloroethane	2021/10/01		100	%	50 - 140
			Tetrachloroethene	2021/10/01		87	%	50 - 140
			1,2,3-trichlorobenzene	2021/10/01		95	%	50 - 140
			1,2,4-trichlorobenzene	2021/10/01		95	%	50 - 140
			1,3,5-trichlorobenzene	2021/10/01		92	%	50 - 140
			1,1,1-trichloroethane	2021/10/01		103	%	50 - 140
			1,1,2-trichloroethane	2021/10/01		102	%	50 - 140
			Trichloroethene	2021/10/01		106	%	50 - 140
			Trichlorofluoromethane	2021/10/01		105	%	50 - 140
			1,2,4-trimethylbenzene	2021/10/01		103	%	50 - 140





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A368866	QW1	Spiked Blank		1,3,5-trimethylbenzene	2021/10/01		106	%	50 - 140
				Vinyl chloride	2021/10/01		127	%	50 - 140
				1,4-Difluorobenzene (sur.)	2021/10/01		104	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		105	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		98	%	50 - 140
				Bromodichloromethane	2021/10/01		98	%	60 - 130
				Bromoform	2021/10/01		94	%	60 - 130
				Bromomethane	2021/10/01		99	%	60 - 130
				Carbon tetrachloride	2021/10/01		101	%	60 - 130
				Chlorobenzene	2021/10/01		98	%	60 - 130
				Dibromochloromethane	2021/10/01		102	%	60 - 130
				Chloroethane	2021/10/01		84	%	60 - 130
				Chloroform	2021/10/01		94	%	60 - 130
				Chloromethane	2021/10/01		97	%	60 - 130
				1,2-dibromoethane	2021/10/01		92	%	60 - 130
				1,2-dichlorobenzene	2021/10/01		105	%	60 - 130
				1,3-dichlorobenzene	2021/10/01		101	%	60 - 130
				1,4-dichlorobenzene	2021/10/01		101	%	60 - 130
				1,1-dichloroethane	2021/10/01		94	%	60 - 130
				1,2-dichloroethane	2021/10/01		104	%	60 - 130
				1,1-dichloroethene	2021/10/01		96	%	60 - 130
				cis-1,2-dichloroethene	2021/10/01		100	%	60 - 130
				trans-1,2-dichloroethene	2021/10/01		90	%	60 - 130
				Dichloromethane	2021/10/01		91	%	60 - 130
				1,2-dichloropropane	2021/10/01		102	%	60 - 130
				cis-1,3-dichloropropene	2021/10/01		120	%	60 - 130
				trans-1,3-dichloropropene	2021/10/01		125	%	60 - 130
				Methyl methacrylate	2021/10/01		104	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/10/01		100	%	60 - 130
				Styrene	2021/10/01		92	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/10/01		94	%	60 - 130
				1,1,2,2-tetrachloroethane	2021/10/01		98	%	60 - 130
				Tetrachloroethene	2021/10/01		85	%	60 - 130
				1,2,3-trichlorobenzene	2021/10/01		97	%	60 - 130
				1,2,4-trichlorobenzene	2021/10/01		95	%	60 - 130
				1,3,5-trichlorobenzene	2021/10/01		92	%	60 - 130
				1,1,1-trichloroethane	2021/10/01		103	%	60 - 130
				1,1,2-trichloroethane	2021/10/01		101	%	60 - 130
				Trichloroethene	2021/10/01		105	%	60 - 130
				Trichlorofluoromethane	2021/10/01		100	%	60 - 130
				1,2,4-trimethylbenzene	2021/10/01		104	%	60 - 130
				1,3,5-trimethylbenzene	2021/10/01		107	%	60 - 130
				Vinyl chloride	2021/10/01		110	%	60 - 130
A368866	QW1	Method Blank		1,4-Difluorobenzene (sur.)	2021/10/01		96	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		98	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		108	%	50 - 140
				Bromodichloromethane	2021/10/01	<0.50		ug/L	
				Bromoform	2021/10/01	<0.50		ug/L	
				Bromomethane	2021/10/01	<2.0		ug/L	
				Carbon tetrachloride	2021/10/01	<0.50		ug/L	
				Chlorobenzene	2021/10/01	<0.50		ug/L	
				Dibromochloromethane	2021/10/01	<1.0		ug/L	
				Chloroethane	2021/10/01	<1.0		ug/L	
				Chloroform	2021/10/01	<0.50		ug/L	
				Chloromethane	2021/10/01	<2.0		ug/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				1,2-dibromoethane	2021/10/01	<0.20		ug/L	
				1,2-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,3-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,4-dichlorobenzene	2021/10/01	<0.50		ug/L	
				1,1-dichloroethane	2021/10/01	<0.50		ug/L	
				1,2-dichloroethane	2021/10/01	<0.50		ug/L	
				1,1-dichloroethene	2021/10/01	<0.50		ug/L	
				cis-1,2-dichloroethene	2021/10/01	<0.50		ug/L	
				trans-1,2-dichloroethene	2021/10/01	<0.50		ug/L	
				Dichloromethane	2021/10/01	<2.0		ug/L	
				1,2-dichloropropane	2021/10/01	<0.50		ug/L	
				cis-1,3-dichloropropene	2021/10/01	<0.50		ug/L	
				trans-1,3-dichloropropene	2021/10/01	<0.50		ug/L	
				Methyl methacrylate	2021/10/01	<0.50		ug/L	
				Methyl-tert-butylether (MTBE)	2021/10/01	<0.50		ug/L	
				Styrene	2021/10/01	<0.50		ug/L	
				1,1,1,2-tetrachloroethane	2021/10/01	<1.0		ug/L	
				1,1,2,2-tetrachloroethane	2021/10/01	<2.0		ug/L	
				Tetrachloroethene	2021/10/01	<0.50		ug/L	
				1,2,3-trichlorobenzene	2021/10/01	<1.0		ug/L	
				1,2,4-trichlorobenzene	2021/10/01	<1.0		ug/L	
				1,3,5-trichlorobenzene	2021/10/01	<0.50		ug/L	
				1,1,1-trichloroethane	2021/10/01	<0.50		ug/L	
				1,1,2-trichloroethane	2021/10/01	<0.50		ug/L	
				Trichloroethene	2021/10/01	<0.50		ug/L	
				Trichlorofluoromethane	2021/10/01	<0.50		ug/L	
				1,2,4-trimethylbenzene	2021/10/01	<0.50		ug/L	
				1,3,5-trimethylbenzene	2021/10/01	<0.50		ug/L	
				Vinyl chloride	2021/10/01	<0.50		ug/L	
A368866	QW1	RPD		Bromodichloromethane	2021/10/01	NC		%	30
				Bromoform	2021/10/01	NC		%	30
				Bromomethane	2021/10/01	NC		%	30
				Carbon tetrachloride	2021/10/01	NC		%	30
				Chlorobenzene	2021/10/01	NC		%	30
				Dibromochloromethane	2021/10/01	NC		%	30
				Chloroethane	2021/10/01	NC		%	30
				Chloroform	2021/10/01	NC		%	30
				Chloromethane	2021/10/01	NC		%	30
				1,2-dibromoethane	2021/10/01	NC		%	30
				1,2-dichlorobenzene	2021/10/01	NC		%	30
				1,3-dichlorobenzene	2021/10/01	NC		%	30
				1,4-dichlorobenzene	2021/10/01	NC		%	30
				1,1-dichloroethane	2021/10/01	NC		%	30
				1,2-dichloroethane	2021/10/01	NC		%	30
				1,1-dichloroethene	2021/10/01	NC		%	30
				cis-1,2-dichloroethene	2021/10/01	NC		%	30
				trans-1,2-dichloroethene	2021/10/01	NC		%	30
				Dichloromethane	2021/10/01	NC		%	30
				1,2-dichloropropane	2021/10/01	NC		%	30
				cis-1,3-dichloropropene	2021/10/01	NC		%	30
				trans-1,3-dichloropropene	2021/10/01	NC		%	30
				Methyl methacrylate	2021/10/01	NC		%	30
				Methyl-tert-butylether (MTBE)	2021/10/01	NC		%	30
				Styrene	2021/10/01	NC		%	30
				1,1,1,2-tetrachloroethane	2021/10/01	NC		%	30





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,1,2,2-tetrachloroethane	2021/10/01	NC		%	30
			Tetrachloroethene	2021/10/01	NC		%	30
			1,2,3-trichlorobenzene	2021/10/01	NC		%	30
			1,2,4-trichlorobenzene	2021/10/01	NC		%	30
			1,3,5-trichlorobenzene	2021/10/01	NC		%	30
			1,1,1-trichloroethane	2021/10/01	NC		%	30
			1,1,2-trichloroethane	2021/10/01	NC		%	30
			Trichloroethene	2021/10/01	NC		%	30
			Trichlorofluoromethane	2021/10/01	NC		%	30
			1,2,4-trimethylbenzene	2021/10/01	NC		%	30
			1,3,5-trimethylbenzene	2021/10/01	NC		%	30
			Vinyl chloride	2021/10/01	NC		%	30
A368930	CAU	Matrix Spike	Naphthenic Acids	2021/10/01		73	%	70 - 130
A368930	CAU	Spiked Blank	Naphthenic Acids	2021/10/01		83	%	70 - 130
A368930	CAU	Method Blank	Naphthenic Acids	2021/10/01	<2.0		mg/L	
A368930	CAU	RPD	Naphthenic Acids	2021/10/01	NC		%	30
A369013	CAU	Matrix Spike [AGW994-13]	Naphthenic Acids	2021/10/04		77	%	70 - 130
A369013	CAU	Spiked Blank	Naphthenic Acids	2021/10/04		84	%	70 - 130
A369013	CAU	Method Blank	Naphthenic Acids	2021/10/04	<2.0		mg/L	
A369013	CAU	RPD	Naphthenic Acids	2021/10/04	NC		%	30
A369027	AP1	Spiked Blank	Turbidity	2021/09/28		103	%	80 - 120
A369027	AP1	Method Blank	Turbidity	2021/09/28	<0.10		NTU	
A369027	AP1	RPD	Turbidity	2021/09/28	0.28		%	20
A369034	AP1	Spiked Blank	Turbidity	2021/09/28		103	%	80 - 120
A369034	AP1	Method Blank	Turbidity	2021/09/28	<0.10		NTU	
A369034	AP1	RPD [AGW995-01]	Turbidity	2021/09/28	0.64		%	20
A369130	JFH	Matrix Spike [AGW995-02]	Dissolved Nitrite (N)	2021/09/28		92	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		121 (1)	%	80 - 120
A369130	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/28		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		105	%	80 - 120
A369130	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/28	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	<0.010		mg/L	
A369130	JFH	RPD [AGW995-02]	Dissolved Nitrite (N)	2021/09/28	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	13		%	20
A369135	JFH	Matrix Spike [AGX001-02]	Dissolved Nitrite (N)	2021/09/28		99	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		114	%	80 - 120
A369135	JFH	Spiked Blank	Dissolved Nitrite (N)	2021/09/28		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/09/28		104	%	80 - 120
A369135	JFH	Method Blank	Dissolved Nitrite (N)	2021/09/28	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	<0.010		mg/L	
A369135	JFH	RPD [AGX001-02]	Dissolved Nitrite (N)	2021/09/28	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/09/28	12		%	20
A369277	PK8	Spiked Blank	Biochemical Oxygen Demand	2021/10/04		91	%	85 - 115
A369277	PK8	Method Blank	Biochemical Oxygen Demand	2021/10/04	<2.0		mg/L	
A369277	PK8	RPD [AGX293-04]	Biochemical Oxygen Demand	2021/10/04	NC		%	20
A369383	FM0	Matrix Spike [AGX002-02]	Orthophosphate (P)	2021/09/29		89	%	80 - 120
A369383	FM0	Spiked Blank	Orthophosphate (P)	2021/09/29		102	%	80 - 120
A369383	FM0	Method Blank	Orthophosphate (P)	2021/09/29	<0.0010		mg/L	
A369383	FM0	RPD [AGX002-02]	Orthophosphate (P)	2021/09/29	3.0		%	20
A369840	FM0	Matrix Spike	Total Nitrogen (N)	2021/09/30		98	%	80 - 120
A369840	FM0	QC Standard	Total Nitrogen (N)	2021/09/30		90	%	80 - 120
A369840	FM0	Spiked Blank	Total Nitrogen (N)	2021/09/30		87	%	80 - 120
A369840	FM0	Method Blank	Total Nitrogen (N)	2021/09/30	<0.020		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A369840	FM0	RPD	Total Nitrogen (N)	2021/09/30	20		%	20
A369936	PK8	Matrix Spike	Chemical Oxygen Demand	2021/09/29		111	%	80 - 120
A369936	PK8	Spiked Blank	Chemical Oxygen Demand	2021/09/29		101	%	80 - 120
A369936	PK8	Method Blank	Chemical Oxygen Demand	2021/09/29	<10		mg/L	
A369936	PK8	RPD	Chemical Oxygen Demand	2021/09/29	9.0		%	20
A369972	STI	Matrix Spike [AGX002-02]	True Colour	2021/09/29		96	%	80 - 120
A369972	STI	Spiked Blank	True Colour	2021/09/29		109	%	80 - 120
A369972	STI	Method Blank	True Colour	2021/09/29	<2.0		PtCo units	
A369972	STI	RPD [AGX002-02]	True Colour	2021/09/30	6.3		%	20
A369980	STI	Matrix Spike	True Colour	2021/09/29		63 (1)	%	80 - 120
A369980	STI	Spiked Blank	True Colour	2021/09/29		105	%	80 - 120
A369980	STI	Method Blank	True Colour	2021/09/29	<2.0		PtCo units	
A369980	STI	RPD	True Colour	2021/09/29	0.85		%	20
A370177	SKM	Matrix Spike	Dissolved Nitrite (N)	2021/10/01		86	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/10/01		-4.5 (1)	%	80 - 120
A370177	SKM	Spiked Blank	Dissolved Nitrite (N)	2021/10/01		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2021/10/01		103	%	80 - 120
A370177	SKM	Method Blank	Dissolved Nitrite (N)	2021/09/29	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2021/09/29	<0.010		mg/L	
A370177	SKM	RPD	Dissolved Nitrite (N)	2021/10/01	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2021/10/01	NC		%	20
A370547	JAB	Matrix Spike	Dissolved Calcium (Ca)	2021/09/30		NC	%	80 - 120
			Dissolved Iron (Fe)	2021/09/30		NC	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/30		95	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/30		NC	%	80 - 120
			Dissolved Potassium (K)	2021/09/30		98	%	80 - 120
			Dissolved Sodium (Na)	2021/09/30		NC	%	80 - 120
A370547	JAB	Spiked Blank	Dissolved Calcium (Ca)	2021/09/30		96	%	80 - 120
			Dissolved Iron (Fe)	2021/09/30		103	%	80 - 120
			Dissolved Magnesium (Mg)	2021/09/30		101	%	80 - 120
			Dissolved Manganese (Mn)	2021/09/30		100	%	80 - 120
			Dissolved Potassium (K)	2021/09/30		99	%	80 - 120
			Dissolved Sodium (Na)	2021/09/30		94	%	80 - 120
A370547	JAB	Method Blank	Dissolved Calcium (Ca)	2021/10/01	<0.30		mg/L	
			Dissolved Iron (Fe)	2021/10/01	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2021/10/01	<0.20		mg/L	
			Dissolved Manganese (Mn)	2021/10/01	<0.0040		mg/L	
			Dissolved Potassium (K)	2021/10/01	<0.30		mg/L	
			Dissolved Sodium (Na)	2021/10/01	<0.50		mg/L	
A370547	JAB	RPD	Dissolved Calcium (Ca)	2021/09/30	0.64		%	20
			Dissolved Iron (Fe)	2021/09/30	0.090		%	20
			Dissolved Magnesium (Mg)	2021/09/30	0.80		%	20
			Dissolved Manganese (Mn)	2021/09/30	0.016		%	20
			Dissolved Potassium (K)	2021/09/30	0.51		%	20
			Dissolved Sodium (Na)	2021/09/30	0.30		%	20
A370623	MHF	Matrix Spike	O-TERPHENYL (sur.)	2021/10/03		106	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/03		109	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/10/03		111	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/10/03		107	%	60 - 140
A370623	MHF	Spiked Blank	O-TERPHENYL (sur.)	2021/10/03		89	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/03		89	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2021/10/03		90	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2021/10/03		87	%	60 - 140
A370623	MHF	Method Blank	O-TERPHENYL (sur.)	2021/10/03		95	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2021/10/03	<0.10		mg/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A370623	MHF	RPD		F3 (C16-C34 Hydrocarbons)	2021/10/03	<0.10		mg/L	
				F4 (C34-C50 Hydrocarbons)	2021/10/03	<0.20		mg/L	
				F2 (C10-C16 Hydrocarbons)	2021/10/03	NC		%	30
				F3 (C16-C34 Hydrocarbons)	2021/10/03	NC		%	30
				F4 (C34-C50 Hydrocarbons)	2021/10/03	NC		%	30
A371010	ANE	Matrix Spike		Total Aluminum (Al)	2021/09/30		117	%	80 - 120
				Total Antimony (Sb)	2021/09/30		110	%	80 - 120
				Total Arsenic (As)	2021/09/30		102	%	80 - 120
				Total Barium (Ba)	2021/09/30		NC	%	80 - 120
				Total Beryllium (Be)	2021/09/30		99	%	80 - 120
				Total Bismuth (Bi)	2021/09/30		102	%	80 - 120
				Total Boron (B)	2021/09/30		105	%	80 - 120
				Total Cadmium (Cd)	2021/09/30		98	%	80 - 120
				Total Chromium (Cr)	2021/09/30		110	%	80 - 120
				Total Cobalt (Co)	2021/09/30		108	%	80 - 120
				Total Copper (Cu)	2021/09/30		107	%	80 - 120
				Total Iron (Fe)	2021/09/30		110	%	80 - 120
				Total Lead (Pb)	2021/09/30		101	%	80 - 120
				Total Lithium (Li)	2021/09/30		97	%	80 - 120
				Total Manganese (Mn)	2021/09/30		110	%	80 - 120
				Total Molybdenum (Mo)	2021/09/30		104	%	80 - 120
				Total Nickel (Ni)	2021/09/30		109	%	80 - 120
				Total Phosphorus (P)	2021/09/30		112	%	80 - 120
				Total Selenium (Se)	2021/09/30		98	%	80 - 120
				Total Silicon (Si)	2021/09/30		78 (1)	%	80 - 120
				Total Silver (Ag)	2021/09/30		98	%	80 - 120
				Total Strontium (Sr)	2021/09/30		NC	%	80 - 120
				Total Thallium (Tl)	2021/09/30		98	%	80 - 120
				Total Tin (Sn)	2021/09/30		101	%	80 - 120
				Total Titanium (Ti)	2021/09/30		121 (1)	%	80 - 120
				Total Uranium (U)	2021/09/30		103	%	80 - 120
				Total Vanadium (V)	2021/09/30		111	%	80 - 120
				Total Zinc (Zn)	2021/09/30		104	%	80 - 120
				Total Zirconium (Zr)	2021/09/30		110	%	80 - 120
A371010	ANE	Spiked Blank		Total Aluminum (Al)	2021/09/30		104	%	80 - 120
				Total Antimony (Sb)	2021/09/30		113	%	80 - 120
				Total Arsenic (As)	2021/09/30		104	%	80 - 120
				Total Barium (Ba)	2021/09/30		101	%	80 - 120
				Total Beryllium (Be)	2021/09/30		102	%	80 - 120
				Total Bismuth (Bi)	2021/09/30		105	%	80 - 120
				Total Boron (B)	2021/09/30		106	%	80 - 120
				Total Cadmium (Cd)	2021/09/30		100	%	80 - 120
				Total Chromium (Cr)	2021/09/30		113	%	80 - 120
				Total Cobalt (Co)	2021/09/30		112	%	80 - 120
				Total Copper (Cu)	2021/09/30		111	%	80 - 120
				Total Iron (Fe)	2021/09/30		109	%	80 - 120
				Total Lead (Pb)	2021/09/30		103	%	80 - 120
				Total Lithium (Li)	2021/09/30		99	%	80 - 120
				Total Manganese (Mn)	2021/09/30		112	%	80 - 120
				Total Molybdenum (Mo)	2021/09/30		103	%	80 - 120
				Total Nickel (Ni)	2021/09/30		113	%	80 - 120
				Total Phosphorus (P)	2021/09/30		111	%	80 - 120
				Total Selenium (Se)	2021/09/30		100	%	80 - 120
				Total Silicon (Si)	2021/09/30		76 (1)	%	80 - 120
				Total Silver (Ag)	2021/09/30		99	%	80 - 120





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371010	ANE	Method Blank	Total Strontium (Sr)	2021/09/30		109	%	80 - 120
			Total Thallium (Tl)	2021/09/30		101	%	80 - 120
			Total Tin (Sn)	2021/09/30		102	%	80 - 120
			Total Titanium (Ti)	2021/09/30		111	%	80 - 120
			Total Uranium (U)	2021/09/30		105	%	80 - 120
			Total Vanadium (V)	2021/09/30		112	%	80 - 120
			Total Zinc (Zn)	2021/09/30		121 (1)	%	80 - 120
			Total Zirconium (Zr)	2021/09/30		115	%	80 - 120
			Total Aluminum (Al)	2021/10/06	<3.0		ug/L	
			Total Antimony (Sb)	2021/10/06	<0.020		ug/L	
			Total Arsenic (As)	2021/10/06	<0.020		ug/L	
			Total Barium (Ba)	2021/10/06	0.159, RDL=0.050 (2)		ug/L	
			Total Beryllium (Be)	2021/10/06	<0.010		ug/L	
			Total Bismuth (Bi)	2021/10/06	<0.010		ug/L	
			Total Boron (B)	2021/10/06	19, RDL=10 (3)		ug/L	
			Total Cadmium (Cd)	2021/10/06	<0.0050		ug/L	
			Total Chromium (Cr)	2021/10/06	0.16, RDL=0.10 (3)		ug/L	
			Total Cobalt (Co)	2021/10/06	<0.010		ug/L	
			Total Copper (Cu)	2021/10/06	0.14, RDL=0.10 (3)		ug/L	
			Total Iron (Fe)	2021/10/06	5.6, RDL=5.0 (3)		ug/L	
			Total Lead (Pb)	2021/10/06	<0.020		ug/L	
			Total Lithium (Li)	2021/10/06	<0.50		ug/L	
			Total Manganese (Mn)	2021/10/06	<0.10		ug/L	
			Total Molybdenum (Mo)	2021/10/06	<0.050		ug/L	
			Total Nickel (Ni)	2021/10/06	0.12, RDL=0.10 (3)		ug/L	
			Total Phosphorus (P)	2021/10/06	<5.0		ug/L	
			Total Selenium (Se)	2021/10/06	<0.040		ug/L	
			Total Silicon (Si)	2021/10/06	<50		ug/L	
			Total Silver (Ag)	2021/10/06	<0.010		ug/L	
			Total Strontium (Sr)	2021/10/06	<0.050		ug/L	
			Total Thallium (Tl)	2021/10/06	<0.0020		ug/L	
			Total Tin (Sn)	2021/10/06	<0.20		ug/L	
			Total Titanium (Ti)	2021/10/06	<2.0		ug/L	
			Total Uranium (U)	2021/10/06	<0.0050		ug/L	
			Total Vanadium (V)	2021/10/06	<0.20		ug/L	
			Total Zinc (Zn)	2021/10/06	2.7, RDL=1.5 (3)		ug/L	
			Total Zirconium (Zr)	2021/10/06	<0.10		ug/L	
A371010	ANE	RPD	Total Aluminum (Al)	2021/10/06	3.3		%	20
			Total Antimony (Sb)	2021/10/06	8.3		%	20
			Total Arsenic (As)	2021/10/06	14		%	20
			Total Barium (Ba)	2021/10/06	2.6		%	20
			Total Beryllium (Be)	2021/10/06	3.5		%	20
			Total Bismuth (Bi)	2021/10/06	NC		%	20
			Total Boron (B)	2021/10/06	2.8		%	20
			Total Cadmium (Cd)	2021/10/06	NC		%	20
			Total Chromium (Cr)	2021/10/06	79 (1)		%	20
			Total Cobalt (Co)	2021/10/06	3.3		%	20
			Total Copper (Cu)	2021/10/06	7.1		%	20





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Iron (Fe)	2021/10/06	5.9		%	20
			Total Lead (Pb)	2021/10/06	NC		%	20
			Total Lithium (Li)	2021/10/06	0.69		%	20
			Total Manganese (Mn)	2021/10/06	3.5		%	20
			Total Molybdenum (Mo)	2021/10/06	2.8		%	20
			Total Nickel (Ni)	2021/10/06	71 (1)		%	20
			Total Selenium (Se)	2021/10/06	0.82		%	20
			Total Silicon (Si)	2021/10/06	2.4		%	20
			Total Silver (Ag)	2021/10/06	NC		%	20
			Total Strontium (Sr)	2021/10/06	7.9		%	20
			Total Thallium (Tl)	2021/10/06	2.4		%	20
			Total Tin (Sn)	2021/10/06	NC		%	20
			Total Titanium (Ti)	2021/10/06	NC		%	20
			Total Uranium (U)	2021/10/06	1.1		%	20
			Total Vanadium (V)	2021/10/06	0.091		%	20
			Total Zinc (Zn)	2021/10/06	16		%	20
			Total Zirconium (Zr)	2021/10/06	NC		%	20
A371036	KGR	Spiked Blank	Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30		104	%	80 - 120
A371036	KGR	Method Blank	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Carbonate (CO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Hydroxide (OH)	2021/09/30	<1.0		mg/L	
A371036	KGR	RPD	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	NC		%	20
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	3.8		%	20
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	3.8		%	20
			Carbonate (CO <sub>3</sub> )	2021/09/30	NC		%	20
			Hydroxide (OH)	2021/09/30	NC		%	20
A371043	KGR	Spiked Blank	pH	2021/09/30		101	%	97 - 103
A371043	KGR	RPD	pH	2021/09/30	1.7		%	N/A
A371045	KGR	Spiked Blank	Conductivity	2021/09/30		104	%	90 - 110
A371045	KGR	Method Blank	Conductivity	2021/09/30	<2.0		uS/cm	
A371045	KGR	RPD	Conductivity	2021/09/30	1.2		%	10
A371046	KGR	Matrix Spike	Dissolved Fluoride (F)	2021/09/30		103	%	80 - 120
A371046	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/09/30		98	%	80 - 120
A371046	KGR	Method Blank	Dissolved Fluoride (F)	2021/09/30	<0.050		mg/L	
A371046	KGR	RPD	Dissolved Fluoride (F)	2021/09/30	NC		%	20
A371050	KGR	Spiked Blank	pH	2021/09/30		101	%	97 - 103
A371050	KGR	RPD [AGW996-02]	pH	2021/09/30	2.1		%	N/A
A371052	KGR	Spiked Blank	Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30		97	%	80 - 120
A371052	KGR	Method Blank	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Carbonate (CO <sub>3</sub> )	2021/09/30	<1.0		mg/L	
			Hydroxide (OH)	2021/09/30	<1.0		mg/L	
A371052	KGR	RPD [AGW996-02]	Alkalinity (PP as CaCO <sub>3</sub> )	2021/09/30	NC		%	20
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/09/30	0.66		%	20
			Bicarbonate (HCO <sub>3</sub> )	2021/09/30	0.66		%	20
			Carbonate (CO <sub>3</sub> )	2021/09/30	NC		%	20
			Hydroxide (OH)	2021/09/30	NC		%	20
A371053	KGR	Spiked Blank	Conductivity	2021/09/30		104	%	90 - 110
A371053	KGR	Method Blank	Conductivity	2021/09/30	<2.0		uS/cm	
A371053	KGR	RPD [AGW996-02]	Conductivity	2021/09/30	0.35		%	10
A371054	KGR	Matrix Spike [AGW996-02]	Dissolved Fluoride (F)	2021/09/30		101	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371054	KGR		Spiked Blank	Dissolved Fluoride (F)	2021/09/30		99	%	80 - 120
A371054	KGR		Method Blank	Dissolved Fluoride (F)	2021/09/30	<0.050		mg/L	
A371054	KGR		RPD [AGW996-02]	Dissolved Fluoride (F)	2021/09/30	6.4		%	20
A371102	STI		Matrix Spike [AGX293-06]	Total Nitrogen (N)	2021/10/04		98	%	80 - 120
A371102	STI		QC Standard	Total Nitrogen (N)	2021/10/04		101	%	80 - 120
A371102	STI		Spiked Blank	Total Nitrogen (N)	2021/10/04		97	%	80 - 120
A371102	STI		Method Blank	Total Nitrogen (N)	2021/10/04	<0.020		mg/L	
A371102	STI		RPD [AGX293-06]	Total Nitrogen (N)	2021/10/04	NC		%	20
A371136	STI		Matrix Spike	Total Nitrogen (N)	2021/10/04		NC	%	80 - 120
A371136	STI		QC Standard	Total Nitrogen (N)	2021/10/04		98	%	80 - 120
A371136	STI		Spiked Blank	Total Nitrogen (N)	2021/10/04		95	%	80 - 120
A371136	STI		Method Blank	Total Nitrogen (N)	2021/10/04	<0.020		mg/L	
A371136	STI		RPD	Total Nitrogen (N)	2021/10/04	8.0		%	20
A371158	FM0		Matrix Spike	Total Nitrogen (N)	2021/10/05		NC	%	80 - 120
A371158	FM0		QC Standard	Total Nitrogen (N)	2021/10/05		100	%	80 - 120
A371158	FM0		Spiked Blank	Total Nitrogen (N)	2021/10/05		92	%	80 - 120
A371158	FM0		Method Blank	Total Nitrogen (N)	2021/10/05	<0.020		mg/L	
A371158	FM0		RPD	Total Nitrogen (N)	2021/10/05	7.9		%	20
A371232	KGR		Matrix Spike	Dissolved Fluoride (F)	2021/09/30		102	%	80 - 120
A371232	KGR		Spiked Blank	Dissolved Fluoride (F)	2021/09/30		97	%	80 - 120
A371232	KGR		Method Blank	Dissolved Fluoride (F)	2021/09/30	<0.050		mg/L	
A371232	KGR		RPD	Dissolved Fluoride (F)	2021/09/30	1.2		%	20
A371237	KGR		Spiked Blank	Alkalinity (Total as CaCO3)	2021/09/30		97	%	80 - 120
A371237	KGR		Method Blank	Alkalinity (PP as CaCO3)	2021/09/30	<1.0		mg/L	
				Alkalinity (Total as CaCO3)	2021/09/30	<1.0		mg/L	
				Bicarbonate (HCO3)	2021/09/30	<1.0		mg/L	
				Carbonate (CO3)	2021/09/30	<1.0		mg/L	
				Hydroxide (OH)	2021/09/30	<1.0		mg/L	
A371237	KGR		RPD	Alkalinity (PP as CaCO3)	2021/09/30	NC		%	20
				Alkalinity (Total as CaCO3)	2021/09/30	0.36		%	20
				Bicarbonate (HCO3)	2021/09/30	0.36		%	20
				Carbonate (CO3)	2021/09/30	NC		%	20
				Hydroxide (OH)	2021/09/30	NC		%	20
A371238	KGR		Spiked Blank	pH	2021/09/30		101	%	97 - 103
A371238	KGR		RPD	pH	2021/09/30	0.69		%	N/A
A371239	KGR		Spiked Blank	Conductivity	2021/09/30		102	%	90 - 110
A371239	KGR		Method Blank	Conductivity	2021/09/30	<2.0		uS/cm	
A371239	KGR		RPD	Conductivity	2021/09/30	0.32		%	10
A371324	JC8		Matrix Spike [AGX293-17]	Dissolved Mercury (Hg)	2021/09/30		96	%	70 - 130
A371324	JC8		Spiked Blank	Dissolved Mercury (Hg)	2021/09/30		96	%	70 - 130
A371324	JC8		Method Blank	Dissolved Mercury (Hg)	2021/09/30	<0.00010		ug/L	
A371324	JC8		RPD [AGX294-17]	Dissolved Mercury (Hg)	2021/09/30	10		%	20
A371386	RSU		Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/01		98	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		94	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		88	%	50 - 140
				Benzene	2021/10/01		68	%	50 - 140
				Toluene	2021/10/01		75	%	50 - 140
				Ethylbenzene	2021/10/01		81	%	50 - 140
				m & p-Xylene	2021/10/01		85	%	50 - 140
				o-Xylene	2021/10/01		85	%	50 - 140
				F1 (C6-C10)	2021/10/01		85	%	60 - 140
A371386	RSU		Spiked Blank	1,4-Difluorobenzene (sur.)	2021/10/01		105	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/01		100	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/01		86	%	50 - 140
				Benzene	2021/10/01		71	%	60 - 130





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371386	RSU	Method Blank	Toluene	2021/10/01		81	%	60 - 130	
			Ethylbenzene	2021/10/01		90	%	60 - 130	
			m & p-Xylene	2021/10/01		94	%	60 - 130	
			o-Xylene	2021/10/01		91	%	60 - 130	
			F1 (C6-C10)	2021/10/01		89	%	60 - 140	
			1,4-Difluorobenzene (sur.)	2021/10/01		92	%	50 - 140	
			4-Bromofluorobenzene (sur.)	2021/10/01		90	%	50 - 140	
			D4-1,2-Dichloroethane (sur.)	2021/10/01		86	%	50 - 140	
			Benzene	2021/10/01	<0.40		ug/L		
			Toluene	2021/10/01	<0.40		ug/L		
			Ethylbenzene	2021/10/01	<0.40		ug/L		
			m & p-Xylene	2021/10/01	<0.80		ug/L		
			o-Xylene	2021/10/01	<0.40		ug/L		
			F1 (C6-C10)	2021/10/01	<100		ug/L		
A371386	RSU	RPD	Benzene	2021/10/01	NC		%	30	
			Toluene	2021/10/01	NC		%	30	
			Ethylbenzene	2021/10/01	NC		%	30	
			m & p-Xylene	2021/10/01	NC		%	30	
			o-Xylene	2021/10/01	NC		%	30	
			F1 (C6-C10)	2021/10/01	NC		%	30	
A371398	QW1	Matrix Spike	1,4-Difluorobenzene (sur.)	2021/10/02		104	%	50 - 140	
			4-Bromofluorobenzene (sur.)	2021/10/02		104	%	50 - 140	
			D4-1,2-Dichloroethane (sur.)	2021/10/02		104	%	50 - 140	
			Bromodichloromethane	2021/10/02		102	%	50 - 140	
			Bromoform	2021/10/02		98	%	50 - 140	
			Bromomethane	2021/10/02		106	%	50 - 140	
			Carbon tetrachloride	2021/10/02		103	%	50 - 140	
			Chlorobenzene	2021/10/02		101	%	50 - 140	
			Dibromochloromethane	2021/10/02		105	%	50 - 140	
			Chloroethane	2021/10/02		91	%	50 - 140	
			Chloroform	2021/10/02		99	%	50 - 140	
			Chloromethane	2021/10/02		103	%	50 - 140	
			1,2-dibromoethane	2021/10/02		97	%	50 - 140	
			1,2-dichlorobenzene	2021/10/02		109	%	50 - 140	
			1,3-dichlorobenzene	2021/10/02		104	%	50 - 140	
			1,4-dichlorobenzene	2021/10/02		106	%	50 - 140	
			1,1-dichloroethane	2021/10/02		98	%	50 - 140	
			1,2-dichloroethane	2021/10/02		110	%	50 - 140	
			1,1-dichloroethene	2021/10/02		99	%	50 - 140	
			cis-1,2-dichloroethene	2021/10/02		103	%	50 - 140	
			trans-1,2-dichloroethene	2021/10/02		94	%	50 - 140	
			Dichloromethane	2021/10/02		96	%	50 - 140	
			1,2-dichloropropane	2021/10/02		108	%	50 - 140	
			cis-1,3-dichloropropene	2021/10/02		119	%	50 - 140	
			trans-1,3-dichloropropene	2021/10/02		126	%	50 - 140	
			Methyl methacrylate	2021/10/02		113	%	50 - 140	
			Methyl-tert-butylether (MTBE)	2021/10/02		106	%	50 - 140	
			Styrene	2021/10/02		95	%	50 - 140	
			1,1,1,2-tetrachloroethane	2021/10/02		98	%	50 - 140	
			1,1,2,2-tetrachloroethane	2021/10/02		104	%	50 - 140	
			Tetrachloroethene	2021/10/02		82	%	50 - 140	
			1,2,3-trichlorobenzene	2021/10/02		106	%	50 - 140	
			1,2,4-trichlorobenzene	2021/10/02		103	%	50 - 140	
			1,3,5-trichlorobenzene	2021/10/02		98	%	50 - 140	
			1,1,1-trichloroethane	2021/10/02		103	%	50 - 140	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A371398	QW1	Spiked Blank		1,1,2-trichloroethane	2021/10/02		107	%	50 - 140
				Trichloroethene	2021/10/02		106	%	50 - 140
				Trichlorofluoromethane	2021/10/02		105	%	50 - 140
				1,2,4-trimethylbenzene	2021/10/02		106	%	50 - 140
				1,3,5-trimethylbenzene	2021/10/02		109	%	50 - 140
				Vinyl chloride	2021/10/02		118	%	50 - 140
				1,4-Difluorobenzene (sur.)	2021/10/02		104	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/02		107	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/02		98	%	50 - 140
				Bromodichloromethane	2021/10/02		101	%	60 - 130
				Bromoform	2021/10/02		93	%	60 - 130
				Bromomethane	2021/10/02		97	%	60 - 130
				Carbon tetrachloride	2021/10/02		105	%	60 - 130
				Chlorobenzene	2021/10/02		99	%	60 - 130
				Dibromochloromethane	2021/10/02		102	%	60 - 130
				Chloroethane	2021/10/02		89	%	60 - 130
				Chloroform	2021/10/02		98	%	60 - 130
				Chloromethane	2021/10/02		106	%	60 - 130
				1,2-dibromoethane	2021/10/02		90	%	60 - 130
				1,2-dichlorobenzene	2021/10/02		108	%	60 - 130
				1,3-dichlorobenzene	2021/10/02		104	%	60 - 130
				1,4-dichlorobenzene	2021/10/02		105	%	60 - 130
				1,1-dichloroethane	2021/10/02		98	%	60 - 130
				1,2-dichloroethane	2021/10/02		106	%	60 - 130
				1,1-dichloroethene	2021/10/02		100	%	60 - 130
				cis-1,2-dichloroethene	2021/10/02		102	%	60 - 130
				trans-1,2-dichloroethene	2021/10/02		93	%	60 - 130
				Dichloromethane	2021/10/02		93	%	60 - 130
				1,2-dichloropropane	2021/10/02		104	%	60 - 130
				cis-1,3-dichloropropene	2021/10/02		105	%	60 - 130
				trans-1,3-dichloropropene	2021/10/02		105	%	60 - 130
				Methyl methacrylate	2021/10/02		103	%	60 - 130
				Methyl-tert-butylether (MTBE)	2021/10/02		103	%	60 - 130
				Styrene	2021/10/02		93	%	60 - 130
				1,1,1,2-tetrachloroethane	2021/10/02		95	%	60 - 130
				1,1,2,2-tetrachloroethane	2021/10/02		97	%	60 - 130
				Tetrachloroethene	2021/10/02		86	%	60 - 130
				1,2,3-trichlorobenzene	2021/10/02		97	%	60 - 130
				1,2,4-trichlorobenzene	2021/10/02		97	%	60 - 130
				1,3,5-trichlorobenzene	2021/10/02		94	%	60 - 130
				1,1,1-trichloroethane	2021/10/02		106	%	60 - 130
				1,1,2-trichloroethane	2021/10/02		101	%	60 - 130
				Trichloroethene	2021/10/02		107	%	60 - 130
				Trichlorofluoromethane	2021/10/02		106	%	60 - 130
				1,2,4-trimethylbenzene	2021/10/02		109	%	60 - 130
				1,3,5-trimethylbenzene	2021/10/02		113	%	60 - 130
				Vinyl chloride	2021/10/02		120	%	60 - 130
A371398	QW1	Method Blank		1,4-Difluorobenzene (sur.)	2021/10/02		96	%	50 - 140
				4-Bromofluorobenzene (sur.)	2021/10/02		99	%	50 - 140
				D4-1,2-Dichloroethane (sur.)	2021/10/02		108	%	50 - 140
				Bromodichloromethane	2021/10/02	<0.50		ug/L	
				Bromoform	2021/10/02	<0.50		ug/L	
				Bromomethane	2021/10/02	<2.0		ug/L	
				Carbon tetrachloride	2021/10/02	<0.50		ug/L	
				Chlorobenzene	2021/10/02	<0.50		ug/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dibromochloromethane	2021/10/02	<1.0		ug/L	
			Chloroethane	2021/10/02	<1.0		ug/L	
			Chloroform	2021/10/02	<0.50		ug/L	
			Chloromethane	2021/10/02	<2.0		ug/L	
			1,2-dibromoethane	2021/10/02	<0.20		ug/L	
			1,2-dichlorobenzene	2021/10/02	<0.50		ug/L	
			1,3-dichlorobenzene	2021/10/02	<0.50		ug/L	
			1,4-dichlorobenzene	2021/10/02	<0.50		ug/L	
			1,1-dichloroethane	2021/10/02	<0.50		ug/L	
			1,2-dichloroethane	2021/10/02	<0.50		ug/L	
			1,1-dichloroethene	2021/10/02	<0.50		ug/L	
			cis-1,2-dichloroethene	2021/10/02	<0.50		ug/L	
			trans-1,2-dichloroethene	2021/10/02	<0.50		ug/L	
			Dichloromethane	2021/10/02	<2.0		ug/L	
			1,2-dichloropropane	2021/10/02	<0.50		ug/L	
			cis-1,3-dichloropropene	2021/10/02	<0.50		ug/L	
			trans-1,3-dichloropropene	2021/10/02	<0.50		ug/L	
			Methyl methacrylate	2021/10/02	<0.50		ug/L	
			Methyl-tert-butylether (MTBE)	2021/10/02	<0.50		ug/L	
			Styrene	2021/10/02	<0.50		ug/L	
			1,1,1,2-tetrachloroethane	2021/10/02	<1.0		ug/L	
			1,1,2,2-tetrachloroethane	2021/10/02	<2.0		ug/L	
			Tetrachloroethene	2021/10/02	<0.50		ug/L	
			1,2,3-trichlorobenzene	2021/10/02	<1.0		ug/L	
			1,2,4-trichlorobenzene	2021/10/02	<1.0		ug/L	
			1,3,5-trichlorobenzene	2021/10/02	<0.50		ug/L	
			1,1,1-trichloroethane	2021/10/02	<0.50		ug/L	
			1,1,2-trichloroethane	2021/10/02	<0.50		ug/L	
			Trichloroethene	2021/10/02	<0.50		ug/L	
			Trichlorofluoromethane	2021/10/02	<0.50		ug/L	
			1,2,4-trimethylbenzene	2021/10/02	<0.50		ug/L	
			1,3,5-trimethylbenzene	2021/10/02	<0.50		ug/L	
			Vinyl chloride	2021/10/02	<0.50		ug/L	
A371398	QW1	RPD	1,1-dichloroethene	2021/10/02	NC		%	30
			cis-1,2-dichloroethene	2021/10/02	0		%	30
			trans-1,2-dichloroethene	2021/10/02	4.8		%	30
			Tetrachloroethene	2021/10/02	0.89		%	30
			Trichloroethene	2021/10/02	1.4		%	30
			Vinyl chloride	2021/10/02	NC		%	30
A371757	JC8	Matrix Spike [AGW993-16]	Total Mercury (Hg)	2021/09/30		89	%	70 - 130
A371757	JC8	Spiked Blank	Total Mercury (Hg)	2021/09/30		102	%	70 - 130
A371757	JC8	Method Blank	Total Mercury (Hg)	2021/09/30	<0.00010		ug/L	
A371757	JC8	RPD [AGW993-16]	Total Mercury (Hg)	2021/09/30	6.8		%	20
A372069	AP1	Matrix Spike	Total Dissolved Solids	2021/10/01		96	%	80 - 120
A372069	AP1	Spiked Blank	Total Dissolved Solids	2021/10/01		98	%	80 - 120
A372069	AP1	Method Blank	Total Dissolved Solids	2021/10/01	<10		mg/L	
A372069	AP1	RPD	Total Dissolved Solids	2021/10/01	1.1		%	20
A372083	AP1	Matrix Spike	Total Suspended Solids	2021/10/01		96	%	80 - 120
A372083	AP1	Spiked Blank	Total Suspended Solids	2021/10/01		90	%	80 - 120
A372083	AP1	Method Blank	Total Suspended Solids	2021/10/01	<1.0		mg/L	
A372083	AP1	RPD	Total Suspended Solids	2021/10/01	2.2		%	20
A372084	QNG	Matrix Spike	Total Suspended Solids	2021/10/01		98	%	80 - 120
A372084	QNG	Spiked Blank	Total Suspended Solids	2021/10/01		91	%	80 - 120
A372084	QNG	Method Blank	Total Suspended Solids	2021/10/01	<1.0		mg/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A372084	QNG	RPD	Total Suspended Solids	2021/10/01	3.3		%	20
A372365	ZWU	Matrix Spike	Total Organic Carbon (C)	2021/10/01		NC	%	80 - 120
A372365	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/10/01		104	%	80 - 120
A372365	ZWU	Method Blank	Total Organic Carbon (C)	2021/10/01	<0.50		mg/L	
A372365	ZWU	RPD	Total Organic Carbon (C)	2021/10/01	5.7		%	20
A372370	ZWU	Matrix Spike	Dissolved Organic Carbon (C)	2021/10/02		NC	%	80 - 120
A372370	ZWU	Spiked Blank	Dissolved Organic Carbon (C)	2021/10/02		100	%	80 - 120
A372370	ZWU	Method Blank	Dissolved Organic Carbon (C)	2021/10/02	<0.50		mg/L	
A372370	ZWU	RPD	Dissolved Organic Carbon (C)	2021/10/02	3.6		%	20
A372544	FM0	Matrix Spike	Total Phosphorus (P)	2021/10/01		97	%	80 - 120
A372544	FM0	QC Standard	Total Phosphorus (P)	2021/10/01		93	%	80 - 120
A372544	FM0	Spiked Blank	Total Phosphorus (P)	2021/10/01		96	%	80 - 120
A372544	FM0	Method Blank	Total Phosphorus (P)	2021/10/01	0.0014, RDL=0.0010 (3)		mg/L	
A372544	FM0	RPD	Total Phosphorus (P)	2021/10/01	NC		%	20
A372554	FM0	Matrix Spike	Total Phosphorus (P)	2021/10/01		91	%	80 - 120
A372554	FM0	QC Standard	Total Phosphorus (P)	2021/10/01		92	%	80 - 120
A372554	FM0	Spiked Blank	Total Phosphorus (P)	2021/10/01		94	%	80 - 120
A372554	FM0	Method Blank	Total Phosphorus (P)	2021/10/01	<0.0010		mg/L	
A372554	FM0	RPD	Total Phosphorus (P)	2021/10/01	NC		%	20
A372555	FM0	Matrix Spike	Dissolved Phosphorus (P)	2021/10/01		103	%	80 - 120
A372555	FM0	QC Standard	Dissolved Phosphorus (P)	2021/10/01		84	%	80 - 120
A372555	FM0	Spiked Blank	Dissolved Phosphorus (P)	2021/10/01		96	%	80 - 120
A372555	FM0	Method Blank	Dissolved Phosphorus (P)	2021/10/01	<0.0010		mg/L	
A372555	FM0	RPD	Dissolved Phosphorus (P)	2021/10/01	NC		%	20
A372557	FM0	Matrix Spike [AGX000-08]	Dissolved Phosphorus (P)	2021/10/04		95	%	80 - 120
A372557	FM0	QC Standard	Dissolved Phosphorus (P)	2021/10/02		92	%	80 - 120
A372557	FM0	Spiked Blank	Dissolved Phosphorus (P)	2021/10/02		97	%	80 - 120
A372557	FM0	Method Blank	Dissolved Phosphorus (P)	2021/10/02	0.0017, RDL=0.0010 (3)		mg/L	
A372557	FM0	RPD [AGX000-08]	Dissolved Phosphorus (P)	2021/10/04	NC		%	20
A373002	KGR	Matrix Spike	Dissolved Fluoride (F)	2021/10/02		101	%	80 - 120
A373002	KGR	Spiked Blank	Dissolved Fluoride (F)	2021/10/02		100	%	80 - 120
A373002	KGR	Method Blank	Dissolved Fluoride (F)	2021/10/02	<0.050		mg/L	
A373002	KGR	RPD	Dissolved Fluoride (F)	2021/10/02	NC		%	20
A373005	KGR	Spiked Blank	pH	2021/10/02		100	%	97 - 103
A373005	KGR	RPD	pH	2021/10/02	1.6		%	N/A
A373006	KGR	Spiked Blank	Alkalinity (Total as CaCO3)	2021/10/02		101	%	80 - 120
A373006	KGR	Method Blank	Alkalinity (PP as CaCO3)	2021/10/02	<1.0		mg/L	
			Alkalinity (Total as CaCO3)	2021/10/02	<1.0		mg/L	
			Bicarbonate (HCO3)	2021/10/02	<1.0		mg/L	
			Carbonate (CO3)	2021/10/02	<1.0		mg/L	
			Hydroxide (OH)	2021/10/02	<1.0		mg/L	
A373006	KGR	RPD	Alkalinity (PP as CaCO3)	2021/10/02	NC		%	20
			Alkalinity (Total as CaCO3)	2021/10/02	NC		%	20
			Bicarbonate (HCO3)	2021/10/02	NC		%	20
			Carbonate (CO3)	2021/10/02	NC		%	20
			Hydroxide (OH)	2021/10/02	NC		%	20
A373007	KGR	Spiked Blank	Conductivity	2021/10/02		104	%	90 - 110
A373007	KGR	Method Blank	Conductivity	2021/10/02	<2.0		uS/cm	
A373007	KGR	RPD	Conductivity	2021/10/02	0.17		%	10
A373099	ZWU	Matrix Spike	Total Inorganic Carbon (C)	2021/10/03		NC	%	80 - 120
A373099	ZWU	Spiked Blank	Total Inorganic Carbon (C)	2021/10/03		102	%	80 - 120
A373099	ZWU	Method Blank	Total Inorganic Carbon (C)	2021/10/03	<1.0		mg/L	
A373099	ZWU	RPD	Total Inorganic Carbon (C)	2021/10/03	2.5		%	20





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A373642	BYM		Matrix Spike	Chemical Oxygen Demand	2021/10/02		92	%	80 - 120
A373642	BYM		Spiked Blank	Chemical Oxygen Demand	2021/10/02		101	%	80 - 120
A373642	BYM		Method Blank	Chemical Oxygen Demand	2021/10/02	<10		mg/L	
A373642	BYM		RPD	Chemical Oxygen Demand	2021/10/02	14		%	20
A373740	STI		Matrix Spike [AGW996-06]	Total Phosphorus (P)	2021/10/06		99	%	80 - 120
A373740	STI		QC Standard	Total Phosphorus (P)	2021/10/04		90	%	N/A
A373740	STI		Spiked Blank	Total Phosphorus (P)	2021/10/04		100	%	80 - 120
A373740	STI		Method Blank	Total Phosphorus (P)	2021/10/04	<0.0010		mg/L	
A373740	STI		RPD [AGW996-06]	Total Phosphorus (P)	2021/10/06	1.8		%	20
A373745	FM0		Matrix Spike [AGW998-06]	Total Phosphorus (P)	2021/10/06		89	%	80 - 120
A373745	FM0		QC Standard	Total Phosphorus (P)	2021/10/06		88	%	80 - 120
A373745	FM0		Spiked Blank	Total Phosphorus (P)	2021/10/06		90	%	80 - 120
A373745	FM0		Method Blank	Total Phosphorus (P)	2021/10/06	<0.0010		mg/L	
A373745	FM0		RPD [AGW998-06]	Total Phosphorus (P)	2021/10/06	9.6		%	20
A373819	JFH		Matrix Spike [AGW999-19]	Total Ammonia (N)	2021/10/03		107	%	80 - 120
A373819	JFH		Spiked Blank	Total Ammonia (N)	2021/10/03		102	%	80 - 120
A373819	JFH		Method Blank	Total Ammonia (N)	2021/10/03	<0.015		mg/L	
A373819	JFH		RPD [AGW999-19]	Total Ammonia (N)	2021/10/03	NC		%	20
A374080	JC7		Spiked Blank	2,3,4-trichlorophenol	2021/10/03		100	%	50 - 140
				2,4,6-TRIBROMOPHENOL (sur.)	2021/10/03		111	%	50 - 140
				2,4-DIBROMOPHENOL (sur.)	2021/10/03		107	%	50 - 140
				Phenol	2021/10/03		48	%	30 - 130
				3 & 4-chlorophenol	2021/10/03		90	%	50 - 140
				2,3,5,6-tetrachlorophenol	2021/10/03		92	%	50 - 140
				2,3,4,6-tetrachlorophenol	2021/10/03		104	%	50 - 140
				2,4,5-trichlorophenol	2021/10/03		104	%	50 - 140
				2,4,6-trichlorophenol	2021/10/03		104	%	50 - 140
				2,3,5-trichlorophenol	2021/10/03		92	%	50 - 140
				2,4-dichlorophenol	2021/10/03		96	%	50 - 140
				2,4-dimethylphenol	2021/10/03		88	%	50 - 140
				2,4-dinitrophenol	2021/10/03		80	%	30 - 130
				2,6-dichlorophenol	2021/10/03		104	%	50 - 140
				2-chlorophenol	2021/10/03		84	%	50 - 140
				2-methylphenol	2021/10/03		72	%	50 - 140
				2-nitrophenol	2021/10/03		76	%	50 - 140
				3 & 4-methylphenol	2021/10/03		72	%	50 - 140
				4,6-dinitro-2-methylphenol	2021/10/03		84	%	30 - 130
				4-chloro-3-methylphenol	2021/10/03		88	%	50 - 140
				4-nitrophenol	2021/10/03		44 (1)	%	50 - 140
				Pentachlorophenol	2021/10/03		76	%	50 - 140
A374080	JC7		Method Blank	2,3,4-trichlorophenol	2021/10/03	<0.00010		mg/L	
				2,4,6-TRIBROMOPHENOL (sur.)	2021/10/03		116	%	50 - 140
				2,4-DIBROMOPHENOL (sur.)	2021/10/03		112	%	50 - 140
				Phenol	2021/10/03	<0.00010		mg/L	
				3 & 4-chlorophenol	2021/10/03	<0.00010		mg/L	
				2,3,5,6-tetrachlorophenol	2021/10/03	<0.00010		mg/L	
				2,3,4,6-tetrachlorophenol	2021/10/03	<0.00010		mg/L	
				2,4,5-trichlorophenol	2021/10/03	<0.00010		mg/L	
				2,4,6-trichlorophenol	2021/10/03	<0.00010		mg/L	
				2,3,5-trichlorophenol	2021/10/03	<0.00010		mg/L	
				2,4-dichlorophenol	2021/10/03	<0.00010		mg/L	
				2,4-dimethylphenol	2021/10/03	<0.00010		mg/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			2,4-dinitrophenol	2021/10/03	<0.0010		mg/L	
			2,6-dichlorophenol	2021/10/03	<0.00010		mg/L	
			2-chlorophenol	2021/10/03	<0.00010		mg/L	
			2-methylphenol	2021/10/03	<0.00010		mg/L	
			2-nitrophenol	2021/10/03	<0.0010		mg/L	
			3 & 4-methylphenol	2021/10/03	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/10/03	<0.0010		mg/L	
			4-chloro-3-methylphenol	2021/10/03	<0.00010		mg/L	
			4-nitrophenol	2021/10/03	<0.0010		mg/L	
			Pentachlorophenol	2021/10/03	<0.00010		mg/L	
A375452	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		99	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		99	%	80 - 120
A375452	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		100	%	80 - 120
A375452	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375452	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	NC		%	20
			Dissolved Sulphate (SO4)	2021/10/05	NC		%	20
A375463	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		112	%	80 - 120
A375463	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		103	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		101	%	80 - 120
A375463	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375463	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	2.6		%	20
			Dissolved Sulphate (SO4)	2021/10/05	3.9		%	20
A375470	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		93	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		101	%	80 - 120
A375470	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		100	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		100	%	80 - 120
A375470	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375470	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	4.1		%	20
			Dissolved Sulphate (SO4)	2021/10/05	NC		%	20
A375682	STI	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		NC	%	80 - 120
A375682	STI	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
			Dissolved Sulphate (SO4)	2021/10/05		96	%	80 - 120
A375682	STI	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2021/10/05	<1.0		mg/L	
A375682	STI	RPD	Dissolved Chloride (Cl)	2021/10/05	2.1		%	20
			Dissolved Sulphate (SO4)	2021/10/05	2.1		%	20
A375833	SJ1	Spiked Blank	2,3,4-trichlorophenol	2021/10/05		92	%	50 - 140
			2,4,6-TRIBROMOPHENOL (sur.)	2021/10/05		103	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/10/05		94	%	50 - 140
			Phenol	2021/10/05		60	%	30 - 130
			3 & 4-chlorophenol	2021/10/05		94	%	50 - 140
			2,3,5,6-tetrachlorophenol	2021/10/05		96	%	50 - 140
			2,3,4,6-tetrachlorophenol	2021/10/05		108	%	50 - 140
			2,4,5-trichlorophenol	2021/10/05		92	%	50 - 140
			2,4,6-trichlorophenol	2021/10/05		100	%	50 - 140
			2,3,5-trichlorophenol	2021/10/05		92	%	50 - 140
			2,4-dichlorophenol	2021/10/05		96	%	50 - 140
			2,4-dimethylphenol	2021/10/05		100	%	50 - 140
			2,4-dinitrophenol	2021/10/05		92	%	30 - 130





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A375833	SJ1	Method Blank	2,6-dichlorophenol	2021/10/05		100	%	50 - 140
			2-chlorophenol	2021/10/05		100	%	50 - 140
			2-methylphenol	2021/10/05		92	%	50 - 140
			2-nitrophenol	2021/10/05		88	%	50 - 140
			3 & 4-methylphenol	2021/10/05		90	%	50 - 140
			4,6-dinitro-2-methylphenol	2021/10/05		96	%	30 - 130
			4-chloro-3-methylphenol	2021/10/05		96	%	50 - 140
			4-nitrophenol	2021/10/05		64	%	50 - 140
			Pentachlorophenol	2021/10/05		72	%	50 - 140
			2,3,4-trichlorophenol	2021/10/05	<0.00010		mg/L	
			2,4,6-TRIBROMOPHENOL (sur.)	2021/10/05		88	%	50 - 140
			2,4-DIBROMOPHENOL (sur.)	2021/10/05		91	%	50 - 140
			Phenol	2021/10/05	<0.00010		mg/L	
			3 & 4-chlorophenol	2021/10/05	<0.00010		mg/L	
			2,3,5,6-tetrachlorophenol	2021/10/05	<0.00010		mg/L	
			2,3,4,6-tetrachlorophenol	2021/10/05	<0.00010		mg/L	
			2,4,5-trichlorophenol	2021/10/05	<0.00010		mg/L	
			2,4,6-trichlorophenol	2021/10/05	<0.00010		mg/L	
			2,3,5-trichlorophenol	2021/10/05	<0.00010		mg/L	
			2,4-dichlorophenol	2021/10/05	<0.00010		mg/L	
			2,4-dimethylphenol	2021/10/05	<0.00010		mg/L	
			2,4-dinitrophenol	2021/10/05	<0.0010		mg/L	
			2,6-dichlorophenol	2021/10/05	<0.00010		mg/L	
			2-chlorophenol	2021/10/05	<0.00010		mg/L	
			2-methylphenol	2021/10/05	<0.00010		mg/L	
			2-nitrophenol	2021/10/05	<0.0010		mg/L	
			3 & 4-methylphenol	2021/10/05	<0.00010		mg/L	
			4,6-dinitro-2-methylphenol	2021/10/05	<0.0010		mg/L	
			4-chloro-3-methylphenol	2021/10/05	<0.00010		mg/L	
			4-nitrophenol	2021/10/05	<0.0010		mg/L	
			Pentachlorophenol	2021/10/05	<0.00010		mg/L	
A376285	BFE	Matrix Spike	Dissolved Chloride (Cl)	2021/10/05		NC	%	80 - 120
A376285	BFE	Spiked Blank	Dissolved Chloride (Cl)	2021/10/05		104	%	80 - 120
A376285	BFE	Method Blank	Dissolved Chloride (Cl)	2021/10/05	<1.0		mg/L	
A376285	BFE	RPD	Dissolved Chloride (Cl)	2021/10/05	0.64		%	20
A376671	ANE	Matrix Spike	Dissolved Aluminum (Al)	2021/10/07		105	%	80 - 120
			Dissolved Antimony (Sb)	2021/10/07		106	%	80 - 120
			Dissolved Arsenic (As)	2021/10/07		105	%	80 - 120
			Dissolved Barium (Ba)	2021/10/07		NC	%	80 - 120
			Dissolved Beryllium (Be)	2021/10/07		87	%	80 - 120
			Dissolved Bismuth (Bi)	2021/10/07		102	%	80 - 120
			Dissolved Boron (B)	2021/10/07		97	%	80 - 120
			Dissolved Cadmium (Cd)	2021/10/07		99	%	80 - 120
			Dissolved Chromium (Cr)	2021/10/07		120	%	80 - 120
			Dissolved Cobalt (Co)	2021/10/07		116	%	80 - 120
			Dissolved Copper (Cu)	2021/10/07		116	%	80 - 120
			Dissolved Iron (Fe)	2021/10/07		105	%	80 - 120
			Dissolved Lead (Pb)	2021/10/07		102	%	80 - 120
			Dissolved Lithium (Li)	2021/10/07		94	%	80 - 120
			Dissolved Manganese (Mn)	2021/10/07		111	%	80 - 120
			Dissolved Molybdenum (Mo)	2021/10/07		105	%	80 - 120
			Dissolved Nickel (Ni)	2021/10/07		118	%	80 - 120
			Dissolved Selenium (Se)	2021/10/07		101	%	80 - 120
			Dissolved Silicon (Si)	2021/10/07		75 (1)	%	80 - 120
			Dissolved Silver (Ag)	2021/10/07		98	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376671	ANE	Spiked Blank		Dissolved Strontium (Sr)	2021/10/07		NC	%	80 - 120
				Dissolved Thallium (Tl)	2021/10/07		99	%	80 - 120
				Dissolved Tin (Sn)	2021/10/07		101	%	80 - 120
				Dissolved Titanium (Ti)	2021/10/07		117	%	80 - 120
				Dissolved Uranium (U)	2021/10/07		107	%	80 - 120
				Dissolved Vanadium (V)	2021/10/07		116	%	80 - 120
				Dissolved Zinc (Zn)	2021/10/07		96	%	80 - 120
				Dissolved Zirconium (Zr)	2021/10/07		113	%	80 - 120
				Dissolved Aluminum (Al)	2021/10/07		105	%	80 - 120
				Dissolved Antimony (Sb)	2021/10/07		104	%	80 - 120
				Dissolved Arsenic (As)	2021/10/07		101	%	80 - 120
				Dissolved Barium (Ba)	2021/10/07		99	%	80 - 120
				Dissolved Beryllium (Be)	2021/10/07		92	%	80 - 120
				Dissolved Bismuth (Bi)	2021/10/07		104	%	80 - 120
				Dissolved Boron (B)	2021/10/07		100	%	80 - 120
				Dissolved Cadmium (Cd)	2021/10/07		102	%	80 - 120
				Dissolved Chromium (Cr)	2021/10/07		112	%	80 - 120
				Dissolved Cobalt (Co)	2021/10/07		110	%	80 - 120
				Dissolved Copper (Cu)	2021/10/07		110	%	80 - 120
				Dissolved Iron (Fe)	2021/10/07		105	%	80 - 120
				Dissolved Lead (Pb)	2021/10/07		103	%	80 - 120
				Dissolved Lithium (Li)	2021/10/07		94	%	80 - 120
				Dissolved Manganese (Mn)	2021/10/07		106	%	80 - 120
				Dissolved Molybdenum (Mo)	2021/10/07		104	%	80 - 120
				Dissolved Nickel (Ni)	2021/10/07		113	%	80 - 120
				Dissolved Selenium (Se)	2021/10/07		97	%	80 - 120
				Dissolved Silicon (Si)	2021/10/07		74 (1)	%	80 - 120
				Dissolved Silver (Ag)	2021/10/07		100	%	80 - 120
				Dissolved Strontium (Sr)	2021/10/07		99	%	80 - 120
				Dissolved Thallium (Tl)	2021/10/07		99	%	80 - 120
				Dissolved Tin (Sn)	2021/10/07		100	%	80 - 120
				Dissolved Titanium (Ti)	2021/10/07		108	%	80 - 120
				Dissolved Uranium (U)	2021/10/07		105	%	80 - 120
				Dissolved Vanadium (V)	2021/10/07		108	%	80 - 120
				Dissolved Zinc (Zn)	2021/10/07		109	%	80 - 120
				Dissolved Zirconium (Zr)	2021/10/07		104	%	80 - 120
A376671	ANE	Method Blank		Dissolved Aluminum (Al)	2021/10/07	<0.50		ug/L	
				Dissolved Antimony (Sb)	2021/10/07	<0.020		ug/L	
				Dissolved Arsenic (As)	2021/10/07	<0.020		ug/L	
				Dissolved Barium (Ba)	2021/10/07	<0.020		ug/L	
				Dissolved Beryllium (Be)	2021/10/07	<0.010		ug/L	
				Dissolved Bismuth (Bi)	2021/10/07	<0.0050		ug/L	
				Dissolved Boron (B)	2021/10/07	<10		ug/L	
				Dissolved Cadmium (Cd)	2021/10/07	<0.0050		ug/L	
				Dissolved Chromium (Cr)	2021/10/07	<0.10		ug/L	
				Dissolved Cobalt (Co)	2021/10/07	<0.0050		ug/L	
				Dissolved Copper (Cu)	2021/10/07	<0.050		ug/L	
				Dissolved Iron (Fe)	2021/10/07	<1.0		ug/L	
				Dissolved Lead (Pb)	2021/10/07	<0.0050		ug/L	
				Dissolved Lithium (Li)	2021/10/07	<0.50		ug/L	
				Dissolved Manganese (Mn)	2021/10/07	<0.050		ug/L	
				Dissolved Molybdenum (Mo)	2021/10/07	<0.050		ug/L	
				Dissolved Nickel (Ni)	2021/10/07	<0.020		ug/L	
				Dissolved Selenium (Se)	2021/10/07	<0.040		ug/L	
				Dissolved Silicon (Si)	2021/10/07	<50		ug/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376671	ANE	RPD		Dissolved Silver (Ag)	2021/10/07	<0.0050		ug/L	
				Dissolved Strontium (Sr)	2021/10/07	<0.050		ug/L	
				Dissolved Thallium (Tl)	2021/10/07	<0.0020		ug/L	
				Dissolved Tin (Sn)	2021/10/07	<0.20		ug/L	
				Dissolved Titanium (Ti)	2021/10/07	<0.50		ug/L	
				Dissolved Uranium (U)	2021/10/07	<0.0020		ug/L	
				Dissolved Vanadium (V)	2021/10/07	<0.20		ug/L	
				Dissolved Zinc (Zn)	2021/10/07	<0.10		ug/L	
				Dissolved Zirconium (Zr)	2021/10/07	<0.10		ug/L	
				Dissolved Aluminum (Al)	2021/10/07	2.4		%	20
				Dissolved Antimony (Sb)	2021/10/07	NC		%	20
				Dissolved Arsenic (As)	2021/10/07	NC		%	20
				Dissolved Barium (Ba)	2021/10/07	0.67		%	20
				Dissolved Beryllium (Be)	2021/10/07	NC		%	20
				Dissolved Bismuth (Bi)	2021/10/07	NC		%	20
				Dissolved Boron (B)	2021/10/07	NC		%	20
				Dissolved Cadmium (Cd)	2021/10/07	NC		%	20
				Dissolved Chromium (Cr)	2021/10/07	NC		%	20
				Dissolved Cobalt (Co)	2021/10/07	5.3		%	20
				Dissolved Copper (Cu)	2021/10/07	NC		%	20
				Dissolved Lead (Pb)	2021/10/07	NC		%	20
				Dissolved Lithium (Li)	2021/10/07	3.5		%	20
				Dissolved Manganese (Mn)	2021/10/07	4.8		%	20
				Dissolved Molybdenum (Mo)	2021/10/07	3.0		%	20
				Dissolved Nickel (Ni)	2021/10/07	1.9		%	20
				Dissolved Selenium (Se)	2021/10/07	1.8		%	20
				Dissolved Silicon (Si)	2021/10/07	1.4		%	20
				Dissolved Silver (Ag)	2021/10/07	NC		%	20
				Dissolved Strontium (Sr)	2021/10/07	2.6		%	20
				Dissolved Thallium (Tl)	2021/10/07	NC		%	20
				Dissolved Tin (Sn)	2021/10/07	NC		%	20
				Dissolved Titanium (Ti)	2021/10/07	NC		%	20
				Dissolved Uranium (U)	2021/10/07	6.4		%	20
				Dissolved Vanadium (V)	2021/10/07	NC		%	20
				Dissolved Zinc (Zn)	2021/10/07	52 (1)		%	20
				Dissolved Zirconium (Zr)	2021/10/07	NC		%	20
A376677	ANE	Matrix Spike [AGW995-10]		Total Aluminum (Al)	2021/10/07		102	%	80 - 120
				Total Antimony (Sb)	2021/10/07		101	%	80 - 120
				Total Arsenic (As)	2021/10/07		102	%	80 - 120
				Total Barium (Ba)	2021/10/07		96	%	80 - 120
				Total Beryllium (Be)	2021/10/07		80	%	80 - 120
				Total Bismuth (Bi)	2021/10/07		92	%	80 - 120
				Total Boron (B)	2021/10/07		NC	%	80 - 120
				Total Cadmium (Cd)	2021/10/07		92	%	80 - 120
				Total Chromium (Cr)	2021/10/07		111	%	80 - 120
				Total Cobalt (Co)	2021/10/07		106	%	80 - 120
				Total Copper (Cu)	2021/10/07		102	%	80 - 120
				Total Iron (Fe)	2021/10/07		95	%	80 - 120
				Total Lead (Pb)	2021/10/07		94	%	80 - 120
				Total Lithium (Li)	2021/10/07		88	%	80 - 120
				Total Manganese (Mn)	2021/10/07		101	%	80 - 120
				Total Molybdenum (Mo)	2021/10/07		NC	%	80 - 120
				Total Nickel (Ni)	2021/10/07		105	%	80 - 120
				Total Selenium (Se)	2021/10/07		94	%	80 - 120





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376677	ANE	Spiked Blank	Total Silicon (Si)	2021/10/07		75 (1)	%	80 - 120
			Total Silver (Ag)	2021/10/07		94	%	80 - 120
			Total Strontium (Sr)	2021/10/07		NC	%	80 - 120
			Total Thallium (Tl)	2021/10/07		92	%	80 - 120
			Total Tin (Sn)	2021/10/07		99	%	80 - 120
			Total Titanium (Ti)	2021/10/07		116	%	80 - 120
			Total Uranium (U)	2021/10/07		99	%	80 - 120
			Total Vanadium (V)	2021/10/07		NC	%	80 - 120
			Total Zinc (Zn)	2021/10/07		96	%	80 - 120
			Total Zirconium (Zr)	2021/10/07		118	%	80 - 120
			Total Aluminum (Al)	2021/10/07		102	%	80 - 120
			Total Antimony (Sb)	2021/10/07		106	%	80 - 120
			Total Arsenic (As)	2021/10/07		98	%	80 - 120
			Total Barium (Ba)	2021/10/07		98	%	80 - 120
			Total Beryllium (Be)	2021/10/07		82	%	80 - 120
			Total Bismuth (Bi)	2021/10/07		99	%	80 - 120
			Total Boron (B)	2021/10/07		98	%	80 - 120
			Total Cadmium (Cd)	2021/10/07		99	%	80 - 120
			Total Chromium (Cr)	2021/10/07		113	%	80 - 120
			Total Cobalt (Co)	2021/10/07		110	%	80 - 120
			Total Copper (Cu)	2021/10/07		111	%	80 - 120
			Total Iron (Fe)	2021/10/07		101	%	80 - 120
			Total Lead (Pb)	2021/10/07		99	%	80 - 120
			Total Lithium (Li)	2021/10/07		87	%	80 - 120
			Total Manganese (Mn)	2021/10/07		104	%	80 - 120
			Total Molybdenum (Mo)	2021/10/07		103	%	80 - 120
			Total Nickel (Ni)	2021/10/07		112	%	80 - 120
			Total Selenium (Se)	2021/10/07		95	%	80 - 120
			Total Silicon (Si)	2021/10/07		71 (1)	%	80 - 120
			Total Silver (Ag)	2021/10/07		98	%	80 - 120
			Total Strontium (Sr)	2021/10/07		96	%	80 - 120
			Total Thallium (Tl)	2021/10/07		96	%	80 - 120
			Total Tin (Sn)	2021/10/07		99	%	80 - 120
			Total Titanium (Ti)	2021/10/07		106	%	80 - 120
			Total Uranium (U)	2021/10/07		101	%	80 - 120
			Total Vanadium (V)	2021/10/07		108	%	80 - 120
			Total Zinc (Zn)	2021/10/07		121 (1)	%	80 - 120
			Total Zirconium (Zr)	2021/10/07		105	%	80 - 120
A376677	ANE	Method Blank	Total Aluminum (Al)	2021/10/08	0.68, RDL=0.50 (4)		ug/L	
			Total Antimony (Sb)	2021/10/08	<0.020		ug/L	
			Total Arsenic (As)	2021/10/08	<0.020		ug/L	
			Total Barium (Ba)	2021/10/08	<0.020		ug/L	
			Total Beryllium (Be)	2021/10/08	<0.010		ug/L	
			Total Bismuth (Bi)	2021/10/08	<0.0050		ug/L	
			Total Boron (B)	2021/10/08	<10		ug/L	
			Total Cadmium (Cd)	2021/10/08	<0.0050		ug/L	
			Total Chromium (Cr)	2021/10/08	<0.10		ug/L	
			Total Cobalt (Co)	2021/10/08	<0.0050		ug/L	
			Total Copper (Cu)	2021/10/08	<0.050		ug/L	
			Total Iron (Fe)	2021/10/08	<1.0		ug/L	
			Total Lead (Pb)	2021/10/08	<0.0050		ug/L	
			Total Lithium (Li)	2021/10/08	<0.50		ug/L	
			Total Manganese (Mn)	2021/10/08	<0.050		ug/L	
			Total Molybdenum (Mo)	2021/10/08	<0.050		ug/L	





## QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A376677	ANE	RPD [AGW995-10]	Total Nickel (Ni)	2021/10/08	<0.020		ug/L	
			Total Selenium (Se)	2021/10/08	<0.040		ug/L	
			Total Silicon (Si)	2021/10/08	<50		ug/L	
			Total Silver (Ag)	2021/10/08	<0.0050		ug/L	
			Total Strontium (Sr)	2021/10/08	<0.050		ug/L	
			Total Thallium (Tl)	2021/10/08	<0.0020		ug/L	
			Total Tin (Sn)	2021/10/08	<0.20		ug/L	
			Total Titanium (Ti)	2021/10/08	<0.50		ug/L	
			Total Uranium (U)	2021/10/08	<0.0020		ug/L	
			Total Vanadium (V)	2021/10/08	<0.20		ug/L	
			Total Zinc (Zn)	2021/10/08	0.64, RDL=0.10		ug/L	
			Total Zirconium (Zr)	2021/10/08	<0.10		ug/L	
			Total Aluminum (Al)	2021/10/08	13		%	20
			Total Antimony (Sb)	2021/10/08	8.8		%	20
			Total Arsenic (As)	2021/10/08	0.25		%	20
			Total Barium (Ba)	2021/10/08	0.83		%	20
			Total Beryllium (Be)	2021/10/08	NC		%	20
			Total Bismuth (Bi)	2021/10/08	NC		%	20
			Total Boron (B)	2021/10/08	4.7		%	20
			Total Cadmium (Cd)	2021/10/08	NC		%	20
			Total Chromium (Cr)	2021/10/08	NC		%	20
			Total Cobalt (Co)	2021/10/08	2.3		%	20
			Total Copper (Cu)	2021/10/08	4.6		%	20
			Total Iron (Fe)	2021/10/08	3.9		%	20
			Total Lead (Pb)	2021/10/08	2.3		%	20
			Total Lithium (Li)	2021/10/08	0.79		%	20
			Total Manganese (Mn)	2021/10/08	3.6		%	20
			Total Molybdenum (Mo)	2021/10/08	2.7		%	20
			Total Nickel (Ni)	2021/10/08	2.0		%	20
			Total Selenium (Se)	2021/10/08	2.0		%	20
			Total Silicon (Si)	2021/10/08	4.1		%	20
			Total Silver (Ag)	2021/10/08	NC		%	20
			Total Strontium (Sr)	2021/10/08	1.0		%	20
			Total Thallium (Tl)	2021/10/08	NC		%	20
			Total Tin (Sn)	2021/10/08	NC		%	20
			Total Titanium (Ti)	2021/10/08	13		%	20
			Total Uranium (U)	2021/10/08	3.6		%	20
			Total Vanadium (V)	2021/10/08	1.1		%	20
			Total Zinc (Zn)	2021/10/08	7.7		%	20
			Total Zirconium (Zr)	2021/10/08	NC		%	20
A376687	DBA	Spiked Blank	pH (15 C)	2021/10/05		98	%	97 - 103
A376687	DBA	RPD	pH (15 C)	2021/10/05	4.3		%	N/A
A380555	TMU	Matrix Spike	Total Inorganic Carbon (C)	2021/10/08		86	%	80 - 120
A380555	TMU	Spiked Blank	Total Inorganic Carbon (C)	2021/10/08		110	%	80 - 120
A380555	TMU	Method Blank	Total Inorganic Carbon (C)	2021/10/08	<1.0		mg/L	
A387831	ZWU	Matrix Spike [AGW993-06]	Total Organic Carbon (C)	2021/10/15		97	%	80 - 120
A387831	ZWU	Spiked Blank	Total Organic Carbon (C)	2021/10/15		105	%	80 - 120
A387831	ZWU	Method Blank	Total Organic Carbon (C)	2021/10/15	<0.50		mg/L	
A387831	ZWU	RPD [AGW993-06]	Total Organic Carbon (C)	2021/10/15	1.3		%	20
A389389	KGR	Spiked Blank	Alkalinity (Total as CaCO <sub>3</sub> )	2021/10/16		98	%	80 - 120
A389389	KGR	Method Blank	Alkalinity (PP as CaCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Alkalinity (Total as CaCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	
			Bicarbonate (HCO <sub>3</sub> )	2021/10/16	<1.0		mg/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
A389389	KGR	RPD	Carbonate (CO3)	2021/10/16	<1.0		mg/L	
			Hydroxide (OH)	2021/10/16	<1.0		mg/L	
			Alkalinity (PP as CaCO3)	2021/10/16	NC		%	20
			Alkalinity (Total as CaCO3)	2021/10/16	0.80		%	20
			Bicarbonate (HCO3)	2021/10/16	0.80		%	20
			Carbonate (CO3)	2021/10/16	NC		%	20
A389391	KGR	Spiked Blank	Hydroxide (OH)	2021/10/16	NC		%	20
			Conductivity	2021/10/16		102	%	90 - 110
A389391	KGR	Method Blank	Conductivity	2021/10/16	<2.0		uS/cm	
A389391	KGR	RPD	Conductivity	2021/10/16	0.89		%	10
A390092	STI	Matrix Spike [AGW993-08]	Dissolved Phosphorus (P)	2021/10/17		93	%	80 - 120
A390092	STI	QC Standard	Dissolved Phosphorus (P)	2021/10/17		89	%	80 - 120
A390092	STI	Spiked Blank	Dissolved Phosphorus (P)	2021/10/17		96	%	80 - 120
A390092	STI	Method Blank	Dissolved Phosphorus (P)	2021/10/17	0.0017, RDL=0.0010 (5)		mg/L	
A390092	STI	RPD [AGW993-08]	Dissolved Phosphorus (P)	2021/10/17	2.7		%	20
A390968	BFE	Matrix Spike	Dissolved Sulphate (SO4)	2021/10/18		NC	%	80 - 120
A390968	BFE	Spiked Blank	Dissolved Sulphate (SO4)	2021/10/18		100	%	80 - 120
A390968	BFE	Method Blank	Dissolved Sulphate (SO4)	2021/10/18	<1.0		mg/L	
A390968	BFE	RPD	Dissolved Sulphate (SO4)	2021/10/18	3.9		%	20
A391105	PK8	Matrix Spike [AGW993-06]	Chemical Oxygen Demand	2021/10/18		101	%	80 - 120
A391105	PK8	Spiked Blank	Chemical Oxygen Demand	2021/10/18		101	%	80 - 120
A391105	PK8	Method Blank	Chemical Oxygen Demand	2021/10/18	<10		mg/L	
A391105	PK8	RPD [AGW993-06]	Chemical Oxygen Demand	2021/10/18	5.4		%	20
A391916	PC5	Matrix Spike	Dissolved Barium (Ba)	2021/10/19		NC	%	80 - 120
			Dissolved Cadmium (Cd)	2021/10/19		85	%	80 - 120
			Dissolved Manganese (Mn)	2021/10/19		90	%	80 - 120
			Dissolved Nickel (Ni)	2021/10/19		87	%	80 - 120
			Dissolved Zinc (Zn)	2021/10/19		91	%	80 - 120
			Dissolved Barium (Ba)	2021/10/19		90	%	80 - 120
			Dissolved Cadmium (Cd)	2021/10/19		92	%	80 - 120
			Dissolved Manganese (Mn)	2021/10/19		96	%	80 - 120
A391916	PC5	Spiked Blank	Dissolved Nickel (Ni)	2021/10/19		96	%	80 - 120
			Dissolved Zinc (Zn)	2021/10/19		97	%	80 - 120
			Dissolved Barium (Ba)	2021/10/19	<0.020		ug/L	
			Dissolved Cadmium (Cd)	2021/10/19	<0.0050		ug/L	
			Dissolved Manganese (Mn)	2021/10/19	<0.050		ug/L	
			Dissolved Nickel (Ni)	2021/10/19	<0.020		ug/L	
			Dissolved Zinc (Zn)	2021/10/19	<0.10		ug/L	
			Dissolved Barium (Ba)	2021/10/19	0.033		%	20
A391916	PC5	RPD	Dissolved Cadmium (Cd)	2021/10/19	NC		%	20
			Dissolved Manganese (Mn)	2021/10/19	0.19		%	20
			Dissolved Nickel (Ni)	2021/10/19	7.1		%	20
			Dissolved Zinc (Zn)	2021/10/19	NC		%	20
			Total Phosphorus (P)	2021/10/19		89	%	80 - 120
			Total Phosphorus (P)	2021/10/19		84	%	80 - 120
			Total Phosphorus (P)	2021/10/19		87	%	80 - 120
			Total Phosphorus (P)	2021/10/19	<0.0010		mg/L	
A392634	FM0	RPD	Total Phosphorus (P)	2021/10/19	NC		%	20
A393408	PC5	Matrix Spike	Total Zinc (Zn)	2021/10/20		90	%	80 - 120
A393408	PC5	Spiked Blank	Total Zinc (Zn)	2021/10/20		107	%	80 - 120
A393408	PC5	Method Blank	Total Zinc (Zn)	2021/10/20	<0.10		ug/L	





### QUALITY ASSURANCE REPORT(CONT'D)

QA/QC		QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
Batch	Init							
A393408	PC5	RPD	Total Zinc (Zn)	2021/10/20	0.37		%	20
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <math>\leq 2 \times</math> RDL).</p> <p>(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.</p> <p>(2) Method blank above criteria. Data inspected. All data <math>&lt;</math> RDL or greater than 10x Method Blank.</p> <p>(3) Method Blank <math>&lt; 2 \times</math> RDL.</p> <p>(4) Method blank <math>&lt; 2 \times</math> RDL.</p> <p>(5) Method blank above criteria and less than 2X RDL. Data inspected.</p>								





### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Gita Pokhrel, Laboratory Supervisor

Janet Gao, B.Sc., QP, Supervisor, Organics

Luba Shymushovska, B.Sc., QP, Senior Analyst, Organics

Maria Magdalena Florescu, Ph.D., P.Chem., QP, Inorganics Manager

Qiliang (Alex) Wu, Analyst II

Sandy Yuan, M.Sc., QP, Scientific Specialist





Bureau Veritas Job #: C172489  
Report Date: 2021/10/27

HATFIELD CONSULTANTS  
Client Project #: Syncrude mesocosm experiment

### VALIDATION SIGNATURE PAGE(CONT'D)

The analytical data and all QC contained in this report were reviewed and validated by:

A handwritten signature in black ink that reads "Veronica Falk".




---

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



 <p>Bureau Veritas Laboratories 4000 19th N.E., Calgary, Alberta Canada T2E 6P6 Tel: (403) 291-3077 Toll-free: 800-563-6266 Fax: (403) 291-9466 www.bvlabs.com</p>		Page 1 of 1																	
<b>CHAIN OF CUSTODY RECORD</b>																			
<b>INVOICE TO:</b>		<b>REPORT TO:</b>																	
Company Name: #11052 HATFIELD CONSULTANTS Attention: Zach Mueller Address: Suite A, 300 MacKenzie Blvd FORT MCMURRAY AB T9H 4C4 Tel: (250) 893-4939 Fax: _____ Email: zmueller@hatfieldgroup.com		Company Name: Zach Mueller Attention: Suite A, 300 MacKenzie Blvd Address: FORT MCMURRAY AB T9H 4C4 Tel: (250) 893-4939 Fax: _____ Email: zmueller@hatfieldgroup.com																	
<b>PROJECT INFORMATION:</b>		<b>Laboratory Use Only:</b>																	
Quotation #: C10909 P.O. #: _____ Project: Syncrude mesocosm experiment Project Name: _____ Site #: _____ Sampled By: _____		BV Labs Job #: C172489 Bottle Order #:  644187 COC #:  C#644187-01-01 Project Manager: Amanda L'Hirondelle																	
<b>Regulatory Criteria:</b> <input type="checkbox"/> ATI <input type="checkbox"/> CCME <input type="checkbox"/> Other		<b>Special Instructions</b> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>																	
<b>ANALYSIS REQUESTED (PLEASE BE SPECIFIC)</b>		<b>Turnaround Time (TAT) Required:</b> (Please provide advance notice for rush projects) <b>Regular (Standard) TAT:</b> (will be applied if Rush TAT is not specified) Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details <input type="checkbox"/> <b>Job Specific Rush TAT (if applies to entire submission)</b> Date Required: _____ Rush Confirmation Number: _____ (call lab for #)																	
<b>SAMPLES MUST BE KEPT COOL (&lt; 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BVLABS</b>		<b># of Bottles</b> <b>Comments</b>																	
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered? (Y/N)	ENV - 2021 Syncrude Mesocosm													
1	River water tank	21/09/24	16:20	W		X													
2	Mesocosm Table1		11:10			X													
3	Mesocosm Table2		11:45			X													
4	Mesocosm Table3		11:45			X													
5	Mesocosm Table4		12:30			X													
6	Mesocosm Table5		11:10			X													
7	Mesocosm Table6		11:10			X													
8	Mesocosm Table7		12:30			X													
9	Mesocosm Table8		11:10			X													
10	Treated OSPW tank		14:00			X													
* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# jars used and not submitted	<b>Laboratory Use Only</b> Time Sensitive: <input type="checkbox"/> Temperature (°C) on Receipt: See ACTR Custody Seal Intact on Cooler? <input type="checkbox"/> Yes <input type="checkbox"/> No										
MATTAN EDWARDS		21/09/27	0900	Reem Phillipos, RCM		2021/09/28	06:10												

Bureau Veritas Canada (2019) Inc.

Received in Fort McMurray  
By: 

SEP 27 2021  
@ 9:00am  
Temp: 11.515 see ACTR  
100-yes CS-NO





Sent to: Bureau Veritas Vancouver  
4606 Canada Way  
Burnaby, BC, V5G 1K5  
Tel: (604) 734-7276

# DV I ARC INTERLAB CHAIN OF CUSTODY RECORD

Page 01 of 01

COC # C172489-MVAN-01-01



QUESTED

Job Barcode Label



## REPORT INFORMATION

Company: Bureau Veritas Laboratories  
Address: 4000 19th N.E., Calgary, Alberta, T2E 6P8  
Contact Name: Amanda L'Hirondelle  
Email: Amanda.lhirondelle@bureauveritas.com, Customersolutionswest@bureauveritas.com  
Phone: (780) 577-7117  
BV Labs Project #: C172489  
Client Invoice To: HATFIELD CONSULTANTS (11052)  
Client Report To: HATFIELD CONSULTANTS (11052)

Incl. on Report? Yes / No

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.
1	AGW993-RIVER WATER TANK	W	2021/09/24	16:20		2
2	AGW994-MESOCOSM TABLE 1	W	2021/09/24	11:10		2
3	AGW995-MESOCOSM TABLE 2	W	2021/09/24	11:45		2
4	AGW996-MESOCOSM TABLE 3	W	2021/09/24	11:45		2
5	AGW997-MESOCOSM TABLE 4	W	2021/09/24	12:30		2
6	AGW998-MESOCOSM TABLE 5	W	2021/09/24	11:10		2
7	AGW999-MESOCOSM TABLE 6	W	2021/09/24	11:10		2
8	AGX000-MESOCOSM TABLE 7	W	2021/09/24	12:30		2
9	AGX001-MESOCOSM TABLE 8	W	2021/09/24	11:10		2
10	AGX002-TREATED OSPW TANK	W	2021/09/24	14:00		2

Mercury-Low Level, Diss., field filtered

Mercury-Low Level, Total

Filter and HNO3 Preserve for Metals

## ADDITIONAL SAMPLE INFORMATION

## SITE LOCATION:

SITE #:

PROJECT #:

Synchrude mesocosm experiment

PO/A/E, TASK ORDER/SERVICE ORDER, LINE ITEM:

## REGULATORY CRITERIA

## SPECIAL INSTRUCTIONS

Please inform BV Labs immediately if you are not accredited for the requested test(s).  
\*\*Please return a copy of this form with the report.\*\*

## REQUIRED EDDs

National Excel (N001)  
Suncor Erims (A037)

## TURNAROUND TIME

☐ Rush Required

2021/10/04

Date Required

Please inform us if rush charges will be incurred.

## COOLER ID:

	YES	NO	Temp:	1	2	3
Custody Seal Present			(°C)			
Custody Seal Intact						
Cooling Media Present						

## COOLER ID:

	YES	NO	Temp:	1	2	3
Custody Seal Present			(°C)			
Custody Seal Intact						
Cooling Media Present						

## COOLER ID:

	YES	NO	Temp:	1	2	3
Custody Seal Present			(°C)			
Custody Seal Intact						
Cooling Media Present						

## RELINQUISHED BY: (SIGN & PRINT)

*[Signature]*  
2.

DATE: (YYYY/MM/DD)

2021/09/28

TIME: (HH:MM)

14:46

## RECEIVED BY: (SIGN & PRINT)

1.

2.

DATE: (YYYY/MM/DD)

TIME: (HH:MM)

Samples Labelled By:

Labels Verified By:

## RECEIVING LAB USE ONLY

BV Labs Job #

C172489





Surrey Water Laboratories  
 400-11st NE, Calgary, Alberta, Canada T2E 6P6 Tel: (403) 291-5677 Toll-free: 800-553-6296 Fax: (403) 291-5475 www.swl.ca

# CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#11052 HATFIELD CONSULTANTS	Company Name:	Zach Mueller	Question #:	C10009	BY Lab Job #:	Butte Order #:
Attention:	Zach Mueller	Attention:	Zach Mueller	P.O. #:			
Address:	Suite A, 300 MacKenzie Blvd FORT MCMURRAY AB T9H 4C4	Address:	Suite A, 300 MacKenzie Blvd FORT MCMURRAY AB T9H 4C4	Project:	Synchrude mesocosm experiment		
Tel:	(250) 893-4939	Tel:	(250) 893-4939	Project Name:		COC #:	Project Manager:
Email:	zmuelter@hatfieldgroup.com	Email:	zmuelter@hatfieldgroup.com	Site #:			
				Sampled By:			

Regulatory Clients:		Special Instructions:		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)										Turnaround Time (TAT) Request:	
<input type="checkbox"/> AT:															
<input type="checkbox"/> CCME:															
<input type="checkbox"/> Other:															

Sample Barcode Label	Barcode (Location) Identifier	Date Sampled	Time Sampled	Method	Matrix	Analysis Requested	Turnaround Time (TAT)
1	BLANK	24/09/24	12:05	W	ENV - 2021 Synchrude Mesocosm	X	
2	DUPLICATE	"	12:25	W	ENV - 2021 Synchrude Mesocosm	X	
3							
4							
5							
6							
7							
8							
9							
10							

27-Sep-21 09:00  
 Amanda L'Hirondelle  
 C172539  
 DKR INS-0109

* REQUESTED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# Jars used and left submitted	Laboratory Use Only	
Amanda L'Hirondelle		24/09/24	09:00	Reem Phillips, Reem		2024/09/28	06:10		Temperature (°C) on Receipt	Controlled Date (YY/MM/DD)
									See ACPR	Yes No

\* UNLESS OTHERWISE AGreed TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BY LAB'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT: [www.swl.ca/terms-conditions](#)

\*\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* ALL SAMPLES ARE HELD FOR 90 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.

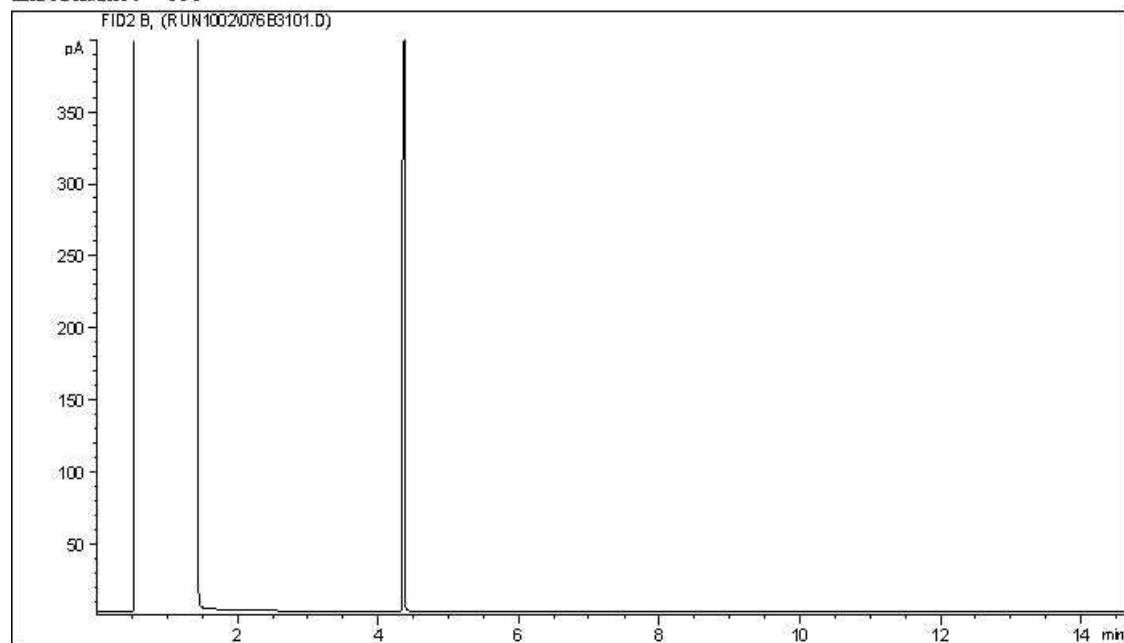
Received in Fort McMurray  
 By: [Signature]

SEP 27 2021  
 @ 8:50am 9:00am  
 Temp: 31.5/1  
 10-UES CS-160

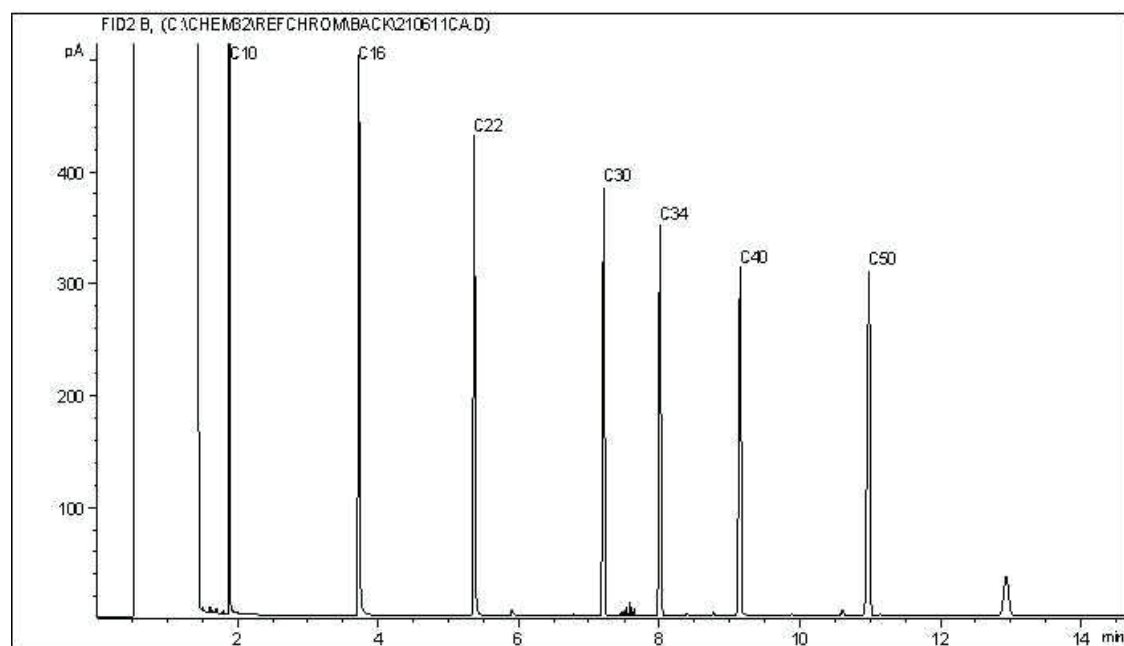


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

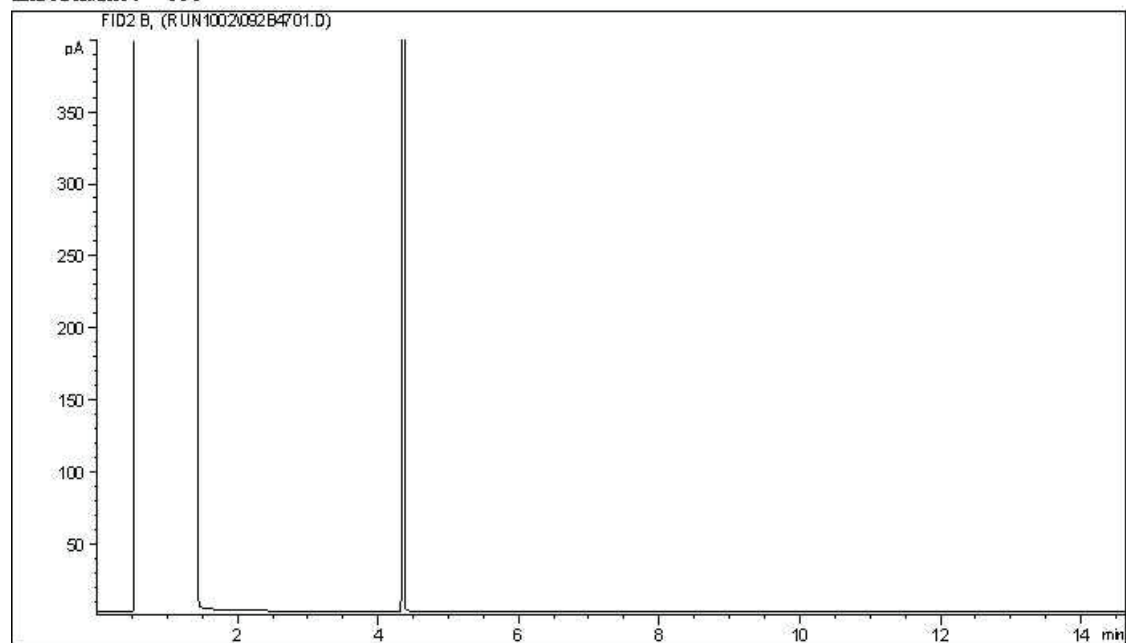
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

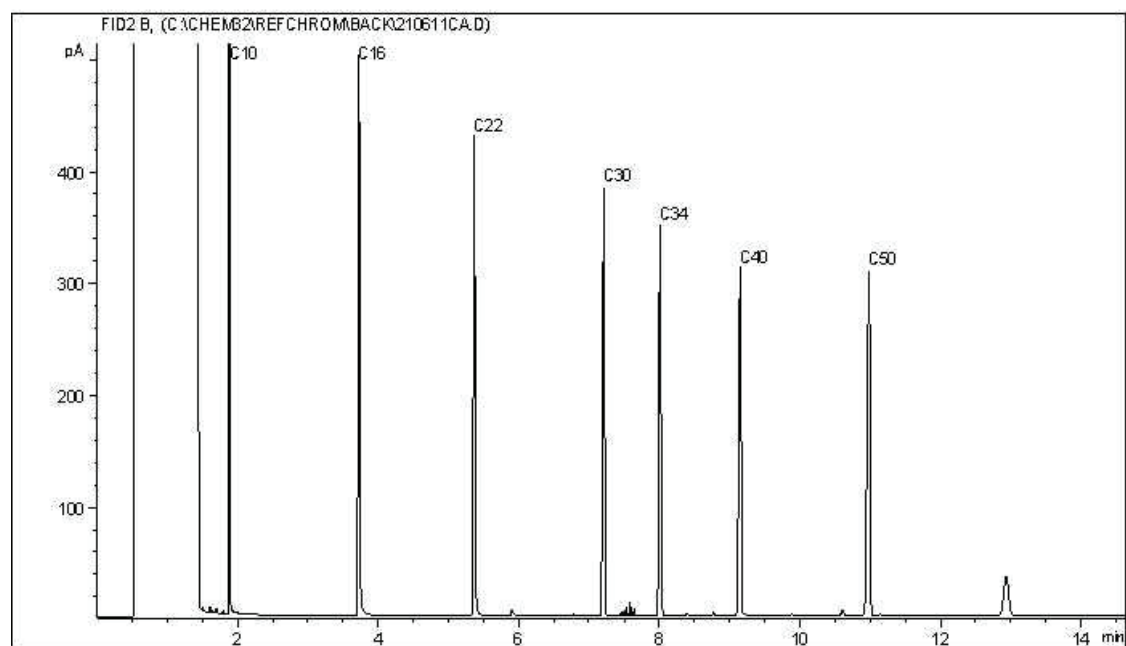


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

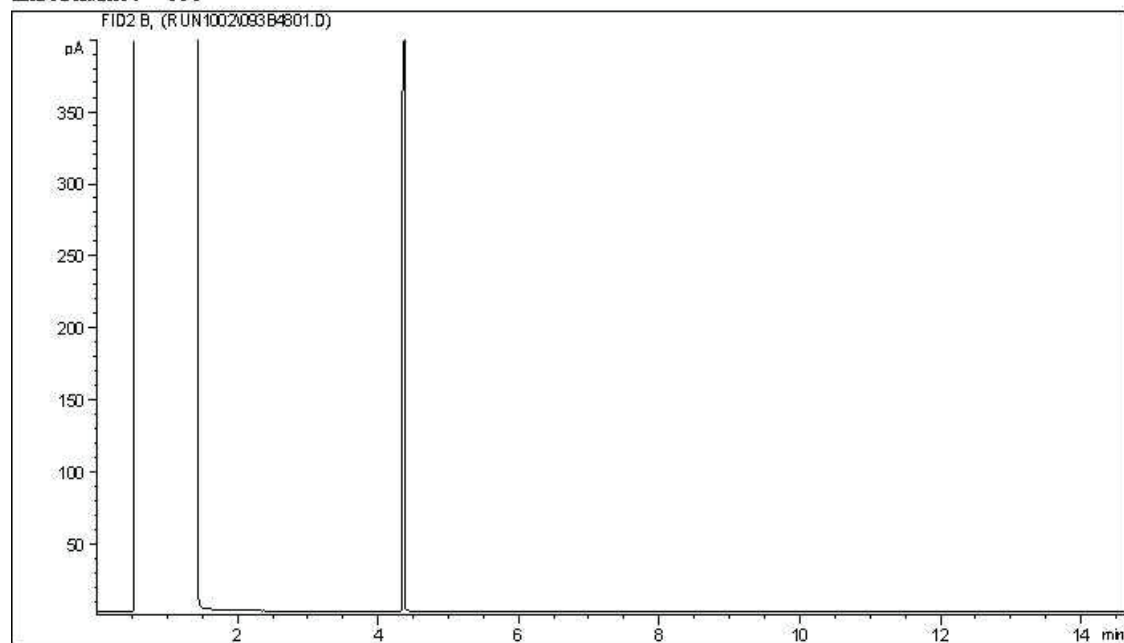
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

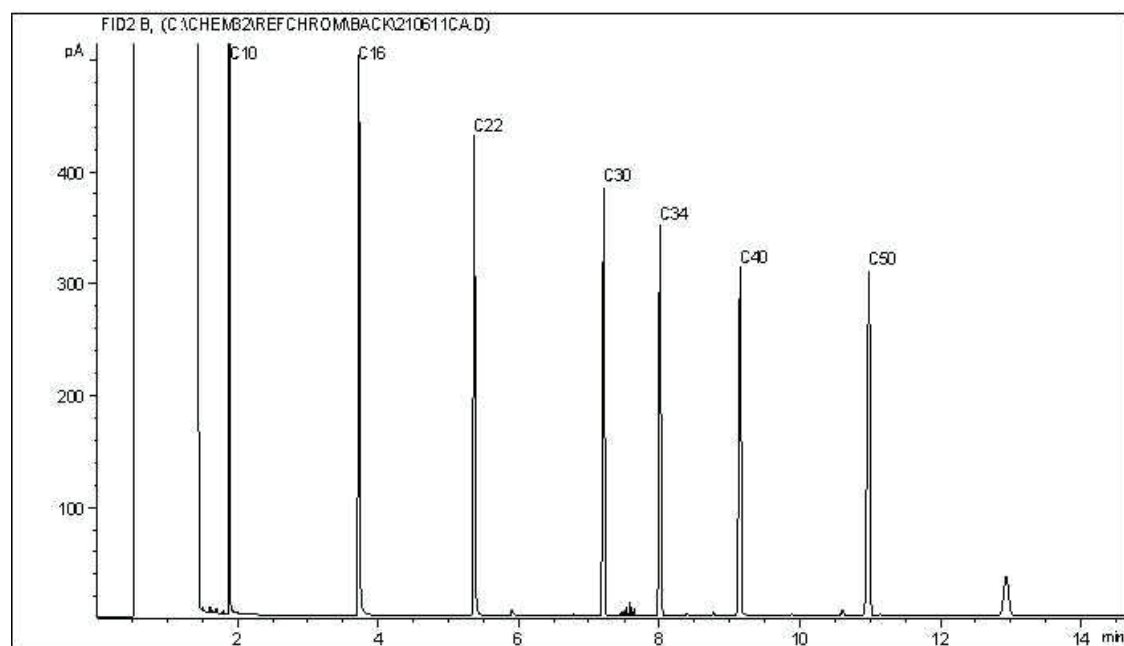


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

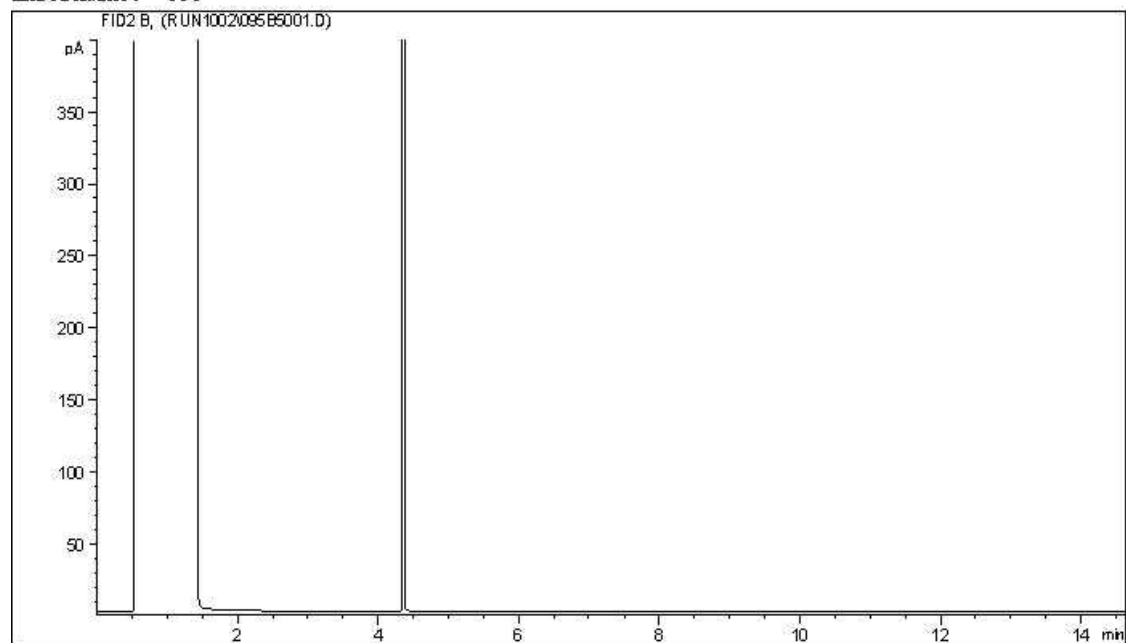
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

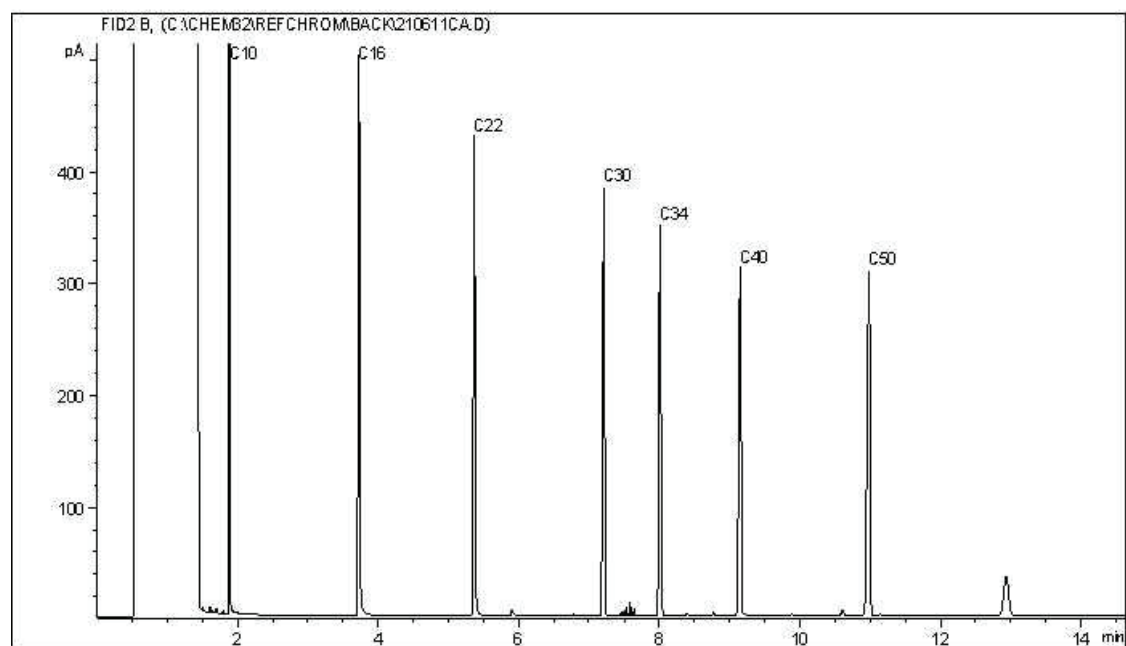


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

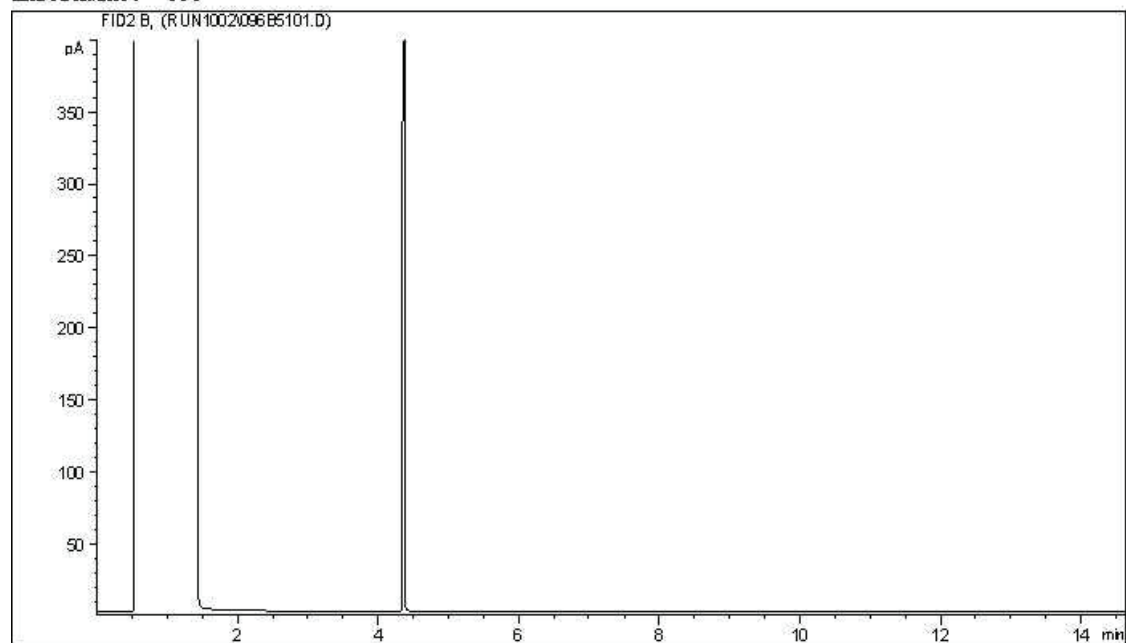
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

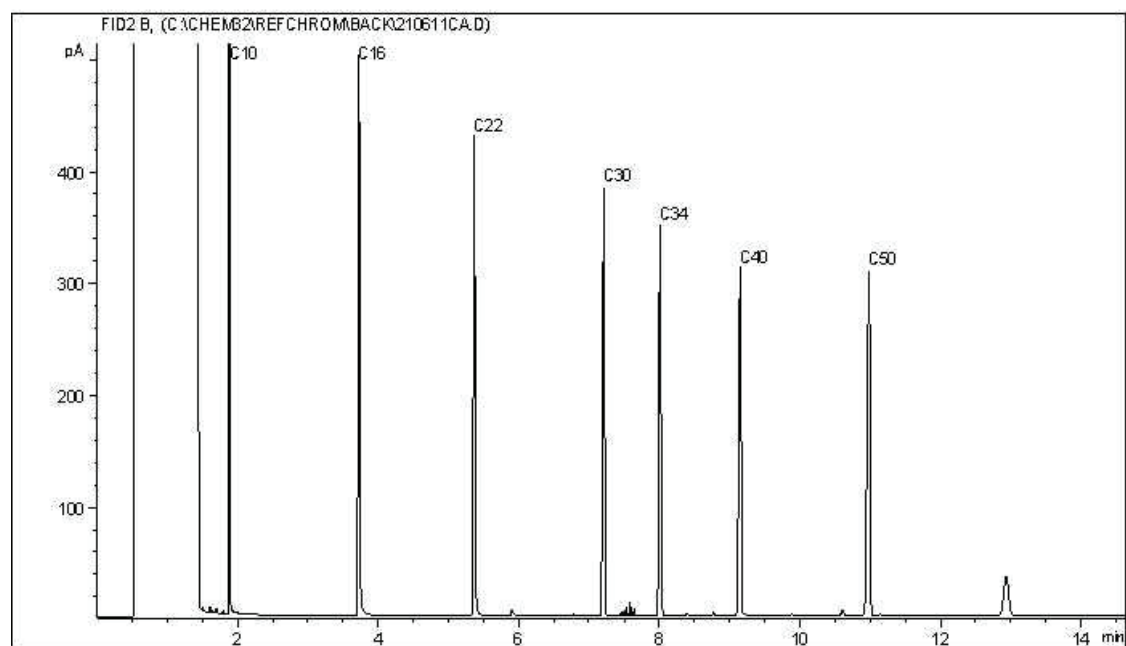


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

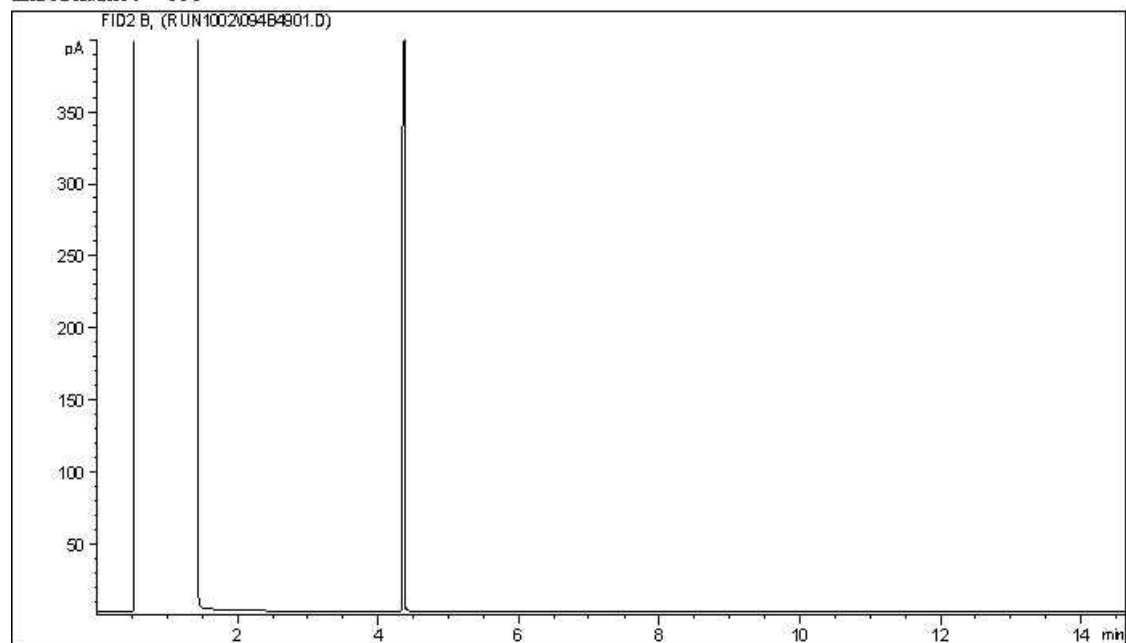
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

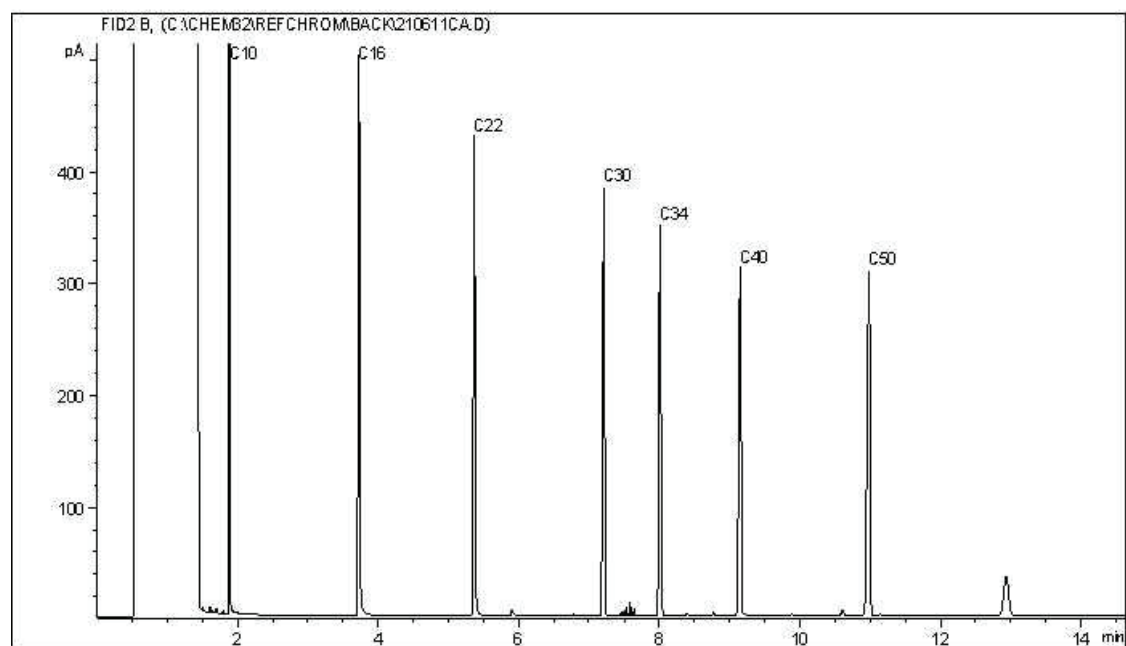


**CCME Hydrocarbons (F2-F4 in water) Chromatogram**

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



**TYPICAL PRODUCT CARBON NUMBER RANGES**

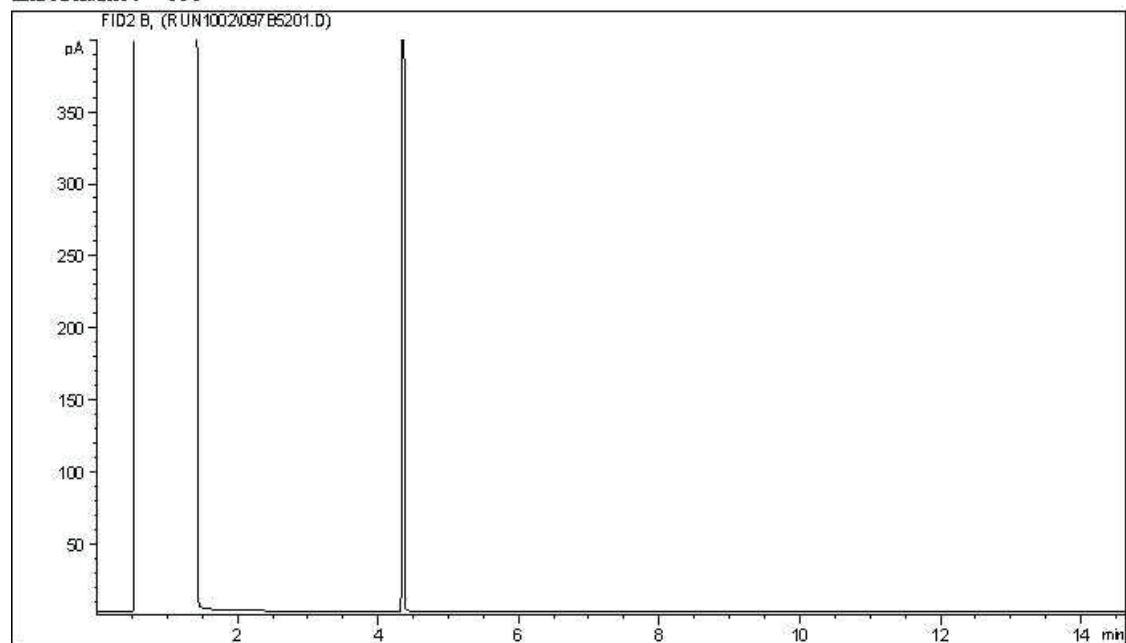
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

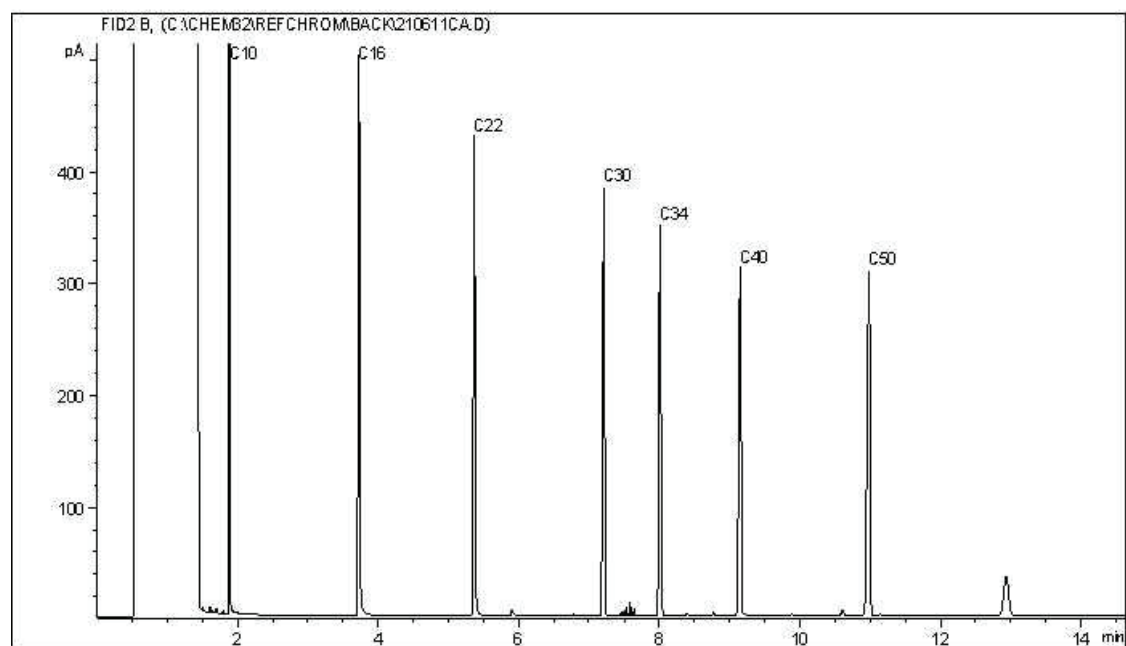


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

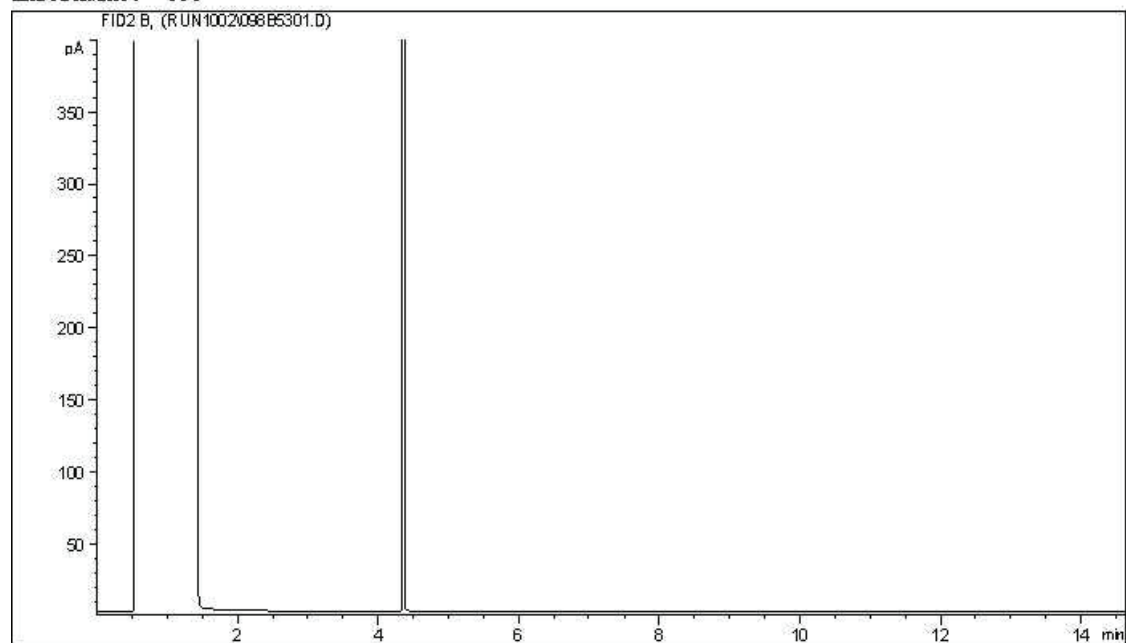
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

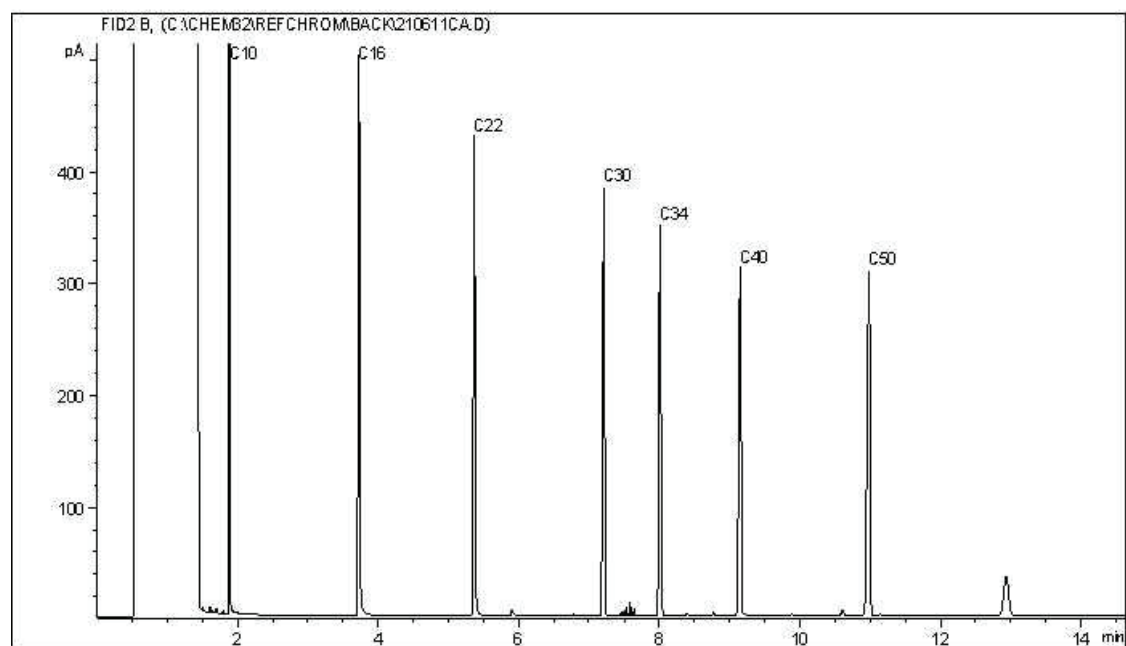


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

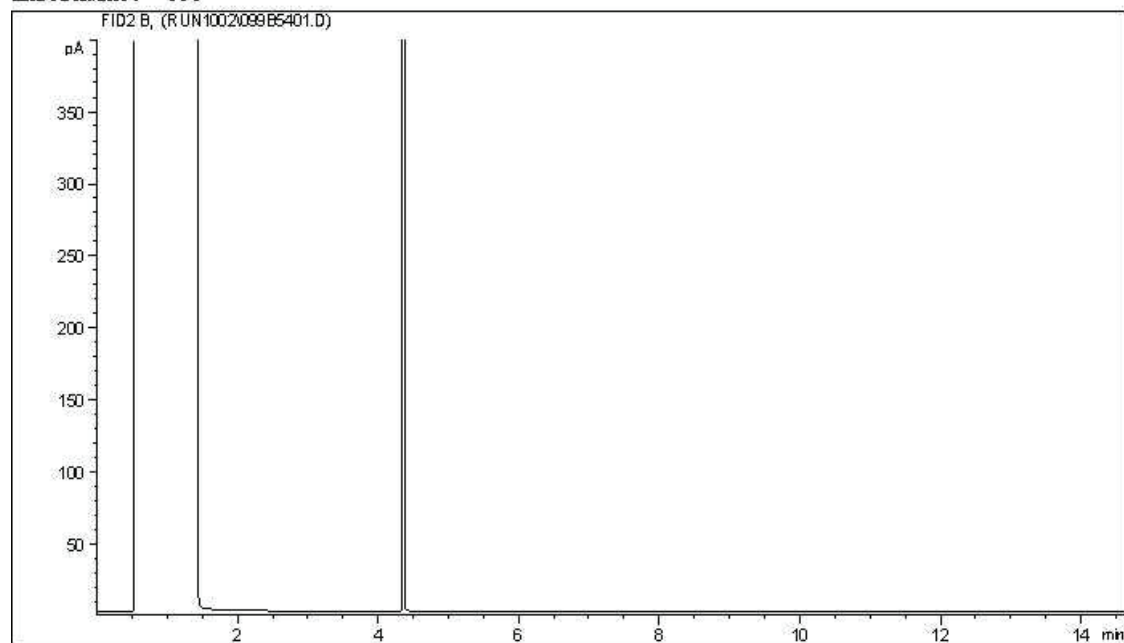
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

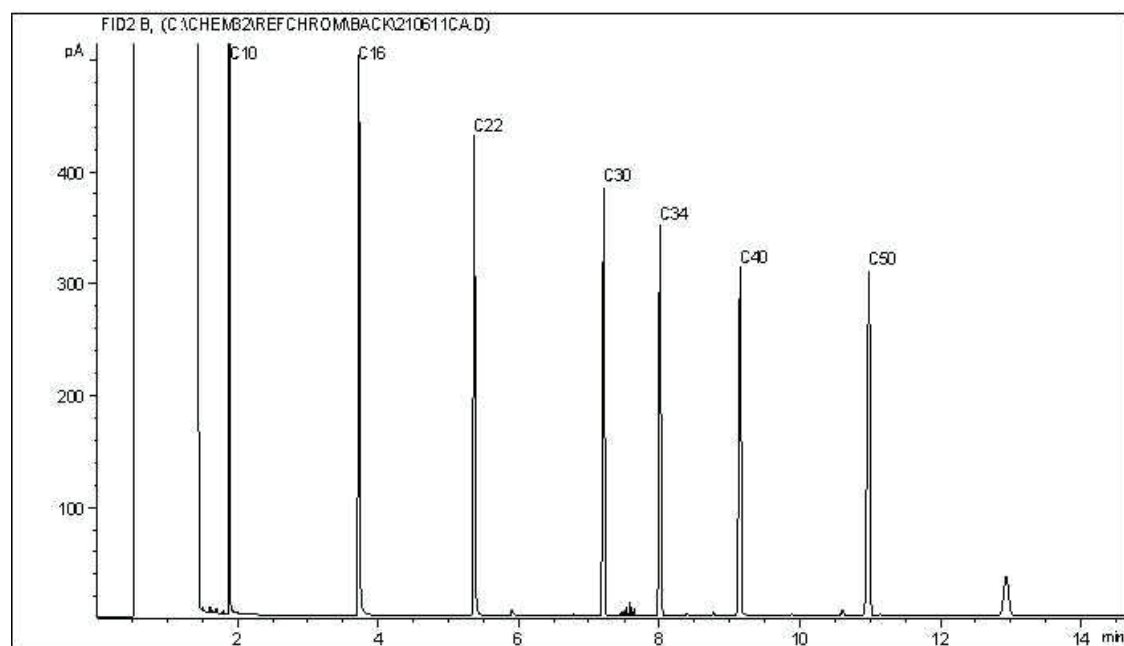


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

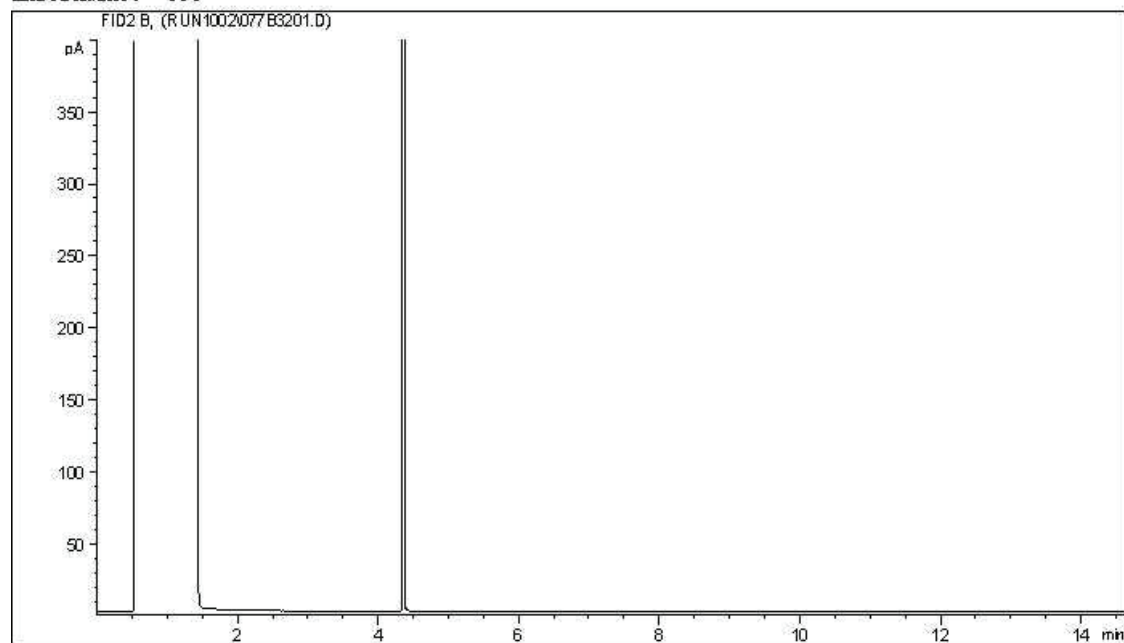
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

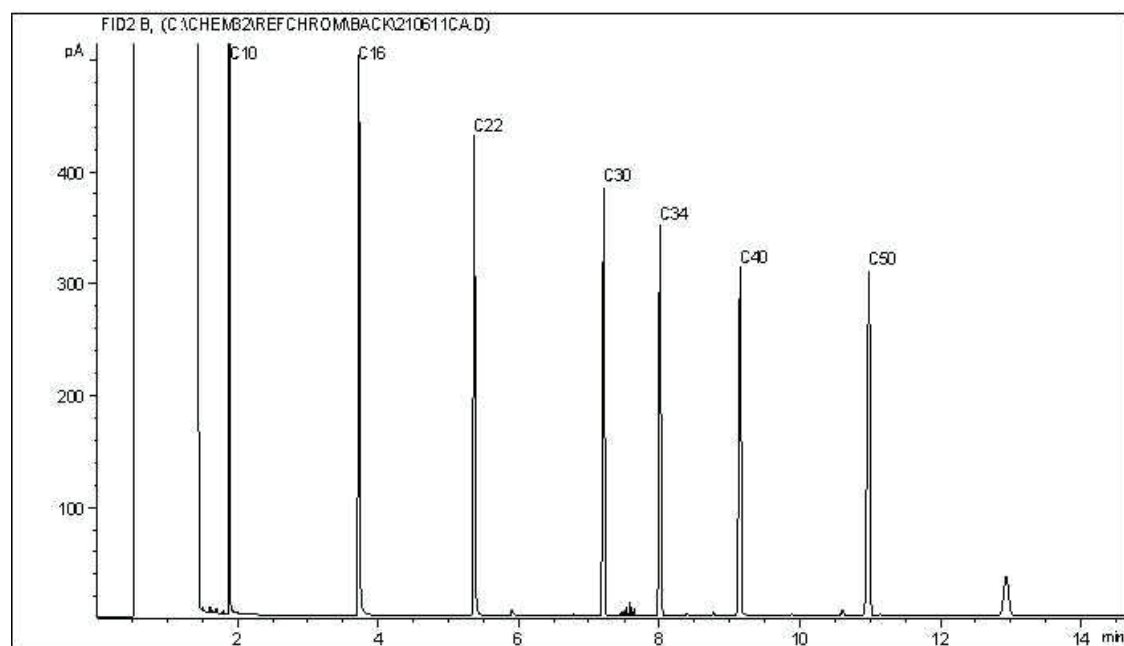


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



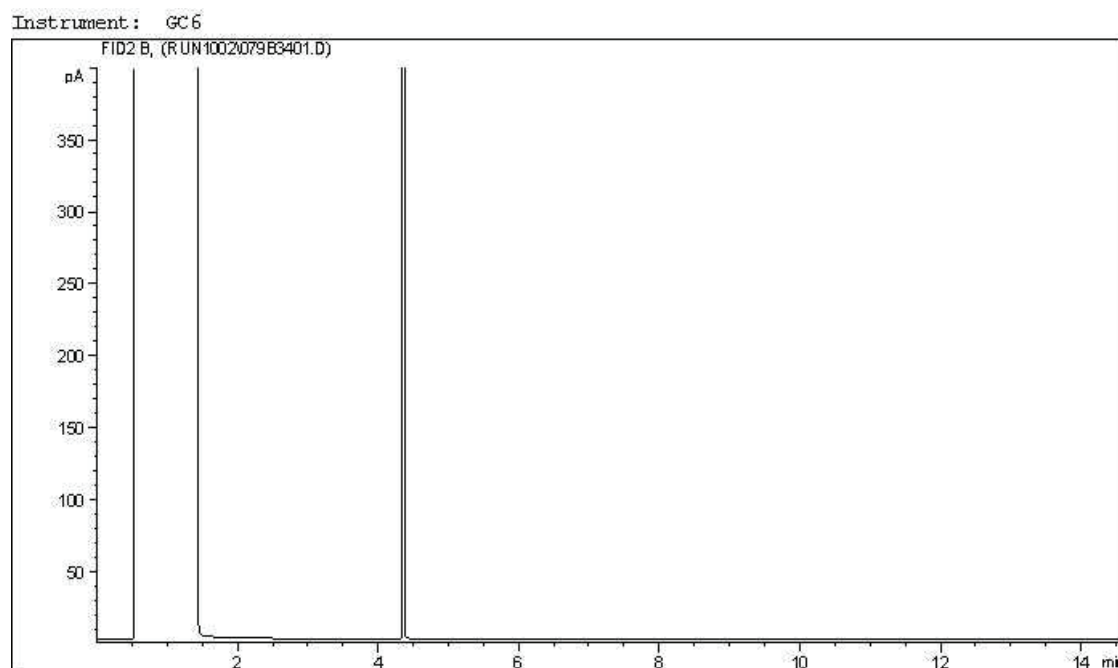
## TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

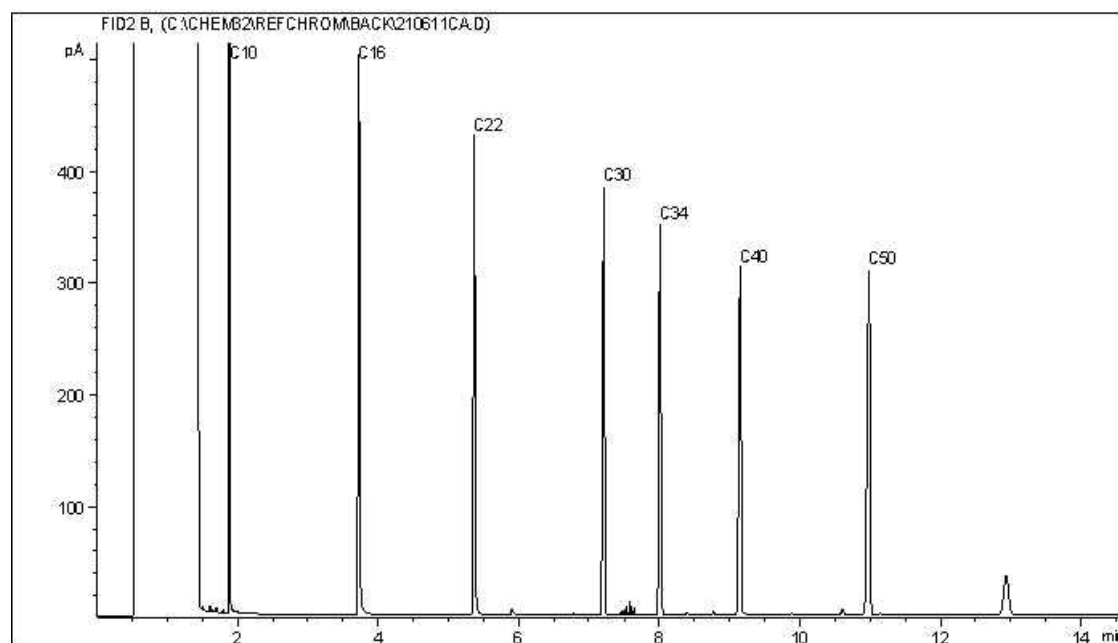
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**



# CCME Hydrocarbons (F2-F4 in water) Chromatogram



## Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

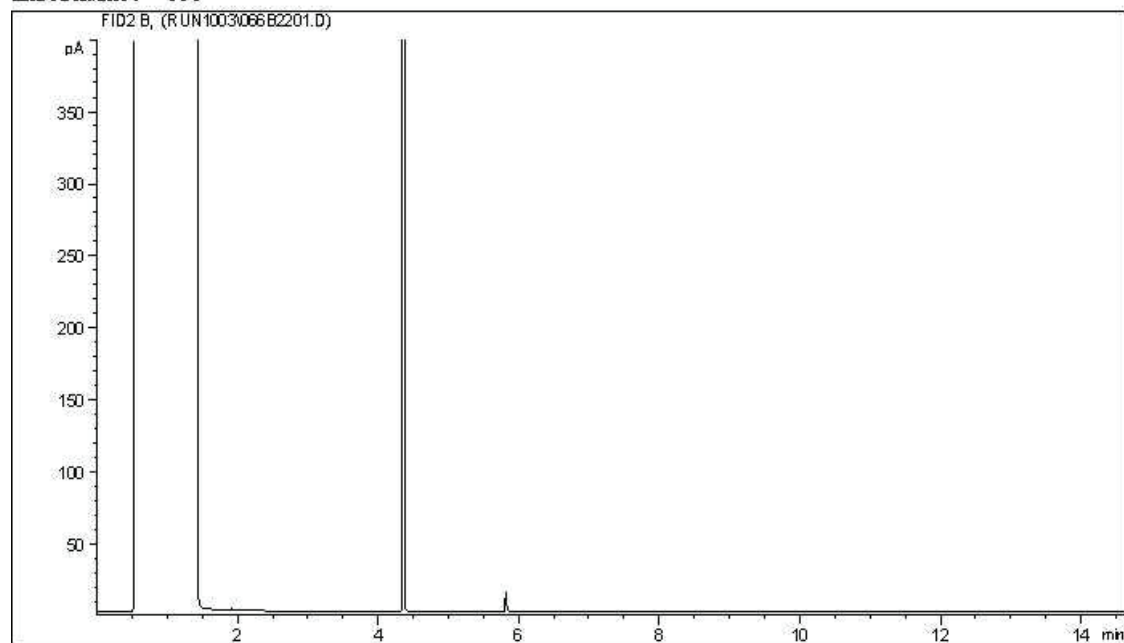
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

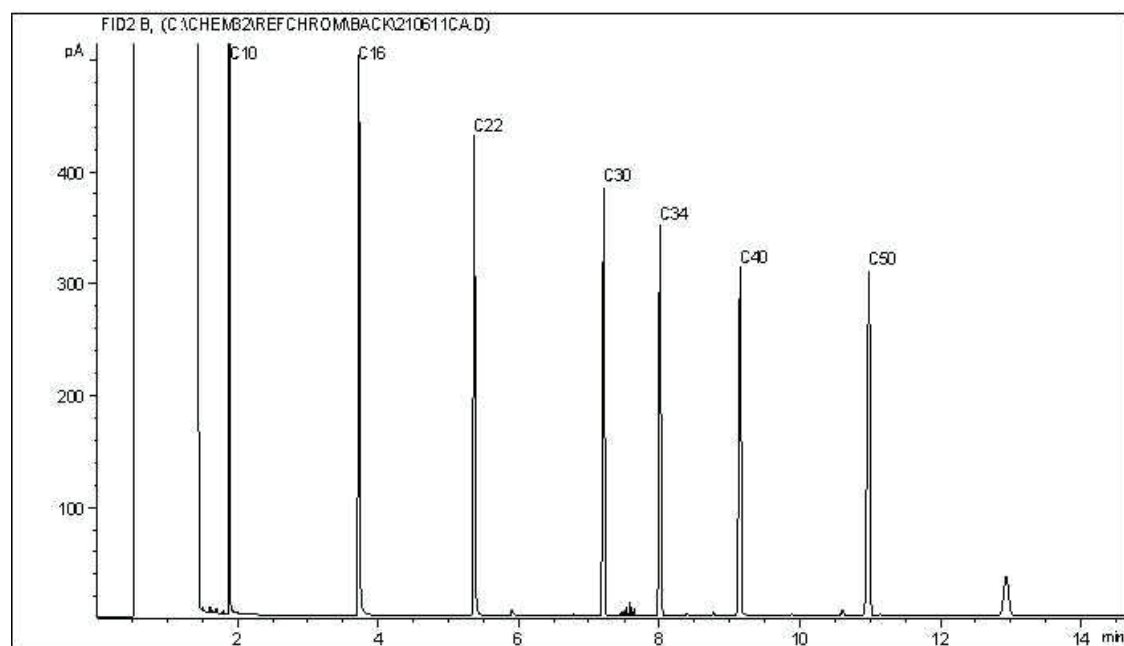


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

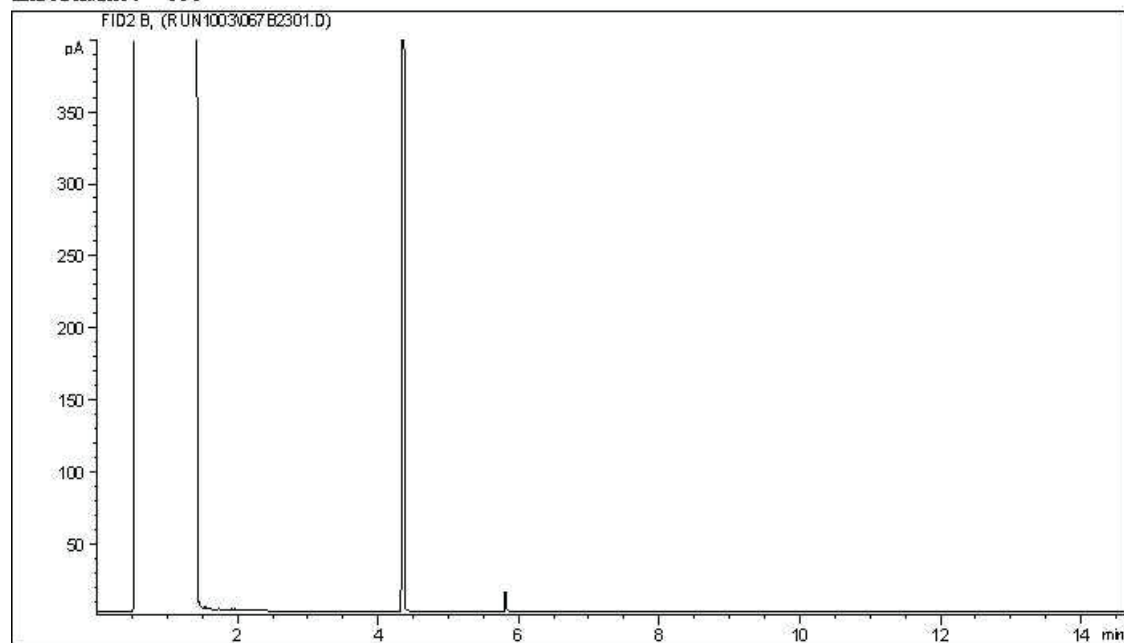
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

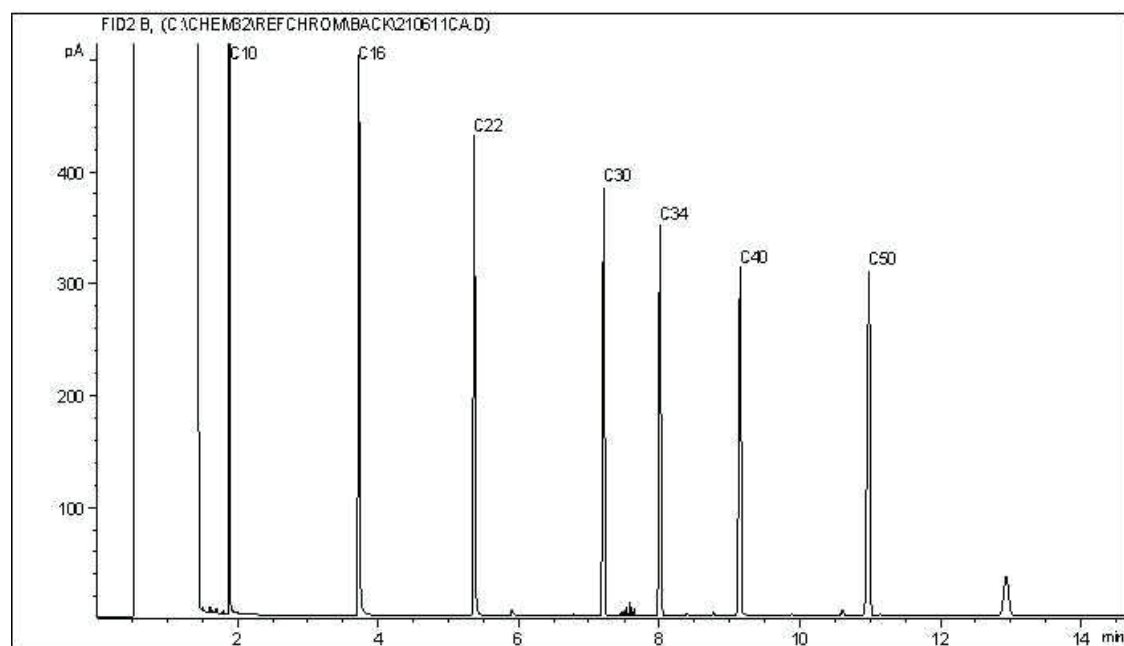


# CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



## TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**



---

## **Appendix A1.5**

### **SPMD Data and Concentration Calculations**

---





2045 Mills Road West

TEL: (250) 655-5800

Sidney, BC, Canada V8L5X2

TOLL-FREE: 1-888-373-0881

SGS AXYS Client No.: 2607

Client Address: Hatfield Consultants  
200-850 Harbourside Dr.  
North Vancouver, BC, CANADA, V7P 0A3

The SGS AXYS contact for these data is Georgina Brooks.

*"This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.*

*Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law."*

*"The sample(s) to which the findings recorded herein (the "Findings") relate was[were] drawn and [or] provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is[are] said to be extracted."*



# BATCH SUMMARY

<b>Batch ID:</b>	WG79135	<b>Date:</b>	18-Feb-2022
<b>Analysis Type:</b>	PAH	<b>Matrix Type:</b>	SPMD
<b>BATCH MAKEUP</b>			
<b>Contract:</b> 2607 <b>Samples:</b>  L35931-1 Travel blank L35931-2 Day zero_dialysis blank L35931-3 Spike blank L35931-4 Treated OSPW field Blank_SPMD L35931-5 River Water field Blank_SPMD L35931-6 Treated OSPW_SPMD L35931-7 River Water 1_SPMD L35931-8 River Water 2_SPMD L35931-9 River Water 3_SPMD		<b>Blank:</b> WG79135-101	
		<b>Reference or Spike:</b> WG79135-102	
		<b>Duplicate:</b>	
<b>Comments:</b> <ol style="list-style-type: none"> <li>1. Data are considered final.</li> <li>2. Data are not blank corrected. Blank data should be taken into consideration when evaluating sample data.</li> <li>3. Blank data should be evaluated against specifications using the same blank sample size as the size of the client samples.</li> </ol>			

Copyright SGS AXYS Analytical Services Ltd  
February 2017

FQA-006 Rev. 4. 20-Sep-2013



## CHAIN OF CUSTODY

2045 Mills Road West TEL: (250) 655-5800 TOLL FREE 1-888-373-0881  
Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

SGS AXYS CLIENT #:

REPORT TO:			INVOICE TO:			ANALYSIS REQUESTED				
Company	Hatfield Consultants LLC		Company	Hatfield Consultants LLC						
Address	850 Harbourside Dr Suite 200		Address	850 Harbourside Dr Suite 200						
	Norther Vancouver BC			Norther Vancouver BC						
	V7P 0A3			V7P 0A3						
Contact	Morgan Edward & Zachary Mueller		Contact	Imsook cha						
Phone	604 926 3261		Phone	604 926 3261						
FAX			FAX							
	<a href="mailto:medwards@hatfieldgroup.com">medwards@hatfieldgroup.com</a>			<a href="mailto:icha@hatfieldgroup.com">icha@hatfieldgroup.com</a>						
E-mail	zmueller@hatfieldgroup.com		E-mail							
Project Name/Number: Syncrude mesocosm project SYN 9110			Sampler's Name: Zachary Mueller							
Signature:										
Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	SGS AXYS Lab Sample ID (Lab use only)					
Treated OSPW_SPMD		Oct 1 2021	13:00	1	289(T)271 (A/C) L35931 - 79 - 6	X				
River Water_SPMD		Oct 1 2021	13:10	3	- 45 - 7 - 8 - 9	X				
Treated OSPW field Blank_SPMD		Oct 1 2021	-	1	- 46 - 4	X				
River Water field Blank_SPMD		Oct 1 2021	-	1	- 67 - 5	X				
Travel Blank		-	-	1	- 1	X				
Day zero_dialysis blank		-	-	1	- 2	X				
Spike blank		-	-	1	- 3	X				
Relinquished by (Signature) <i>Zach Mueller</i> Date <i>Oct 26 2021</i> Time <i>15:00</i>			Received by (Signature) <i>[Signature]</i> Date <i>28 Oct 2021</i> Time <i>09:05</i>			Courier		Waybill No.		
Relinquished by (Signature) _____ Date _____ Time _____			Received by (Signature) _____ Date _____ Time _____			Sample Receipt				
Remarks <i>combine SPMD in each of the cassies into a single sample for treat OSPW-SPMD as well as the River water-SPMDs + treated OSPW field blank exposed to atmosphere for total of 4 min 35 sec for treat OSPW-SPMD deployment &amp; retrieval. River water field Blank exposed to atmosphere for a total of 7 min 19 sec</i>										
Temp °C						Cooler				
Custody Seal #										
Seal Intact Y / N										
Sample Tags Y / N										



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## CLIENT SAMPLE NO.

Travel blank

Sample Collection:

N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 28-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 12:03:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No.

SYN 9110

Lab Sample I.D.:

L35931-1

Sample Size:

1 sample

Initial Calibration Date:

28-Jan-2022

Instrument ID:

LR GC/MS

GC Column ID:

RTX5

Sample Data Filename:

PH2S0535.D

Blank Data Filename:

PH2S0534.D

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	20.7	0.809 (S)	0.07	1.006
Acenaphthylene	208-96-8	ND		0.466 (S)		
Acenaphthene	83-32-9	J	2.28	0.435 (S)	1.12	1.047
2-Methylfluorene	1430-97-3	ND		0.801 (S)		
C2 Phenanthrenes/Anthracenes			3.98	0.588 (S)		
Fluorene	86-73-7	J	2.63	0.466 (S)	1.11	0.843
Phenanthrene	85-01-8		25.7	0.343 (S)	0.21	1.004
Anthracene	120-12-7	J	0.983	0.346 (S)	0.18	1.011
C1 Phenanthrenes/Anthracenes			9.28	0.306 (S)		
Fluoranthene	206-44-0	J	7.45	0.285 (S)	0.23	1.204
Pyrene	129-00-0	J	3.49	0.282 (S)	0.22	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	ND		0.197 (S)		
Chrysene <sup>4</sup>	218-01-9	J	0.630	0.206 (S)	0.29	1.003
Benzo[b]fluoranthene	205-99-2	ND		0.406 (S)		
Benzo[j,k]fluoranthenes		ND		0.449 (S)		
Benzo[e]pyrene	192-97-2	ND		0.568 (S)		
Benzo[a]pyrene	50-32-8	ND		0.610 (S)		
Perylene	198-55-0	ND		0.624 (S)		
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.834 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.368 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.334 (S)		
2-Methylnaphthalene	91-57-6	J	16.0	1.09 (S)	0.92	1.009
1-Methylnaphthalene	90-12-0	J	8.98	1.16 (S)	0.92	1.040
C1-Naphthalenes			24.9	1.09 (S)		
Biphenyl	92-52-4	J	6.02	0.247 (S)	0.29	1.005
C1-Biphenyls			7.97	0.309 (S)		
C2-Biphenyls			6.80	0.340 (S)		
C2-Naphthalenes			29.4	1.23 (S)		
1,2-Dimethylnaphthalene	573-98-8	ND		1.23 (S)		



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	5.52	1.01 (S)	0.72	1.011
C3-Naphthalenes			20.6	1.28 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	4.99	1.25 (S)	1.08	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	J	4.51	1.31 (S)	1.09	1.227
C4-Naphthalenes			7.70	0.643 (S)		
C1-Acenaphthenes		ND		0.869 (S)		
C1-Fluorenes			7.02	0.801 (S)		
1,7-Dimethylfluorene	442-66-0	ND		1.22 (S)		
C2-Fluorenes		ND		1.22 (S)		
C3-Fluorenes		ND		0.918 (S)		
Dibenzothiophene	132-65-0	J	2.36	0.638 (S)	0.10	1.003
C1-Dibenzothiophenes			1.04	0.399 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	NDR J	0.501	0.399 (S)	0.94	1.094
C2-Dibenzothiophenes			12.9	0.255 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	0.727	0.255 (S)	0.14	1.160
4,6-Dimethyldibenzothiophene	1207-12-1	J	0.532	0.219 (S)	0.19	1.153
C3-Dibenzothiophenes		ND		0.510 (S)		
C4-Dibenzothiophenes		ND		0.556 (S)		
3-Methylphenanthrene	832-71-3	J	2.54	0.307 (S)	0.64	1.088
2-Methylphenanthrene	2531-84-2	J	3.39	0.315 (S)	0.52	1.092
2-Methylanthracene	613-12-7	ND		0.301 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	1.61	0.307 (S)	0.67	1.107
1-Methylphenanthrene	832-69-9	J	1.74	0.306 (S)	0.60	1.110
3,6-Dimethylphenanthrene	1576-67-6	ND		0.603 (S)		
2,6-Dimethylphenanthrene	17980-16-4	ND		0.588 (S)		
1,7-Dimethylphenanthrene	483-87-4	J	0.676	0.575 (S)	0.41	1.193
1,8-Dimethylphenanthrene	7372-87-4	ND		0.588 (S)		
C3-Phenanthrenes/Anthracenes			0.676	0.316 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		0.316 (S)		
Retene	483-65-8	J	1.08	0.778 (S)	1.63	1.302
C4-Phenanthrenes/Anthracenes		ND		0.778 (S)		
C1-Fluoranthenes/Pyrenes			0.470	0.234 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	0.263	0.234 (S)	1.25	1.300
C2-Fluoranthenes/Pyrenes		ND		0.203 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.172 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.140 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.299 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	ND		0.296 (S)		
1-Methylchrysene	3351-28-8	ND		0.302 (S)		
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.310 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		0.310 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.439 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.594 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.820 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.820 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.627 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	NDR J	1.01	0.643 (S)	0.10	1.378
Fluoranthene d-10	93951-69-0		5250	0.417 (S)	0.17	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	434	0.472 (S)	0.27	1.004
Anthracene d-10			4140	1.86 (S)	0.15	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## CLIENT SAMPLE NO.

Travel blank

Sample Collection:

N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-1

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 12:03:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0535.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	912	45.5	0.09	0.609
2-Methylnaphthalene d-10		2010	1050	52.5	0.19	0.756
Biphenyl d-10		2020	1190	59.3		0.868
2,6-Dimethylnaphthalene d-12		2010	1220	61.0	0.79	0.895
Acenaphthylene d-8		2010	1250	62.4	0.15	0.961
Dibenzothiophene d-8		2010	1440	71.5	0.09	0.792
Phenanthrene d-10		2010	1670	83.4	0.15	0.808
Benzo[a]anthracene d-12		2010	1780	88.5	0.24	1.164
Chrysene d-12		2010	1830	91.2	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1910	95.7	0.21	0.957
Benzo[k]fluoranthene d-12		1990	1900	95.7	0.20	0.962
Benzo[a]pyrene d-12		2010	1850	92.1	0.20	1.008
Perylene d-12		2000	1810	90.7	0.24	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1650	82.1	0.18	1.206
Benzo[ghi]perylene d-12		1920	1610	83.8	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-1\_Form2\_PH2S0535.D\_SJ3023084.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
Day zero\_dialysis blank  
Sample Collection:  
N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 28-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 12:52:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No. SYN 9110

Lab Sample I.D.: L35931-2

Sample Size: 1 sample

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

Sample Data Filename: PH2S0536.D

Blank Data Filename: PH2S0534.D

Cal. Ver. Data Filename: PH2S0530.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	19.2	0.598 (S)	0.07	1.006
Acenaphthylene	208-96-8	ND		0.402 (S)		
Acenaphthene	83-32-9	J	1.79	1.10 (S)	1.23	1.047
2-Methylfluorene	1430-97-3	ND		0.645 (S)		
C2 Phenanthrenes/Anthracenes			1.94	0.554 (S)		
Fluorene	86-73-7	J	1.99	0.492 (S)	0.86	0.844
Phenanthrene	85-01-8	J	13.8	0.509 (S)	0.19	1.004
Anthracene	120-12-7	NDR J	0.710	0.513 (S)	0.14	1.011
C1 Phenanthrenes/Anthracenes			5.44	0.308 (S)		
Fluoranthene	206-44-0	J	5.26	0.186 (S)	0.21	1.204
Pyrene	129-00-0	J	2.61	0.184 (S)	0.24	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	ND		0.230 (S)		
Chrysene <sup>4</sup>	218-01-9	J	0.578	0.242 (S)	0.26	1.002
Benzo[b]fluoranthene	205-99-2	ND		0.677 (S)		
Benzo[j,k]fluoranthenes		ND		0.716 (S)		
Benzo[e]pyrene	192-97-2	ND		0.905 (S)		
Benzo[a]pyrene	50-32-8	ND		0.972 (S)		
Perylene	198-55-0	ND		1.01 (S)		
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.672 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.445 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.403 (S)		
2-Methylnaphthalene	91-57-6	J	14.2	0.761 (S)	0.90	1.009
1-Methylnaphthalene	90-12-0	J	7.55	0.808 (S)	0.96	1.040
C1-Naphthalenes			21.7	0.761 (S)		
Biphenyl	92-52-4	J	5.05	0.785 (S)	0.31	1.005
C1-Biphenyls			5.55	0.363 (S)		
C2-Biphenyls			4.34	0.858 (S)		
C2-Naphthalenes			26.8	0.747 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	0.791	0.747 (S)	1.48	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	4.09	0.614 (S)	0.80	1.011
C3-Naphthalenes			11.8	0.855 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	3.78	0.835 (S)	0.81	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	NDR J	2.77	0.877 (S)	1.28	1.227
C4-Naphthalenes			2.46	0.674 (S)		
C1-Acenaphthenes		ND		0.623 (S)		
C1-Fluorenes			4.24	0.645 (S)		
1,7-Dimethylfluorene	442-66-0	ND		0.904 (S)		
C2-Fluorenes			0.979	0.904 (S)		
C3-Fluorenes			3.13	1.13 (S)		
Dibenzothiophene	132-65-0	J	1.53	0.607 (S)	0.08	1.003
C1-Dibenzothiophenes			0.646	0.331 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	ND		0.331 (S)		
C2-Dibenzothiophenes			1.37	0.510 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	0.567	0.510 (S)	0.19	1.160
4,6-Dimethyldibenzothiophene	1207-12-1	ND		0.438 (S)		
C3-Dibenzothiophenes		ND		0.404 (S)		
C4-Dibenzothiophenes		ND		0.276 (S)		
3-Methylphenanthrene	832-71-3	J	1.51	0.309 (S)	0.66	1.088
2-Methylphenanthrene	2531-84-2	J	2.05	0.316 (S)	0.53	1.092
2-Methylanthracene	613-12-7	ND		0.302 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	0.978	0.309 (S)	0.65	1.107
1-Methylphenanthrene	832-69-9	J	0.893	0.308 (S)	0.59	1.110
3,6-Dimethylphenanthrene	1576-67-6	ND		0.567 (S)		
2,6-Dimethylphenanthrene	17980-16-4	ND		0.554 (S)		
1,7-Dimethylphenanthrene	483-87-4	ND		0.541 (S)		
1,8-Dimethylphenanthrene	7372-87-4	ND		0.554 (S)		
C3-Phenanthrenes/Anthracenes		ND		0.422 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		0.422 (S)		
Retene	483-65-8	J	0.889	0.602 (S)	1.64	1.302
C4-Phenanthrenes/Anthracenes		ND		0.602 (S)		
C1-Fluoranthenes/Pyrenes		ND		0.428 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	ND		0.428 (S)		
C2-Fluoranthenes/Pyrenes		ND		0.198 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.231 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.148 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.351 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	ND		0.347 (S)		
1-Methylchrysene	3351-28-8	ND		0.355 (S)		
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.243 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		0.243 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.394 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.606 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.958 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.958 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.620 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	ND		0.674 (S)		
Fluoranthene d-10	93951-69-0		5580	0.560 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	430	1.09 (S)	0.26	1.004
Anthracene d-10			4140	1.18 (S)	0.15	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

CLIENT SAMPLE NO.  
Day zero\_dialysis blank  
Sample Collection:  
N/A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-2

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 12:52:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0536.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	1030	51.2	0.09	0.609
2-Methylnaphthalene d-10		2010	1120	56.0	0.19	0.755
Biphenyl d-10		2020	1230	60.9		0.868
2,6-Dimethylnaphthalene d-12		2010	1250	62.2	0.79	0.896
Acenaphthylene d-8		2010	1260	62.9	0.16	0.961
Dibenzothiophene d-8		2010	1620	80.5	0.09	0.792
Phenanthrene d-10		2010	1740	86.5	0.15	0.808
Benzo[a]anthracene d-12		2010	1640	81.8	0.24	1.164
Chrysene d-12		2010	1710	85.3	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1910	95.4	0.21	0.957
Benzo[k]fluoranthene d-12		1990	1890	95.2	0.20	0.962
Benzo[a]pyrene d-12		2010	1820	90.6	0.20	1.008
Perylene d-12		2000	1820	91.0	0.24	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1610	80.4	0.18	1.206
Benzo[ghi]perylene d-12		1920	1590	82.6	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-2\_Form2\_PH2S0536.D\_SJ3023085.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## CLIENT SAMPLE NO.

Spike blank

Sample Collection:

N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 28-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 11-Feb-2022 Time: 12:10:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No.

SYN 9110

Lab Sample I.D.:

L35931-3 i

Sample Size:

1 sample

Initial Calibration Date:

10-Feb-2022

Instrument ID:

LR GC/MS

GC Column ID:

RTX5

Sample Data Filename:

PH2U0083.D

Blank Data Filename:

PH2S0534.D

Cal. Ver. Data Filename:

PH2U0076.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	24.5	0.879 (S)	0.07	1.007
Acenaphthylene	208-96-8	J	3.51	0.860 (S)	0.19	1.003
Acenaphthene	83-32-9	J	5.41	0.520 (S)	1.22	1.048
2-Methylfluorene	1430-97-3	J	2.76	0.854 (S)	1.08	0.939
C2 Phenanthrenes/Anthracenes			7.42	0.594 (S)		
Fluorene	86-73-7	J	4.11	0.393 (S)	1.13	0.844
Phenanthrene	85-01-8	J	22.4	0.151 (S)	0.20	1.004
Anthracene	120-12-7	J	3.27	0.147 (S)	0.18	1.013
C1 Phenanthrenes/Anthracenes			12.2	0.252 (S)		
Fluoranthene	206-44-0	J	8.78	0.321 (S)	0.17	1.206
Pyrene	129-00-0	J	6.94	0.314 (S)	0.18	1.241
Benz[a]anthracene <sup>3</sup>	56-55-3	J	3.90	0.201 (S)	0.23	1.003
Chrysene <sup>4</sup>	218-01-9	J	4.23	0.185 (S)	0.34	1.003
Benzo[b]fluoranthene	205-99-2	J	2.58	0.388 (S)	0.23	1.004
Benzo[j,k]fluoranthenes		J	3.52	0.405 (S)	0.24	1.003
Benzo[e]pyrene	192-97-2	J	2.76	0.491 (S)	0.17	0.996
Benzo[a]pyrene	50-32-8	J	3.14	0.521 (S)	0.23	1.005
Perylene	198-55-0	NDR J	3.06	0.544 (S)	0.41	1.005
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	J	4.18	0.344 (S)	0.14	1.008
Indeno[1,2,3-cd]pyrene	193-39-5	J	3.42	0.303 (S)	0.16	1.003
Benzo[ghi]perylene	191-24-2	J	3.70	0.294 (S)	0.14	1.003
2-Methylnaphthalene	91-57-6	J	17.9	1.00 (S)	0.86	1.010
1-Methylnaphthalene	90-12-0	J	10.1	1.06 (S)	0.91	1.040
C1-Naphthalenes			28.0	1.00 (S)		
Biphenyl	92-52-4	J	7.85	0.450 (S)	0.29	1.006
C1-Biphenyls			5.41	0.312 (S)		
C2-Biphenyls			5.26	0.437 (S)		
C2-Naphthalenes			28.2	1.14 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	4.11	1.14 (S)	1.36	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	6.84	0.963 (S)	0.56	1.011
C3-Naphthalenes			17.6	0.666 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	6.56	0.655 (S)	0.74	1.209
2,3,5-Trimethylnaphthalene	2245-38-7	J	6.68	0.677 (S)	0.86	1.226
C4-Naphthalenes			6.78	0.492 (S)		
C1-Acenaphthenes		ND		0.621 (S)		
C1-Fluorenes			8.22	0.854 (S)		
1,7-Dimethylfluorene	442-66-0	J	2.16	0.602 (S)	0.06	1.035
C2-Fluorenes			9.91	0.602 (S)		
C3-Fluorenes		ND		1.01 (S)		
Dibenzothiophene	132-65-0	J	5.16	0.221 (S)	0.08	1.003
C1-Dibenzothiophenes			3.38	0.358 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	2.69	0.358 (S)	0.62	1.096
C2-Dibenzothiophenes			5.10	0.242 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	0.342	0.242 (S)	1.09	1.164
4,6-Dimethyldibenzothiophene	1207-12-1	J	2.99	0.211 (S)	0.17	1.154
C3-Dibenzothiophenes		ND		0.559 (S)		
C4-Dibenzothiophenes		ND		0.153 (S)		
3-Methylphenanthrene	832-71-3	J	2.15	0.247 (S)	0.50	1.089
2-Methylphenanthrene	2531-84-2	J	4.35	0.260 (S)	0.59	1.094
2-Methylanthracene	613-12-7	J	1.54	0.230 (S)	0.44	1.101
9/4-Methylphenanthrene	883-20-5/832-64-4	J	1.17	0.247 (S)	0.57	1.107
1-Methylphenanthrene	832-69-9	J	3.02	0.252 (S)	0.53	1.111
3,6-Dimethylphenanthrene	1576-67-6	J	2.98	0.611 (S)	0.41	1.166
2,6-Dimethylphenanthrene	17980-16-4	ND		0.594 (S)		
1,7-Dimethylphenanthrene	483-87-4	J	2.73	0.578 (S)	0.35	1.194
1,8-Dimethylphenanthrene	7372-87-4	ND		0.594 (S)		
C3-Phenanthrenes/Anthracenes			3.87	0.319 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	J	3.76	0.319 (S)	0.61	1.295
Retene	483-65-8	J	5.36	0.736 (S)	1.36	1.302
C4-Phenanthrenes/Anthracenes			4.70	0.736 (S)		
C1-Fluoranthenes/Pyrenes		ND		0.456 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	2.92	0.456 (S)	1.13	1.302
C2-Fluoranthenes/Pyrenes		ND		0.193 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.477 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.142 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			5.60	0.196 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	J	3.28	0.194 (S)		1.066
1-Methylchrysene	3351-28-8	J	2.99	0.199 (S)		1.074
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			2.34	0.200 (S)		
5,9-Dimethylchrysene	139493-40-6	J	2.49	0.200 (S)		1.126
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			0.222	0.175 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.292 (S)		
C1-Benzofluoranthenes/Benzopyrenes			2.69	0.355 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	J	2.85	0.355 (S)		1.110
C2-Benzofluoranthenes/Benzopyrenes		ND		0.407 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	NDR J	4.27	0.492 (S)	0.09	1.376
Fluoranthene d-10	93951-69-0	J	5.48	0.275 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	32.3	0.290 (S)	0.23	1.004
Anthracene d-10		J	10.0	0.466 (S)	0.11	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## CLIENT SAMPLE NO.

Spike blank

Sample Collection:

N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-3 i

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

10-Feb-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 11-Feb-2022 Time: 12:10:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2U0083.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2U0076.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	1140	56.7	0.09	0.609
2-Methylnaphthalene d-10		2010	1230	61.4	0.19	0.756
Biphenyl d-10		2020	1310	65.2		0.868
2,6-Dimethylnaphthalene d-12		2010	1330	66.5	0.71	0.896
Acenaphthylene d-8		2010	1360	67.7	0.15	0.961
Dibenzothiophene d-8		2010	1550	77.2	0.08	0.791
Phenanthrene d-10		2010	1610	80.5	0.14	0.808
Benzo[a]anthracene d-12		2010	1980	98.5	0.23	1.166
Chrysene d-12		2010	2020	100	0.26	1.170
Benzo[b]fluoranthene d-12		2000	1960	97.8	0.20	0.958
Benzo[k]fluoranthene d-12		1990	1920	96.4	0.19	0.961
Benzo[a]pyrene d-12		2010	2000	99.8	0.20	1.009
Perylene d-12		2000	1970	98.7	0.24	1.024
Indeno[1,2,3-cd]pyrene d-12		2010	2180	109	0.18	1.208
Benzo[ghi]perylene d-12		1920	1970	103	0.19	1.239

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-3\_Form2\_PH2U0083.D\_SJ3027659.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
Treated OSPW field Blank\_SPMD  
Sample Collection:  
N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 28-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 13:41:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No.

SYN 9110

Lab Sample I.D.:

L35931-4

Sample Size:

1 sample

Initial Calibration Date:

28-Jan-2022

Instrument ID:

LR GC/MS

GC Column ID:

RTX5

Sample Data Filename:

PH2S0537.D

Blank Data Filename:

PH2S0534.D

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	21.6	0.582 (S)	0.08	1.006
Acenaphthylene	208-96-8	J	0.371	0.325 (S)	0.23	1.002
Acenaphthene	83-32-9	J	2.04	1.06 (S)	1.01	1.047
2-Methylfluorene	1430-97-3	ND		0.621 (S)		
C2 Phenanthrenes/Anthracenes			4.27	0.531 (S)		
Fluorene	86-73-7	J	1.94	0.560 (S)	1.08	0.844
Phenanthrene	85-01-8	J	20.2	0.538 (S)	0.20	1.003
Anthracene	120-12-7	J	0.662	0.542 (S)	0.22	1.011
C1 Phenanthrenes/Anthracenes			9.16	0.459 (S)		
Fluoranthene	206-44-0	J	8.95	0.231 (S)	0.21	1.204
Pyrene	129-00-0	J	5.23	0.228 (S)	0.19	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	J	0.187	0.150 (S)	0.27	1.003
Chrysene <sup>4</sup>	218-01-9	J	0.606	0.168 (S)	0.27	1.003
Benzo[b]fluoranthene	205-99-2	ND		0.353 (S)		
Benzo[j,k]fluoranthenes		ND		0.377 (S)		
Benzo[e]pyrene	192-97-2	ND		0.496 (S)		
Benzo[a]pyrene	50-32-8	ND		0.533 (S)		
Perylene	198-55-0	ND		0.530 (S)		
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.315 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.268 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.249 (S)		
2-Methylnaphthalene	91-57-6	J	17.1	0.671 (S)	0.93	1.009
1-Methylnaphthalene	90-12-0	J	9.34	0.712 (S)	0.89	1.040
C1-Naphthalenes			26.4	0.671 (S)		
Biphenyl	92-52-4	J	5.96	0.259 (S)	0.29	1.005
C1-Biphenyls			6.79	0.457 (S)		
C2-Biphenyls			5.75	0.807 (S)		
C2-Naphthalenes			29.6	0.505 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	1.27	0.505 (S)	1.44	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	5.01	0.415 (S)	0.73	1.011
C3-Naphthalenes			14.3	0.843 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	4.06	0.823 (S)	1.01	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	J	3.16	0.864 (S)	1.03	1.229
C4-Naphthalenes			4.19	0.710 (S)		
C1-Acenaphthenes		ND		0.662 (S)		
C1-Fluorenes			4.43	0.621 (S)		
1,7-Dimethylfluorene	442-66-0	ND		1.23 (S)		
C2-Fluorenes			2.00	1.23 (S)		
C3-Fluorenes			6.16	1.05 (S)		
Dibenzothiophene	132-65-0	J	1.88	0.517 (S)	0.10	1.003
C1-Dibenzothiophenes			1.32	0.347 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	0.439	0.347 (S)	0.80	1.094
C2-Dibenzothiophenes			10.5	0.802 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	ND		0.802 (S)		
4,6-Dimethyldibenzothiophene	1207-12-1	ND		0.689 (S)		
C3-Dibenzothiophenes		ND		0.401 (S)		
C4-Dibenzothiophenes		ND		0.317 (S)		
3-Methylphenanthrene	832-71-3	J	2.64	0.460 (S)	0.59	1.088
2-Methylphenanthrene	2531-84-2	J	3.17	0.471 (S)	0.65	1.092
2-Methylanthracene	613-12-7	ND		0.450 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	1.72	0.460 (S)	0.64	1.107
1-Methylphenanthrene	832-69-9	J	1.64	0.459 (S)	0.70	1.110
3,6-Dimethylphenanthrene	1576-67-6	ND		0.544 (S)		
2,6-Dimethylphenanthrene	17980-16-4	ND		0.531 (S)		
1,7-Dimethylphenanthrene	483-87-4	J	0.779	0.519 (S)	0.40	1.193
1,8-Dimethylphenanthrene	7372-87-4	ND		0.531 (S)		
C3-Phenanthrenes/Anthracenes			1.09	0.456 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		0.456 (S)		
Retene	483-65-8	J	1.13	0.612 (S)	1.82	1.301
C4-Phenanthrenes/Anthracenes		ND		0.612 (S)		
C1-Fluoranthenes/Pyrenes			0.288	0.199 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	0.498	0.199 (S)	1.20	1.298
C2-Fluoranthenes/Pyrenes		ND		0.276 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.230 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.169 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.224 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	ND		0.222 (S)		
1-Methylchrysene	3351-28-8	ND		0.227 (S)		
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.313 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		0.313 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.246 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.335 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.696 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.696 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.541 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	ND		0.710 (S)		
Fluoranthene d-10	93951-69-0		4720	0.417 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	438	1.00 (S)	0.30	1.004
Anthracene d-10			4140	2.27 (S)	0.15	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

CLIENT SAMPLE NO.  
Treated OSPW field Blank\_SPMD  
Sample Collection:  
N/A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-4

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 13:41:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0537.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	995	49.6	0.09	0.609
2-Methylnaphthalene d-10		2010	1110	55.3	0.19	0.755
Biphenyl d-10		2020	1210	60.2		0.868
2,6-Dimethylnaphthalene d-12		2010	1230	61.5	0.79	0.896
Acenaphthylene d-8		2010	1260	62.9	0.15	0.961
Dibenzothiophene d-8		2010	1440	71.8	0.09	0.792
Phenanthrene d-10		2010	1570	78.3	0.15	0.808
Benzo[a]anthracene d-12		2010	1930	96.0	0.24	1.164
Chrysene d-12		2010	1960	97.6	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1940	97.0	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1930	97.1	0.20	0.962
Benzo[a]pyrene d-12		2010	1870	93.1	0.20	1.009
Perylene d-12		2000	1870	93.4	0.25	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1780	89.0	0.18	1.206
Benzo[ghi]perylene d-12		1920	1710	89.0	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-4\_Form2\_PH2S0537.D\_SJ3023086.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water field Blank\_SPMD  
Sample Collection:  
N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 28-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 14:30:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No.

SYN 9110

Lab Sample I.D.:

L35931-5

Sample Size:

1 sample

Initial Calibration Date:

28-Jan-2022

Instrument ID:

LR GC/MS

GC Column ID:

RTX5

Sample Data Filename:

PH2S0538.D

Blank Data Filename:

PH2S0534.D

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	23.3	0.461 (S)	0.08	1.006
Acenaphthylene	208-96-8	J	0.376	0.332 (S)	0.20	1.003
Acenaphthene	83-32-9	J	1.99	0.942 (S)	0.99	1.048
2-Methylfluorene	1430-97-3	ND		0.622 (S)		
C2 Phenanthrenes/Anthracenes			3.31	1.48 (S)		
Fluorene	86-73-7	J	2.24	0.258 (S)	1.07	0.844
Phenanthrene	85-01-8	J	19.8	0.620 (S)	0.19	1.003
Anthracene	120-12-7	J	0.756	0.625 (S)	0.23	1.011
C1 Phenanthrenes/Anthracenes			7.91	0.329 (S)		
Fluoranthene	206-44-0	J	6.60	0.146 (S)	0.25	1.204
Pyrene	129-00-0	J	3.28	0.144 (S)	0.25	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	ND		0.130 (S)		
Chrysene <sup>4</sup>	218-01-9	J	0.208	0.134 (S)	0.33	1.003
Benzo[b]fluoranthene	205-99-2	ND		0.369 (S)		
Benzo[j,k]fluoranthenes		ND		0.385 (S)		
Benzo[e]pyrene	192-97-2	ND		0.502 (S)		
Benzo[a]pyrene	50-32-8	ND		0.540 (S)		
Perylene	198-55-0	ND		0.538 (S)		
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.567 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.429 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.410 (S)		
2-Methylnaphthalene	91-57-6	J	17.6	0.967 (S)	0.92	1.009
1-Methylnaphthalene	90-12-0	J	9.39	1.03 (S)	0.95	1.040
C1-Naphthalenes			27.0	0.967 (S)		
Biphenyl	92-52-4	J	5.79	0.172 (S)	0.28	1.005
C1-Biphenyls			6.79	0.455 (S)		
C2-Biphenyls			5.86	0.517 (S)		
C2-Naphthalenes			29.3	0.509 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	1.20	0.509 (S)	1.59	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	5.36	0.418 (S)	0.73	1.011
C3-Naphthalenes			14.4	1.11 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	3.93	1.08 (S)	1.01	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	NDR J	3.35	1.13 (S)	1.42	1.227
C4-Naphthalenes			5.71	0.827 (S)		
C1-Acenaphthenes		ND		0.668 (S)		
C1-Fluorenes			6.65	0.622 (S)		
1,7-Dimethylfluorene	442-66-0	ND		0.691 (S)		
C2-Fluorenes			3.14	0.691 (S)		
C3-Fluorenes			2.02	1.04 (S)		
Dibenzothiophene	132-65-0	NDR J	1.73	0.633 (S)	0.06	1.003
C1-Dibenzothiophenes			1.17	0.319 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	0.387	0.319 (S)	0.82	1.095
C2-Dibenzothiophenes			12.2	0.371 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	0.760	0.371 (S)	0.36	1.160
4,6-Dimethyldibenzothiophene	1207-12-1	J	0.577	0.318 (S)	0.17	1.153
C3-Dibenzothiophenes		ND		0.297 (S)		
C4-Dibenzothiophenes			0.542	0.259 (S)		
3-Methylphenanthrene	832-71-3	J	2.17	0.330 (S)	0.63	1.088
2-Methylphenanthrene	2531-84-2	J	2.87	0.338 (S)	0.55	1.092
2-Methylanthracene	613-12-7	ND		0.323 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	1.50	0.330 (S)	0.68	1.107
1-Methylphenanthrene	832-69-9	J	1.37	0.329 (S)	0.63	1.110
3,6-Dimethylphenanthrene	1576-67-6	ND		1.51 (S)		
2,6-Dimethylphenanthrene	17980-16-4	ND		1.48 (S)		
1,7-Dimethylphenanthrene	483-87-4	ND		1.44 (S)		
1,8-Dimethylphenanthrene	7372-87-4	ND		1.48 (S)		
C3-Phenanthrenes/Anthracenes		ND		0.329 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		0.329 (S)		
Retene	483-65-8	J	0.926	0.631 (S)	1.73	1.302
C4-Phenanthrenes/Anthracenes		ND		0.631 (S)		
C1-Fluoranthenes/Pyrenes			0.557	0.528 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	ND		0.528 (S)		
C2-Fluoranthenes/Pyrenes		ND		0.217 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.217 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.149 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.250 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	ND		0.247 (S)		
1-Methylchrysene	3351-28-8	ND		0.252 (S)		
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.259 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		0.259 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.323 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.647 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.397 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.397 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.867 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	ND		0.827 (S)		
Fluoranthene d-10	93951-69-0		4720	0.282 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	448	1.18 (S)	0.27	1.004
Anthracene d-10			4120	1.53 (S)	0.15	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water field Blank\_SPMD  
Sample Collection:  
N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-5

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 14:30:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0538.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	1080	54.0	0.09	0.609
2-Methylnaphthalene d-10		2010	1240	61.5	0.19	0.755
Biphenyl d-10		2020	1360	67.7		0.868
2,6-Dimethylnaphthalene d-12		2010	1400	69.6	0.79	0.895
Acenaphthylene d-8		2010	1410	70.2	0.16	0.961
Dibenzothiophene d-8		2010	1450	72.1	0.09	0.792
Phenanthrene d-10		2010	1580	78.8	0.15	0.808
Benzo[a]anthracene d-12		2010	1800	89.4	0.25	1.164
Chrysene d-12		2010	1840	91.3	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1770	88.3	0.21	0.957
Benzo[k]fluoranthene d-12		1990	1760	88.2	0.20	0.962
Benzo[a]pyrene d-12		2010	1750	87.1	0.20	1.008
Perylene d-12		2000	1750	87.7	0.25	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1670	83.2	0.18	1.206
Benzo[ghi]perylene d-12		1920	1620	84.6	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-5\_Form2\_PH2S0538.D\_SJ3023087.html; Workgroup: WG79135; Design ID: 4460 ]



SGS AXYS METHOD MLA-021 Rev 12

Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
Treated OSPW \_SPMD  
Sample Collection:  
01-Oct-2021 13:00

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Matrix: SPMD

Lab Sample I.D.:

L35931-6

Sample Receipt Date: 28-Oct-2021

Sample Size:

1 sample

Extraction Date: 22-Dec-2021

Initial Calibration Date:

28-Jan-2022

Analysis Date: 31-Jan-2022 Time: 22:18:00

Instrument ID:

LR GC/MS

Extract Volume (uL): 500

Sample Data Filename:

PH2S0550.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3		37.2	0.573 (S)	0.07	1.006
Acenaphthylene	208-96-8	J	8.06	1.47 (S)	0.21	1.003
Acenaphthene	83-32-9		146	1.37 (S)	1.22	1.047
2-Methylfluorene	1430-97-3		36.1	4.10 (S)	1.24	0.939
C2 Phenanthrenes/Anthracenes			448	3.75 (S)		
Fluorene	86-73-7		100	0.748 (S)	1.03	0.843
Phenanthrene	85-01-8		333	3.14 (S)	0.20	1.003
Anthracene	120-12-7	J	4.14	3.17 (S)	0.22	1.011
C1 Phenanthrenes/Anthracenes			594	2.19 (S)		
Fluoranthene	206-44-0	J	21.5	1.69 (S)	0.23	1.204
Pyrene	129-00-0		53.7	1.66 (S)	0.21	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	ND		1.20 (S)		
Chrysene <sup>4</sup>	218-01-9		64.9	1.29 (S)	0.31	1.002
Benzo[b]fluoranthene	205-99-2	J	1.24	0.781 (S)	0.22	1.004
Benzo[j,k]fluoranthenes		ND		0.912 (S)		
Benzo[e]pyrene	192-97-2	J	6.60	1.19 (S)	0.22	0.996
Benzo[a]pyrene	50-32-8	ND		1.27 (S)		
Perylene	198-55-0	J	1.92	1.28 (S)	0.23	1.004
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.662 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	NDR J	0.768	0.591 (S)	0.70	1.002
Benzo[ghi]perylene	191-24-2	J	1.59	0.564 (S)	0.18	1.002
2-Methylnaphthalene	91-57-6		103	1.45 (S)	0.91	1.009
1-Methylnaphthalene	90-12-0		113	1.54 (S)	0.92	1.040
C1-Naphthalenes			216	1.45 (S)		
Biphenyl	92-52-4	J	19.5	0.318 (S)	0.30	1.005
C1-Biphenyls			53.1	0.485 (S)		
C2-Biphenyls			67.5	0.952 (S)		
C2-Naphthalenes			1080	1.59 (S)		
1,2-Dimethylnaphthalene	573-98-8		113	1.59 (S)	1.34	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0		152	1.31 (S)	0.72	1.011
C3-Naphthalenes			1280	2.53 (S)		
2,3,6-Trimethylnaphthalene	829-26-5		302	2.47 (S)	0.98	1.204
2,3,5-Trimethylnaphthalene	2245-38-7		273	2.59 (S)	1.09	1.226
C4-Naphthalenes			484	3.63 (S)		
C1-Acenaphthenes			23.8	0.640 (S)		
C1-Fluorenes			234	4.10 (S)		
1,7-Dimethylfluorene	442-66-0	J	23.2	2.41 (S)	0.10	1.034
C2-Fluorenes			332	2.41 (S)		
C3-Fluorenes			276	6.50 (S)		
Dibenzothiophene	132-65-0		147	0.955 (S)	0.09	1.003
C1-Dibenzothiophenes			508	1.65 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3		135	1.65 (S)	0.74	1.095
C2-Dibenzothiophenes			787	2.49 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR	56.8	2.49 (S)	0.85	1.163
4,6-Dimethyldibenzothiophene	1207-12-1		108	2.14 (S)	0.18	1.153
C3-Dibenzothiophenes			549	1.03 (S)		
C4-Dibenzothiophenes			179	3.76 (S)		
3-Methylphenanthrene	832-71-3		122	2.20 (S)	0.62	1.088
2-Methylphenanthrene	2531-84-2		171	2.25 (S)	0.59	1.092
2-Methylanthracene	613-12-7	ND		2.15 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4		188	2.20 (S)	0.60	1.106
1-Methylphenanthrene	832-69-9		114	2.19 (S)	0.60	1.110
3,6-Dimethylphenanthrene	1576-67-6	NDR	43.2	3.84 (S)	1.13	1.164
2,6-Dimethylphenanthrene	17980-16-4		28.6	3.75 (S)	0.31	1.171
1,7-Dimethylphenanthrene	483-87-4		65.8	3.66 (S)	0.34	1.192
1,8-Dimethylphenanthrene	7372-87-4	J	15.9	3.75 (S)	0.40	1.210
C3-Phenanthrenes/Anthracenes			334	3.48 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	J	14.8	3.48 (S)	0.61	1.292
Retene	483-65-8	J	17.6	9.55 (S)	1.46	1.302
C4-Phenanthrenes/Anthracenes			388	9.55 (S)		
C1-Fluoranthenes/Pyrenes			46.7	2.59 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	15.6	2.59 (S)	1.04	1.300
C2-Fluoranthenes/Pyrenes			53.8	0.886 (S)		
C3-Fluoranthenes/Pyrenes			30.2	1.20 (S)		
C4-Fluoranthenes/Pyrenes			8.85	0.837 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			51.5	0.888 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	J	3.46	0.879 (S)		1.065
1-Methylchrysene	3351-28-8	J	2.85	0.898 (S)		1.072
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			37.6	0.944 (S)		
5,9-Dimethylchrysene	139493-40-6	J	5.78	0.944 (S)		1.124
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			8.19	0.851 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.713 (S)		
C1-Benzofluoranthenes/Benzopyrenes			7.17	1.08 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	J	1.09	1.08 (S)		1.108
C2-Benzofluoranthenes/Benzopyrenes			2.85	1.32 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6		65.3	3.63 (S)	0.03	1.377
Fluoranthene d-10	93951-69-0		4390	2.89 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	407	3.29 (S)	0.29	1.004
Anthracene d-10			2880	1.24 (S)	0.15	1.008

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

CLIENT SAMPLE NO.  
Treated OSPW \_SPMD  
Sample Collection:  
01-Oct-2021 13:00

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-6

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 22:18:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0550.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	765	38.1	0.09	0.609
2-Methylnaphthalene d-10		2010	1010	50.1	0.19	0.756
Biphenyl d-10		2020	1140	56.6		0.868
2,6-Dimethylnaphthalene d-12		2010	1200	60.0	0.78	0.896
Acenaphthylene d-8		2010	1220	61.0	0.15	0.961
Dibenzothiophene d-8		2010	1480	73.5	0.09	0.792
Phenanthrene d-10		2010	1590	79.1	0.15	0.808
Benzo[a]anthracene d-12		2010	1870	92.8	0.24	1.164
Chrysene d-12		2010	1840	91.7	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1930	96.4	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1840	92.7	0.20	0.962
Benzo[a]pyrene d-12		2010	1720	85.7	0.21	1.009
Perylene d-12		2000	1750	87.4	0.25	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1410	70.5	0.18	1.206
Benzo[ghi]perylene d-12		1920	1360	71.1	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-6\_Form2\_PH2S0550.D\_SJ3023076.html; Workgroup: WG79135; Design ID: 4460 ]



SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water 1\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-7

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 23:07:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0551.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	10.1	0.629 (S)	0.08	1.006
Acenaphthylene	208-96-8	J	1.47	0.286 (S)	0.19	1.003
Acenaphthene	83-32-9	J	7.36	0.715 (S)	1.26	1.047
2-Methylfluorene	1430-97-3	J	1.52	0.690 (S)	1.23	0.939
C2 Phenanthrenes/Anthracenes			33.8	2.06 (S)		
Fluorene	86-73-7	J	5.73	0.437 (S)	1.04	0.844
Phenanthrene	85-01-8		40.6	0.734 (S)	0.20	1.003
Anthracene	120-12-7	NDR J	1.79	0.740 (S)	0.27	1.011
C1 Phenanthrenes/Anthracenes			34.7	0.785 (S)		
Fluoranthene	206-44-0	J	19.0	0.984 (S)	0.20	1.204
Pyrene	129-00-0	J	17.9	0.970 (S)	0.20	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	J	4.62	0.812 (S)	0.28	1.002
Chrysene <sup>4</sup>	218-01-9	J	10.1	0.857 (S)	0.35	1.002
Benzo[b]fluoranthene	205-99-2	J	4.34	0.297 (S)	0.24	1.004
Benzo[j,k]fluoranthenes		J	4.18	0.321 (S)	0.22	1.002
Benzo[e]pyrene	192-97-2	J	4.34	0.423 (S)	0.23	0.996
Benzo[a]pyrene	50-32-8	J	4.36	0.455 (S)	0.21	1.003
Perylene	198-55-0	J	8.34	0.474 (S)	0.19	1.004
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	J	3.29	0.573 (S)	0.17	1.007
Indeno[1,2,3-cd]pyrene	193-39-5	J	4.71	0.569 (S)	0.24	1.002
Benzo[ghi]perylene	191-24-2	J	4.98	0.531 (S)	0.23	1.002
2-Methylnaphthalene	91-57-6	J	8.68	0.625 (S)	0.94	1.009
1-Methylnaphthalene	90-12-0	J	8.78	0.663 (S)	0.95	1.040
C1-Naphthalenes			17.5	0.625 (S)		
Biphenyl	92-52-4	J	4.38	0.200 (S)	0.30	1.005
C1-Biphenyls			7.54	0.354 (S)		
C2-Biphenyls			8.22	0.847 (S)		
C2-Naphthalenes			43.1	0.690 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	2.41	0.690 (S)	1.33	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	7.32	0.567 (S)	0.70	1.011
C3-Naphthalenes			38.9	1.46 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	9.43	1.43 (S)	1.03	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	NDR J	7.68	1.50 (S)	1.13	1.226
C4-Naphthalenes			26.6	1.65 (S)		
C1-Acenaphthenes		ND		0.736 (S)		
C1-Fluorenes			11.4	0.690 (S)		
1,7-Dimethylfluorene	442-66-0	ND		2.78 (S)		
C2-Fluorenes			21.9	2.78 (S)		
C3-Fluorenes			24.1	2.10 (S)		
Dibenzothiophene	132-65-0	J	4.73	1.65 (S)	0.09	1.003
C1-Dibenzothiophenes			13.4	1.29 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	4.03	1.29 (S)	0.76	1.094
C2-Dibenzothiophenes			53.1	0.889 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	2.31	0.889 (S)	1.28	1.162
4,6-Dimethyldibenzothiophene	1207-12-1	J	7.44	0.763 (S)	0.17	1.153
C3-Dibenzothiophenes			74.6	0.866 (S)		
C4-Dibenzothiophenes			27.0	1.30 (S)		
3-Methylphenanthrene	832-71-3	J	8.23	0.787 (S)	0.62	1.088
2-Methylphenanthrene	2531-84-2	J	10.8	0.807 (S)	0.63	1.092
2-Methylanthracene	613-12-7	J	0.867	0.771 (S)	0.45	1.099
9/4-Methylphenanthrene	883-20-5/832-64-4	J	8.46	0.787 (S)	0.65	1.107
1-Methylphenanthrene	832-69-9	J	6.38	0.785 (S)	0.62	1.110
3,6-Dimethylphenanthrene	1576-67-6	NDR J	4.09	2.12 (S)	0.87	1.164
2,6-Dimethylphenanthrene	17980-16-4	J	2.74	2.06 (S)	0.36	1.171
1,7-Dimethylphenanthrene	483-87-4	J	5.12	2.02 (S)	0.37	1.193
1,8-Dimethylphenanthrene	7372-87-4	ND		2.06 (S)		
C3-Phenanthrenes/Anthracenes			45.7	1.62 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	J	3.50	1.62 (S)	0.55	1.294
Retene	483-65-8	J	20.0	3.89 (S)	1.39	1.302
C4-Phenanthrenes/Anthracenes			76.9	3.89 (S)		
C1-Fluoranthenes/Pyrenes			15.1	0.642 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	5.58	0.642 (S)	1.17	1.301
C2-Fluoranthenes/Pyrenes			17.0	0.544 (S)		
C3-Fluoranthenes/Pyrenes			4.07	0.889 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.395 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			15.7	0.597 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	J	4.83	0.591 (S)		1.065
1-Methylchrysene	3351-28-8	J	5.24	0.604 (S)		1.072
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			8.98	0.501 (S)		
5,9-Dimethylchrysene	139493-40-6	J	4.41	0.501 (S)		1.124
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.592 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.478 (S)		
C1-Benzofluoranthenes/Benzopyrenes			2.63	0.673 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	J	3.33	0.673 (S)		1.107
C2-Benzofluoranthenes/Benzopyrenes		ND		0.593 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	NDR J	5.12	1.65 (S)	0.06	1.378
Fluoranthene d-10	93951-69-0		4200	1.78 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	447	1.10 (S)	0.32	1.004
Anthracene d-10			3010	0.671 (S)	0.15	1.008

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

CLIENT SAMPLE NO.  
River Water 1\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-7

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 28-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 23:07:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0551.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	904	45.1	0.09	0.609
2-Methylnaphthalene d-10		2010	1050	52.4	0.19	0.755
Biphenyl d-10		2020	1150	56.9		0.868
2,6-Dimethylnaphthalene d-12		2010	1180	58.8	0.78	0.895
Acenaphthylene d-8		2010	1180	58.7	0.15	0.961
Dibenzothiophene d-8		2010	1310	65.3	0.09	0.792
Phenanthrene d-10		2010	1490	74.5	0.15	0.808
Benzo[a]anthracene d-12		2010	1890	93.9	0.24	1.164
Chrysene d-12		2010	1860	92.4	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1890	94.6	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1860	93.2	0.20	0.962
Benzo[a]pyrene d-12		2010	1800	89.8	0.20	1.009
Perylene d-12		2000	1800	89.8	0.25	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1720	85.9	0.18	1.207
Benzo[ghi]perylene d-12		1920	1660	86.4	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-7\_Form2\_PH2S0551.D\_SJ3023077.html; Workgroup: WG79135; Design ID: 4460 ]



SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water 2\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-8

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 29-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 23:56:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0552.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	10.8	0.844 (S)	0.07	1.007
Acenaphthylene	208-96-8	J	1.38	0.362 (S)	0.19	1.003
Acenaphthene	83-32-9	J	5.97	1.01 (S)	1.25	1.047
2-Methylfluorene	1430-97-3	J	1.11	0.500 (S)	1.28	0.939
C2 Phenanthrenes/Anthracenes			33.3	0.498 (S)		
Fluorene	86-73-7	J	5.05	0.356 (S)	1.06	0.844
Phenanthrene	85-01-8		34.1	0.652 (S)	0.19	1.003
Anthracene	120-12-7	J	1.79	0.657 (S)	0.20	1.011
C1 Phenanthrenes/Anthracenes			29.9	1.97 (S)		
Fluoranthene	206-44-0	J	15.3	0.717 (S)	0.18	1.204
Pyrene	129-00-0	J	15.0	0.708 (S)	0.21	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	J	0.875	0.703 (S)	0.30	1.002
Chrysene <sup>4</sup>	218-01-9	J	6.51	0.768 (S)	0.34	1.002
Benzo[b]fluoranthene	205-99-2	ND		0.350 (S)		
Benzo[j,k]fluoranthenes		ND		0.377 (S)		
Benzo[e]pyrene	192-97-2	J	1.41	0.485 (S)	0.25	0.996
Benzo[a]pyrene	50-32-8	ND		0.521 (S)		
Perylene	198-55-0	J	5.60	0.527 (S)	0.20	1.004
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.577 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.387 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.372 (S)		
2-Methylnaphthalene	91-57-6	J	8.63	0.723 (S)	0.92	1.009
1-Methylnaphthalene	90-12-0	J	8.43	0.768 (S)	0.95	1.040
C1-Naphthalenes			17.1	0.723 (S)		
Biphenyl	92-52-4	J	3.61	0.817 (S)	0.32	1.005
C1-Biphenyls			5.72	0.490 (S)		
C2-Biphenyls			5.29	0.788 (S)		
C2-Naphthalenes			38.5	0.778 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	2.51	0.778 (S)	1.59	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	6.53	0.639 (S)	0.77	1.011
C3-Naphthalenes			34.5	0.928 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	9.38	0.906 (S)	0.92	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	J	8.02	0.951 (S)	1.05	1.226
C4-Naphthalenes			31.3	1.27 (S)		
C1-Acenaphthenes		ND		0.751 (S)		
C1-Fluorenes			11.4	0.500 (S)		
1,7-Dimethylfluorene	442-66-0	ND		2.00 (S)		
C2-Fluorenes			17.3	2.00 (S)		
C3-Fluorenes			33.6	1.28 (S)		
Dibenzothiophene	132-65-0	J	3.93	0.371 (S)	0.10	1.003
C1-Dibenzothiophenes			13.1	1.26 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	3.95	1.26 (S)	0.73	1.094
C2-Dibenzothiophenes			52.4	0.605 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	J	3.08	0.605 (S)	0.61	1.162
4,6-Dimethyldibenzothiophene	1207-12-1	J	6.61	0.520 (S)	0.18	1.153
C3-Dibenzothiophenes			48.7	1.63 (S)		
C4-Dibenzothiophenes			28.1	0.848 (S)		
3-Methylphenanthrene	832-71-3	J	6.73	1.97 (S)	0.68	1.088
2-Methylphenanthrene	2531-84-2	J	9.64	2.02 (S)	0.56	1.092
2-Methylanthracene	613-12-7	ND		1.93 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	8.10	1.97 (S)	0.63	1.107
1-Methylphenanthrene	832-69-9	J	5.46	1.97 (S)	0.60	1.110
3,6-Dimethylphenanthrene	1576-67-6	NDR J	3.47	0.510 (S)	1.14	1.165
2,6-Dimethylphenanthrene	17980-16-4	J	2.50	0.498 (S)	0.31	1.171
1,7-Dimethylphenanthrene	483-87-4	J	5.60	0.487 (S)	0.38	1.188
1,8-Dimethylphenanthrene	7372-87-4	J	1.02	0.498 (S)	0.43	1.209
C3-Phenanthrenes/Anthracenes			37.4	1.78 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		1.78 (S)		
Retene	483-65-8	J	17.6	1.97 (S)	1.54	1.302
C4-Phenanthrenes/Anthracenes			84.4	1.97 (S)		
C1-Fluoranthenes/Pyrenes			14.9	1.07 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	4.80	1.07 (S)	1.03	1.300
C2-Fluoranthenes/Pyrenes			15.6	0.815 (S)		
C3-Fluoranthenes/Pyrenes			7.32	0.474 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.518 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			8.05	0.383 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	J	0.951	0.379 (S)		1.065
1-Methylchrysene	3351-28-8	J	1.25	0.387 (S)		1.072
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			5.39	2.12 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		2.12 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.518 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.405 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		1.07 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		1.07 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.783 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	J	5.30	1.27 (S)	0.04	1.377
Fluoranthene d-10	93951-69-0		4540	1.73 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	428	1.24 (S)	0.30	1.004
Anthracene d-10			3100	1.48 (S)	0.15	1.008

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

CLIENT SAMPLE NO.  
River Water 2\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-8

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 29-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 31-Jan-2022 Time: 23:56:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0552.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	855	42.7	0.09	0.609
2-Methylnaphthalene d-10		2010	1120	55.5	0.19	0.756
Biphenyl d-10		2020	1190	58.9		0.868
2,6-Dimethylnaphthalene d-12		2010	1220	60.8	0.80	0.896
Acenaphthylene d-8		2010	1260	63.0	0.15	0.961
Dibenzothiophene d-8		2010	1360	67.8	0.09	0.792
Phenanthrene d-10		2010	1500	74.6	0.15	0.808
Benzo[a]anthracene d-12		2010	1770	88.3	0.24	1.164
Chrysene d-12		2010	1750	87.1	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1870	93.7	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1830	91.7	0.20	0.962
Benzo[a]pyrene d-12		2010	1750	87.4	0.20	1.009
Perylene d-12		2000	1760	88.2	0.24	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1440	71.8	0.18	1.207
Benzo[ghi]perylene d-12		1920	1390	72.5	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-8\_Form2\_PH2S0552.D\_SJ3023078.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water 3\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SPMD

Sample Receipt Date: 29-Oct-2021

Extraction Date: 22-Dec-2021

Analysis Date: 01-Feb-2022 Time: 00:45:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Project No.

SYN 9110

Lab Sample I.D.:

L35931-9

Sample Size:

1 sample

Initial Calibration Date:

28-Jan-2022

Instrument ID:

LR GC/MS

GC Column ID:

RTX5

Sample Data Filename:

PH2S0553.D

Blank Data Filename:

PH2S0534.D

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	8.93	0.772 (S)	0.08	1.006
Acenaphthylene	208-96-8	J	1.74	0.380 (S)	0.21	1.003
Acenaphthene	83-32-9	J	5.90	1.60 (S)	1.32	1.047
2-Methylfluorene	1430-97-3	J	1.55	1.07 (S)	1.27	0.939
C2 Phenanthrenes/Anthracenes			33.0	0.991 (S)		
Fluorene	86-73-7	J	5.29	0.752 (S)	1.07	0.844
Phenanthrene	85-01-8		35.7	0.833 (S)	0.20	1.004
Anthracene	120-12-7	J	1.30	0.839 (S)	0.19	1.011
C1 Phenanthrenes/Anthracenes			29.9	1.22 (S)		
Fluoranthene	206-44-0	J	15.0	0.834 (S)	0.19	1.204
Pyrene	129-00-0	J	15.1	0.822 (S)	0.20	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	J	0.604	0.595 (S)	0.27	1.002
Chrysene <sup>4</sup>	218-01-9	J	5.62	0.638 (S)	0.33	1.002
Benzo[b]fluoranthene	205-99-2	ND		0.547 (S)		
Benzo[j,k]fluoranthenes		ND		0.601 (S)		
Benzo[e]pyrene	192-97-2	J	0.981	0.753 (S)	0.24	0.996
Benzo[a]pyrene	50-32-8	ND		0.809 (S)		
Perylene	198-55-0	J	4.34	0.855 (S)	0.25	1.004
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.337 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.266 (S)		
Benzo[ghi]perylene	191-24-2	J	0.459	0.262 (S)	0.18	1.002
2-Methylnaphthalene	91-57-6	J	8.61	1.17 (S)	0.89	1.009
1-Methylnaphthalene	90-12-0	J	9.46	1.24 (S)	0.87	1.040
C1-Naphthalenes			18.1	1.17 (S)		
Biphenyl	92-52-4	J	4.28	0.242 (S)	0.31	1.005
C1-Biphenyls			6.59	0.468 (S)		
C2-Biphenyls			7.36	1.04 (S)		
C2-Naphthalenes			41.2	0.711 (S)		
1,2-Dimethylnaphthalene	573-98-8	J	2.04	0.711 (S)	1.17	1.082



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	J	7.19	0.584 (S)	0.69	1.011
C3-Naphthalenes			36.8	1.19 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	9.63	1.16 (S)	0.90	1.204
2,3,5-Trimethylnaphthalene	2245-38-7	J	7.49	1.22 (S)	1.03	1.226
C4-Naphthalenes			26.1	0.661 (S)		
C1-Acenaphthenes		ND		0.810 (S)		
C1-Fluorenes			10.8	1.07 (S)		
1,7-Dimethylfluorene	442-66-0	ND		3.59 (S)		
C2-Fluorenes			16.0	3.59 (S)		
C3-Fluorenes			37.2	2.17 (S)		
Dibenzothiophene	132-65-0	J	4.63	1.28 (S)	0.08	1.003
C1-Dibenzothiophenes			12.2	1.43 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	J	3.38	1.43 (S)	0.86	1.095
C2-Dibenzothiophenes			45.0	4.52 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	ND		4.52 (S)		
4,6-Dimethyldibenzothiophene	1207-12-1	J	6.28	3.88 (S)	0.19	1.153
C3-Dibenzothiophenes			57.0	2.14 (S)		
C4-Dibenzothiophenes			27.2	2.10 (S)		
3-Methylphenanthrene	832-71-3	J	7.45	1.22 (S)	0.63	1.088
2-Methylphenanthrene	2531-84-2	J	9.33	1.25 (S)	0.56	1.092
2-Methylanthracene	613-12-7	ND		1.20 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	J	7.56	1.22 (S)	0.64	1.107
1-Methylphenanthrene	832-69-9	J	5.57	1.22 (S)	0.63	1.110
3,6-Dimethylphenanthrene	1576-67-6	NDR J	3.46	1.02 (S)	0.90	1.165
2,6-Dimethylphenanthrene	17980-16-4	J	2.42	0.991 (S)	0.31	1.171
1,7-Dimethylphenanthrene	483-87-4	J	5.24	0.968 (S)	0.41	1.188
1,8-Dimethylphenanthrene	7372-87-4	J	1.36	0.991 (S)	0.43	1.210
C3-Phenanthrenes/Anthracenes			35.3	1.25 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	J	1.89	1.25 (S)	0.51	1.292
Retene	483-65-8	J	13.5	3.56 (S)	1.66	1.302
C4-Phenanthrenes/Anthracenes			59.0	3.56 (S)		
C1-Fluoranthenes/Pyrenes			12.2	0.824 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	J	4.26	0.824 (S)	1.06	1.300
C2-Fluoranthenes/Pyrenes			17.0	0.560 (S)		
C3-Fluoranthenes/Pyrenes			6.34	0.428 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.313 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			8.18	0.404 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	J	0.719	0.400 (S)		1.065
1-Methylchrysene	3351-28-8	J	1.11	0.409 (S)		1.072
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>			5.19	1.48 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		1.48 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.415 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.327 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.875 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.875 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.532 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	J	4.75	0.661 (S)	0.04	1.378
Fluoranthene d-10	93951-69-0		4170	1.39 (S)	0.18	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	J	426	1.29 (S)	0.35	1.004
Anthracene d-10			3140	2.84 (S)	0.15	1.008

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 2

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.  
River Water 3\_SPMD  
Sample Collection:  
01-Oct-2021 13:10

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

SYN 9110

Lab Sample I.D.:

L35931-9

Matrix: SPMD

Sample Size:

1 sample

Sample Receipt Date: 29-Oct-2021

Initial Calibration Date:

28-Jan-2022

Extraction Date: 22-Dec-2021

Instrument ID:

LR GC/MS

Analysis Date: 01-Feb-2022 Time: 00:45:00

GC Column ID:

RTX5

Extract Volume (uL): 500

Sample Data Filename:

PH2S0553.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0545.D

Concentration Units: ng absolute

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	997	49.7	0.09	0.609
2-Methylnaphthalene d-10		2010	1100	55.0	0.19	0.755
Biphenyl d-10		2020	1180	58.6		0.868
2,6-Dimethylnaphthalene d-12		2010	1210	60.1	0.78	0.895
Acenaphthylene d-8		2010	1210	60.3	0.15	0.961
Dibenzothiophene d-8		2010	1370	68.1	0.09	0.792
Phenanthrene d-10		2010	1540	76.7	0.15	0.808
Benzo[a]anthracene d-12		2010	2010	99.8	0.24	1.164
Chrysene d-12		2010	1980	98.7	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1960	97.8	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1930	96.9	0.20	0.962
Benzo[a]pyrene d-12		2010	1880	93.8	0.20	1.009
Perylene d-12		2000	1880	94.2	0.24	1.024
Indeno[1,2,3-cd]pyrene d-12		2010	1770	88.1	0.18	1.206
Benzo[ghi]perylene d-12		1920	1670	86.9	0.19	1.238

(1) Where applicable, custom lab flags have been used on this report.

(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest2.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: PAH\_PAH\_LO\_LPAHF\_L35931-9\_Form2\_PH2S0553.D\_SJ3023079.html; Workgroup: WG79135; Design ID: 4460 ]



SGS AXYS METHOD MLA-021 Rev 12

Form 1A

## POLYAROMATIC HYDROCARBON ANALYSIS REPORT

CLIENT SAMPLE NO.

Lab Blank

Sample Collection:

N/A

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Project No.

N/A

Matrix: SOLVENT

Lab Sample I.D.:

WG79135-101

Sample Receipt Date: N/A

Sample Size:

1 sample

Extraction Date: 22-Dec-2021

Initial Calibration Date:

28-Jan-2022

Analysis Date: 31-Jan-2022 Time: 11:14:00

Instrument ID:

LR GC/MS

Extract Volume (uL): 500

Sample Data Filename:

PH2S0534.D

Injection Volume (uL): 1.0

Blank Data Filename:

PH2S0534.D

Dilution Factor: N/A

Cal. Ver. Data Filename:

PH2S0530.D

Concentration Units: ng/sample

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene	91-20-3	J	2.84	0.549 (S)	0.08	1.006
Acenaphthylene	208-96-8	NDR J	0.357	0.265 (S)	0.12	1.003
Acenaphthene	83-32-9	ND		0.506 (S)		
2-Methylfluorene	1430-97-3	ND		1.04 (S)		
C2 Phenanthrenes/Anthracenes		ND		0.369 (S)		
Fluorene	86-73-7	ND		0.581 (S)		
Phenanthrene	85-01-8	J	0.847	0.258 (S)	0.20	1.004
Anthracene	120-12-7	J	0.609	0.260 (S)	0.20	1.012
C1 Phenanthrenes/Anthracenes		ND		0.496 (S)		
Fluoranthene	206-44-0	J	0.724	0.156 (S)	0.25	1.205
Pyrene	129-00-0	NDR J	0.602	0.154 (S)	0.07	1.240
Benz[a]anthracene <sup>3</sup>	56-55-3	NDR J	0.260	0.194 (S)	0.06	1.002
Chrysene <sup>4</sup>	218-01-9	NDR J	0.233	0.200 (S)	0.48	1.002
Benzo[b]fluoranthene	205-99-2	ND		0.379 (S)		
Benzo[j,k]fluoranthenes		ND		0.415 (S)		
Benzo[e]pyrene	192-97-2	ND		0.580 (S)		
Benzo[a]pyrene	50-32-8	ND		0.623 (S)		
Perylene	198-55-0	ND		0.629 (S)		
Dibenz[a,h]anthracene <sup>5</sup>	53-70-3	ND		0.342 (S)		
Indeno[1,2,3-cd]pyrene	193-39-5	ND		0.291 (S)		
Benzo[ghi]perylene	191-24-2	ND		0.260 (S)		
2-Methylnaphthalene	91-57-6	J	0.929	0.406 (S)	0.92	1.009
1-Methylnaphthalene	90-12-0	J	0.616	0.430 (S)	0.76	1.040
C1-Naphthalenes			1.54	0.406 (S)		
Biphenyl	92-52-4	ND		0.890 (S)		
C1-Biphenyls			0.930	0.416 (S)		
C2-Biphenyls			0.982	0.379 (S)		
C2-Naphthalenes			8.40	1.08 (S)		
1,2-Dimethylnaphthalene	573-98-8	ND		1.08 (S)		



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	CONC. FOUND	REPORTING LIMIT (RL) <sup>2</sup>	ION ABUND. RATIO	RRT
2,6-Dimethylnaphthalene	581-42-0	ND		0.891 (S)		
C3-Naphthalenes			1.96	0.517 (S)		
2,3,6-Trimethylnaphthalene	829-26-5	J	0.655	0.505 (S)	0.93	1.208
2,3,5-Trimethylnaphthalene	2245-38-7	ND		0.530 (S)		
C4-Naphthalenes		ND		0.664 (S)		
C1-Acenaphthenes		ND		0.852 (S)		
C1-Fluorenes			5.26	1.04 (S)		
1,7-Dimethylfluorene	442-66-0	ND		2.08 (S)		
C2-Fluorenes		ND		2.08 (S)		
C3-Fluorenes		ND		1.37 (S)		
Dibenzothiophene	132-65-0	J	0.840	0.325 (S)	0.07	1.003
C1-Dibenzothiophenes		ND		0.313 (S)		
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3	ND		0.313 (S)		
C2-Dibenzothiophenes			0.841	0.414 (S)		
2,4-Dimethyldibenzothiophene	31317-18-7	NDR J	0.818	0.414 (S)	0.15	1.162
4,6-Dimethyldibenzothiophene	1207-12-1	ND		0.355 (S)		
C3-Dibenzothiophenes		ND		0.255 (S)		
C4-Dibenzothiophenes		ND		0.414 (S)		
3-Methylphenanthrene	832-71-3	ND		0.498 (S)		
2-Methylphenanthrene	2531-84-2	ND		0.510 (S)		
2-Methylanthracene	613-12-7	ND		0.488 (S)		
9/4-Methylphenanthrene	883-20-5/832-64-4	ND		0.498 (S)		
1-Methylphenanthrene	832-69-9	ND		0.496 (S)		
3,6-Dimethylphenanthrene	1576-67-6	ND		0.378 (S)		
2,6-Dimethylphenanthrene	17980-16-4	ND		0.369 (S)		
1,7-Dimethylphenanthrene	483-87-4	ND		0.360 (S)		
1,8-Dimethylphenanthrene	7372-87-4	ND		0.369 (S)		
C3-Phenanthrenes/Anthracenes		ND		0.554 (S)		
1,2,6-Trimethylphenanthrene	30436-55-6	ND		0.554 (S)		
Retene	483-65-8	ND		0.964 (S)		
C4-Phenanthrenes/Anthracenes		ND		0.964 (S)		
C1-Fluoranthenes/Pyrenes		ND		0.241 (S)		
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0/238-84-6	ND		0.241 (S)		
C2-Fluoranthenes/Pyrenes		ND		0.217 (S)		
C3-Fluoranthenes/Pyrenes		ND		0.266 (S)		
C4-Fluoranthenes/Pyrenes		ND		0.217 (S)		
C1-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.184 (S)		
5/6-Methylchrysene	3697-24-3/1705-85-7	ND		0.182 (S)		
1-Methylchrysene	3351-28-8	ND		0.186 (S)		
C2-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.286 (S)		
5,9-Dimethylchrysene	139493-40-6	ND		0.286 (S)		
C3-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.262 (S)		
C4-Benzo[a]anthracenes/Chrysenes <sup>4</sup>		ND		0.357 (S)		
C1-Benzofluoranthenes/Benzopyrenes		ND		0.768 (S)		
7-Methylbenzo[a]pyrene	63041-77-0	ND		0.768 (S)		
C2-Benzofluoranthenes/Benzopyrenes		ND		0.497 (S)		
1,4,6,7-Tetramethylnaphthalene	13764-18-6	ND		0.664 (S)		
Fluoranthene d-10	93951-69-0	NDR J	1.98	0.137 (S)	0.37	0.834
Dibenzo[a,h]anthracene d-14	13250-98-1	NDR J	17.9	1.16 (S)	1.26	1.004
Anthracene d-10		NDR J	10.2	0.678 (S)	0.19	1.009

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL; NDR = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than limit of quantification.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.

(3) May co-elute with Cyclopenta(cd)pyrene.

(4) May co-elute with Triphenylene.

(5) May co-elute with Dibenzo[a,c]anthracene.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Peter Chen \_\_\_\_\_



POLYAROMATIC HYDROCARBON ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

Matrix: SOLVENT

Sample Receipt Date: N/A

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 11:14:00

Extract Volume (uL): 500

Injection Volume (uL): 1.0

Dilution Factor: N/A

Concentration Units: ng absolute

Project No.

Lab Sample I.D.: WG79135-101

Sample Size: 1 sample

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

Sample Data Filename: PH2S0534.D

Blank Data Filename: PH2S0534.D

Cal. Ver. Data Filename: PH2S0530.D

This page is part of a total report that contains information necessary for accreditation compliance.  
This test is not CALA accredited. Sample results relate only to the sample tested.

LABELLED COMPOUND	LAB FLAG <sup>1</sup>	SPIKE CONC.	CONC. FOUND	R(%) <sup>2</sup>	ION ABUND. RATIO	RRT
Naphthalene d-8		2010	643	32.0	0.09	0.609
2-Methylnaphthalene d-10		2010	802	39.9	0.19	0.755
Biphenyl d-10		2020	845	42.0		0.868
2,6-Dimethylnaphthalene d-12		2010	870	43.4	0.79	0.895
Acenaphthylene d-8		2010	856	42.7	0.15	0.961
Dibenzothiophene d-8		2010	1000	49.9	0.09	0.792
Phenanthrene d-10		2010	1170	58.5	0.15	0.808
Benzo[a]anthracene d-12		2010	1790	89.3	0.24	1.164
Chrysene d-12		2010	1930	96.0	0.27	1.169
Benzo[b]fluoranthene d-12		2000	1870	93.4	0.21	0.958
Benzo[k]fluoranthene d-12		1990	1860	93.6	0.20	0.962
Benzo[a]pyrene d-12		2010	1710	85.4	0.20	1.009
Perylene d-12		2000	1690	84.7	0.24	1.023
Indeno[1,2,3-cd]pyrene d-12		2010	1640	82.0	0.19	1.206
Benzo[ghi]perylene d-12		1920	1590	82.6	0.19	1.237

(1) Where applicable, custom lab flags have been used on this report.  
(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 8A

## POLYAROMATIC HYDROCARBON ONGOING PRECISION AND RECOVERY (OPR)

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

OPR Data Filename: PH2S0531.D

Matrix: SOLVENT

Lab Sample I.D.: WG79135-102

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 08:48:00

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON 100 uL EXTRACT.

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	ION ABUND. RATIO	SPIKE CONC. (ng/mL)	CONC. FOUND (ng/mL)	OPR CONC. LIMITS (ng/mL)	% RECOVERY
Naphthalene	91-20-3		0.07	20200	18800	14100 - 26200	93.1
Acenaphthylene	208-96-8		0.20	20200	18700	14100 - 28300	92.8
Acenaphthene	83-32-9		1.17	20000	19300	14000 - 26000	96.5
2-Methylfluorene	1430-97-3		1.34	20000	18700	10000 - 30100	93.2
Fluorene	86-73-7		1.00	20000	17000	12000 - 27900	85.4
Phenanthrene	85-01-8		0.20	20100	18600	14000 - 26100	92.8
Anthracene	120-12-7		0.19	20000	18900	14000 - 26000	94.7
Fluoranthene	206-44-0		0.21	20000	20600	14000 - 26000	103
Pyrene	129-00-0		0.21	20000	20300	14000 - 26000	102
Benz[a]anthracene	56-55-3		0.28	20000	18700	14000 - 26100	93.3
Chrysene	218-01-9		0.30	20100	18500	14000 - 26100	92.3
Benzo[b]fluoranthene	205-99-2		0.22	20100	18200	14100 - 26200	90.2
Benzo[j,k]fluoranthenes			0.22	20000	18400	14000 - 26000	92.2
Benzo[e]pyrene	192-97-2		0.21	20000	19500	14000 - 26000	97.5
Benzo[a]pyrene	50-32-8		0.22	20100	18700	14100 - 26200	93.1
Perylene	198-55-0		0.22	20000	18800	14000 - 26000	94.1
Dibenz[a,h]anthracene	53-70-3		0.17	20000	19400	14000 - 25900	97.4
Indeno[1,2,3-cd]pyrene	193-39-5		0.22	20000	18400	14000 - 26100	91.9
Benzo[ghi]perylene	191-24-2		0.22	19900	18800	14000 - 25900	94.1
2-Methylnaphthalene	91-57-6		0.90	20000	18900	14000 - 26000	94.5
1-Methylnaphthalene	90-12-0		0.93	20200	19200	14100 - 26200	95.2
Biphenyl	92-52-4		0.29	20200	18700	14100 - 26200	92.7
1,2-Dimethylnaphthalene	573-98-8		1.33	20100	18700	12100 - 28200	93.0
2,6-Dimethylnaphthalene	581-42-0		0.72	20000	18600	14000 - 26000	92.9
2,3,6-Trimethylnaphthalene	829-26-5		0.93	20100	19700	10000 - 30100	98.0
2,3,5-Trimethylnaphthalene	2245-38-7		0.93	20000	19900	10000 - 30000	99.2
1,7-Dimethylfluorene	442-66-0		0.08	20100	22100	10000 - 30100	110
Dibenzothiophene	132-65-0		0.09	20000	18500	12000 - 28000	92.5
2/3-Methyldibenzothiophenes	20928-02-3/16587-52-3		0.72	20100	20100	10100 - 30200	99.9
4,6-Dimethyldibenzothiophene	1207-12-1		0.16	20200	22700	10100 - 30300	113
2-Methylphenanthrene	2531-84-2		0.59	20200	21900	10100 - 30200	109
2-Methylantracene	613-12-7		0.51	20000	21800	10000 - 30000	109
1-Methylphenanthrene	832-69-9		0.61	20000	21600	10000 - 30100	108
3,6-Dimethylphenanthrene	1576-67-6		0.36	20100	21200	10100 - 30200	105
1,7-Dimethylphenanthrene	483-87-4		0.35	20000	22000	10000 - 30000	110



COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	ION ABUND. RATIO	SPIKE CONC. (ng/mL)	CONC. FOUND (ng/mL)	OPR CONC. LIMITS (ng/mL)	% RECOVERY
1,2,6-Trimethylphenanthrene	30436-55-6		0.61	20100	24600	10000 - 30100	123
Retene	483-65-8		1.67	20100	24300	10000 - 30100	121
3-Methylfluoranthene/Benzo[a]fluorene	1706-01- 0/238-84-6		1.10	17000	19400	8500 - 25500	114
5/6-Methylchrysene	3697-24- 3/1705-85-7			20000	19900	9990 - 30000	99.7
1-Methylchrysene	3351-28-8			20100	20300	10000 - 30100	101
5,9-Dimethylchrysene	139493-40-6			15000	16300	7500 - 22500	109
7-Methylbenzo[a]pyrene	63041-77-0			20100	21900	10000 - 30100	109
1,4,6,7-Tetramethylnaphthalene	13764-18-6		0.03	20200	21100	10100 - 40300	105
Fluoranthene d-10	93951-69-0		0.17	19900	16200	13900 - 25800	81.8
Dibenzo[a,h]anthracene d-14	13250-98-1		0.30	19200	18400	13400 - 24900	96.2
Anthracene d-10			0.14	19900	17600	13900 - 25900	88.3

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

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Report Filename: PAH\_PAH\_LO\_LPAHF\_WG79135-102\_Form8A\_SJ3023080.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 8B

## POLYAROMATIC HYDROCARBON ONGOING PRECISION AND RECOVERY (OPR)

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 2607

OPR Data Filename: PH2S0531.D

Matrix: SOLVENT

Lab Sample I.D.: WG79135-102

Extraction Date: 22-Dec-2021

Analysis Date: 31-Jan-2022 Time: 08:48:00

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON 100 µL EXTRACT.

LABELED COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	ION ABUND. RATIO	SPIKE CONC. (ng/mL)	CONC. FOUND (ng/mL)	OPR CONC. LIMITS (ng/mL)	% RECOVERY
Naphthalene d-8	1146-65-2		0.09	20100	11800	3010-26100	58.7
2-Methylnaphthalene d-10	7297-45-2		0.19	20100	12800	4020-26100	63.8
Biphenyl d-10	1486-01-7			20200	13700	3020-26200	67.8
2,6-Dimethylnaphthalene d-12	350820-12-1		0.79	20100	13800	4010-26100	68.6
Acenaphthylene d-8	93951-97-4		0.15	20100	13600	4010-26100	67.7
Dibenzothiophene d-8	33262-29-2		0.09	20100	13200	6030-26100	65.8
Phenanthrene d-10	1517-22-2		0.15	20100	15100	6020-26100	75.2
Benzo[a]anthracene d-12	1718-53-2		0.24	20100	18600	6030-26100	92.6
Chrysene d-12	1719-03-5		0.27	20100	19400	6030-26100	96.4
Benzo[b]fluoranthene d-12	93951-98-5		0.21	20000	18600	6000-26000	93.0
Benzo[k]fluoranthene d-12	93952-01-3		0.20	19900	19200	5970-25900	96.6
Benzo[a]pyrene d-12	63466-71-7		0.20	20100	18400	6020-26100	92.0
Perylene d-12	1520-96-3		0.25	20000	17900	6000-26000	89.5
Indeno[1,2,3-cd]pyrene d-12	203578-33-0		0.18	20100	17600	6020-26100	87.6
Benzo[ghi]perylene d-12	93951-66-7		0.19	19200	17600	5760-25000	91.4

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Peter Chen\_\_\_\_\_

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

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Report Filename: PAH\_PAH\_LO\_LPAHF\_WG79135-102\_Form8B\_SJ3023080.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3A

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION RELATIVE RESPONSES

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2S0507.D

CS2 Data Filename: PH2S0508.D

CS3 Data Filename: PH2S0509.D

CS4 Data Filename: PH2S0511.D

CS5 Data Filename: PH2S0510.D

CS6 Data Filename: N/A

COMPOUND	LAB FLAG 1	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
Naphthalene			1.18	1.16	1.21	1.18	1.16	1.18	1.77
Acenaphthylene			1.20	1.18	1.21	1.20	1.18	1.20	1.06
Acenaphthene			0.61	0.61	0.64	0.63	0.63	0.63	1.95
2-Methylfluorene			0.54	0.54	0.56	0.57	0.58	0.56	3.48
Fluorene			0.87	0.92	0.94	0.91	0.90	0.91	2.56
Phenanthrene			1.26	1.24	1.29	1.28	1.27	1.27	1.51
Anthracene			1.25	1.22	1.28	1.27	1.27	1.26	1.95
Fluoranthene			1.47	1.33	1.38	1.42	1.40	1.40	3.52
Pyrene			1.52	1.38	1.39	1.42	1.39	1.42	3.95
Benz[a]anthracene			1.27	1.34	1.36	1.38	1.40	1.35	3.67
Chrysene			1.25	1.26	1.33	1.34	1.34	1.30	3.26
Benzo[b]fluoranthene			1.60	1.52	1.53	1.56	1.57	1.56	2.05
Benzo[j,k]fluoranthenes			1.23	1.25	1.35	1.36	1.36	1.31	4.77
Benzo[e]pyrene			1.26	1.27	1.40	1.47	1.47	1.37	7.54
Benzo[a]pyrene			1.18	1.19	1.28	1.35	1.39	1.28	7.42
Perylene			1.11	1.10	1.24	1.31	1.36	1.23	9.55
Dibenz[a,h]anthracene			1.02	1.00	1.14	1.26	1.34	1.15	12.7
Indeno[1,2,3-cd]pyrene			1.33	1.30	1.34	1.38	1.42	1.35	3.60
Benzo[ghi]perylene			1.20	1.19	1.28	1.35	1.38	1.28	6.58
2-Methylnaphthalene			1.24	1.23	1.28	1.26	1.26	1.25	1.47
1-Methylnaphthalene			1.18	1.15	1.21	1.19	1.18	1.18	1.60
Biphenyl			1.11	1.09	1.12	1.11	1.10	1.11	0.99
C1-Biphenyls			1.11	1.09	1.12	1.11	1.10	1.11	0.99
C2-Biphenyls			1.11	1.09	1.12	1.11	1.10	1.11	0.99
1,2-Dimethylnaphthalene			1.10	1.05	1.09	1.09	1.09	1.08	1.73
2,6-Dimethylnaphthalene			1.31	1.27	1.34	1.33	1.33	1.32	2.08
C3-Naphthalenes			1.12	1.07	1.15	1.16	1.17	1.13	3.59
2,3,6-Trimethylnaphthalene			1.16	1.10	1.17	1.19	1.19	1.16	3.36
2,3,5-Trimethylnaphthalene			1.09	1.04	1.12	1.14	1.15	1.11	3.92
C4-Naphthalenes			1.03	0.97	1.03	1.07	1.09	1.04	4.65
C1-Acenaphthenes			0.61	0.61	0.64	0.63	0.63	0.63	1.95
C1-Fluorenes			0.54	0.54	0.56	0.57	0.58	0.56	3.48
1,7-Dimethylfluorene			0.35	0.33	0.37	0.43	0.44	0.38	13.2
C2-Fluorenes			0.35	0.33	0.37	0.43	0.44	0.38	13.2
C3-Fluorenes			0.35	0.33	0.37	0.43	0.44	0.38	13.2
Dibenzothiophene			1.20	1.18	1.22	1.20	1.20	1.20	1.24
2/3-Methyldibenzothiophenes			0.70	0.65	0.73	0.82	0.84	0.75	10.9
C2-Dibenzothiophenes			0.59	0.53	0.61	0.67	0.67	0.61	9.62



COMPOUND	LAB FLAG 1	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
2,4-Dimethyldibenzothiophene			0.59	0.53	0.61	0.67	0.67	0.61	9.62
4,6-Dimethyldibenzothiophene			0.69	0.61	0.70	0.78	0.79	0.71	10.4
C3-Dibenzothiophenes			0.59	0.53	0.61	0.67	0.67	0.61	9.62
C4-Dibenzothiophenes			0.59	0.53	0.61	0.67	0.67	0.61	9.62
3-Methylphenanthrene			0.76	0.69	0.80	0.87	0.89	0.80	10.1
2-Methylphenanthrene			0.74	0.66	0.77	0.87	0.89	0.78	12.1
2-Methylanthracene			0.78	0.71	0.84	0.87	0.91	0.82	9.17
9/4-Methylphenanthrene			0.76	0.69	0.80	0.87	0.89	0.80	10.1
1-Methylphenanthrene			0.78	0.70	0.81	0.87	0.88	0.81	9.25
3,6-Dimethylphenanthrene			0.71	0.67	0.70	0.76	0.77	0.72	6.00
2,6-Dimethylphenanthrene			0.75	0.67	0.72	0.77	0.78	0.74	6.00
1,7-Dimethylphenanthrene			0.78	0.68	0.74	0.79	0.80	0.76	6.20
1,8-Dimethylphenanthrene			0.75	0.67	0.72	0.77	0.78	0.74	6.00
C3-Phenanthrenes/Anthracenes			0.58	0.51	0.52	0.59	0.60	0.56	7.40
1,2,6-Trimethylphenanthrene			0.58	0.51	0.52	0.59	0.60	0.56	7.40
Retene			0.23	0.20	0.22	0.24	0.25	0.23	7.31
C4-Phenanthrenes/Anthracenes			0.23	0.20	0.22	0.24	0.25	0.23	7.31
3-Methylfluoranthene/Benzo[a]fluorene			0.80	0.67	0.73	0.78	0.79	0.75	7.06
C2-Fluoranthenes/Pyrenes			0.80	0.67	0.73	0.78	0.79	0.75	7.06
C3-Fluoranthenes/Pyrenes			0.80	0.67	0.73	0.78	0.79	0.75	7.06
C4-Fluoranthenes/Pyrenes			0.80	0.67	0.73	0.78	0.79	0.75	7.06
C1-Benzo[a]anthracenes/Chrysenes			0.69	0.67	0.74	0.80	0.84	0.75	9.74
5/6-Methylchrysene			0.71	0.67	0.75	0.81	0.84	0.76	9.20
1-Methylchrysene			0.68	0.66	0.73	0.80	0.83	0.74	10.3
C2-Benzo[a]anthracenes/Chrysenes			0.53	0.48	0.56	0.64	0.68	0.58	14.5
5,9-Dimethylchrysene			0.53	0.48	0.56	0.64	0.68	0.58	14.5
C3-Benzo[a]anthracenes/Chrysenes			0.53	0.48	0.56	0.64	0.68	0.58	14.5
C4-Benzo[a]anthracenes/Chrysenes			0.53	0.48	0.56	0.64	0.68	0.58	14.5
C1-Benzo[a]anthracenes/Chrysenes			0.61	0.57	0.71	0.85	0.93	0.73	21.0
Benzofluoranthenes/Benzopyrenes									
7-Methylbenzo[a]pyrene			0.61	0.57	0.71	0.85	0.93	0.73	21.0
C2-Benzo[a]anthracenes/Chrysenes			0.61	0.57	0.71	0.85	0.93	0.73	21.0
Benzofluoranthenes/Benzopyrenes									
1,4,6,7-Tetramethylnaphthalene			1.03	0.97	1.03	1.07	1.09	1.04	4.65
Fluoranthene d-10			1.10	1.19	1.25	1.23	1.23	1.20	5.02
Dibenzo[a,h]anthracene d-14			0.88	0.88	0.89	0.91	0.96	0.90	3.69
Anthracene d-10			1.08	1.07	1.06	1.07	1.08	1.07	0.76

(1) Where applicable, custom lab flags have been used on this report.

(2) QC limit is 20% for native compounds with a labeled analog, 35% for those without a labeled analog.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

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Report Filename: GENERIC-SPECS\_PAH\_LO\_28-Jan-2022\_PH2S\_Form3A\_GS96049.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3B

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION RELATIVE RESPONSES

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2S0507.D

CS2 Data Filename: PH2S0508.D

CS3 Data Filename: PH2S0509.D

CS4 Data Filename: PH2S0511.D

CS5 Data Filename: PH2S0510.D

CS6 Data Filename: N/A

Labeled Compound	LAB FLAG <sup>1</sup>	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
Naphthalene d-8			1.65	1.70	1.69	1.66	1.70	1.68	1.35
2-Methylnaphthalene d-10			1.02	1.04	1.04	1.02	1.04	1.03	1.03
Biphenyl d-10			1.40	1.41	1.41	1.39	1.42	1.40	0.81
2,6-Dimethylnaphthalene d-12			0.86	0.87	0.86	0.85	0.87	0.86	0.62
Acenaphthylene d-8			1.77	1.77	1.78	1.77	1.79	1.78	0.54
Dibenzothiophene d-8			0.87	0.97	0.99	0.96	0.97	0.95	4.77
Phenanthrene d-10			0.83	0.92	0.94	0.93	0.94	0.91	5.01
Benzo[a]anthracene d-12			0.83	0.78	0.74	0.76	0.77	0.78	4.38
Chrysene d-12			0.85	0.81	0.79	0.82	0.83	0.82	3.08
Benzo[b]fluoranthene d-12			0.95	0.94	0.95	0.94	0.95	0.94	0.52
Benzo[k]fluoranthene d-12			1.05	1.05	1.06	1.09	1.14	1.08	3.65
Benzo[a]pyrene d-12			0.96	0.94	0.95	0.93	0.97	0.95	1.39
Perylene d-12			1.02	1.02	1.01	1.01	1.03	1.02	0.64
Indeno[1,2,3-cd]pyrene d-12			0.95	0.93	0.92	0.90	0.91	0.92	2.01
Benzo[ghi]perylene d-12			1.06	1.05	1.05	1.04	1.07	1.05	0.78

(1) Where applicable, custom lab flags have been used on this report.

(2) QC limit is 35% for labeled compounds.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Form3B.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_28-Jan-2022\_PH2S\_Form3B\_GS96049.html; Workgroup: WG79135; Design ID: 4460 ]



## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION ION ABUNDANCE RATIOS

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2S0507.D

CS2 Data Filename: PH2S0508.D

CS3 Data Filename: PH2S0509.D

CS4 Data Filename: PH2S0511.D

CS5 Data Filename: PH2S0510.D

CS6 Data Filename: N/A

COMPOUND	LAB FLAG <sup>1</sup>	M/Z's FORMING RATIO	ION ABUNDANCE RATIO					
			CS0	CS1	CS2	CS3	CS4	CS5
Naphthalene		128,102		0.09	0.08	0.08	0.08	0.08
Acenaphthylene		152,151		0.20	0.20	0.20	0.20	0.20
Acenaphthene		154,153		1.17	1.17	1.17	1.17	1.17
2-Methylfluorene		180,165		1.32	1.37	1.36	1.36	1.36
Fluorene		166,165		1.03	0.99	1.01	1.00	0.99
Phenanthrene		178,176		0.20	0.20	0.19	0.20	0.20
Anthracene		178,176		0.19	0.18	0.19	0.19	0.19
Fluoranthene		202,200		0.20	0.21	0.20	0.21	0.21
Pyrene		202,200		0.21	0.21	0.21	0.21	0.21
Benz[a]anthracene		228,226		0.26	0.27	0.28	0.28	0.28
Chrysene		228,226		0.30	0.29	0.30	0.31	0.31
Benzo[b]fluoranthene		252,253		0.23	0.22	0.22	0.22	0.22
Benzo[j,k]fluoranthenes		252,253		0.21	0.21	0.21	0.22	0.22
Benzo[e]pyrene		252,253		0.21	0.20	0.21	0.21	0.21
Benzo[a]pyrene		252,253		0.21	0.21	0.21	0.22	0.22
Perylene		252,253		0.21	0.22	0.22	0.22	0.22
Dibenz[a,h]anthracene		278,139		0.16	0.16	0.17	0.17	0.17
Indeno[1,2,3-cd]pyrene		276,138		0.25	0.23	0.21	0.21	0.21
Benzo[ghi]perylene		276,138		0.23	0.23	0.23	0.23	0.23
2-Methylnaphthalene		142,141		0.90	0.91	0.90	0.90	0.90
1-Methylnaphthalene		142,141		0.91	0.92	0.93	0.93	0.93
Biphenyl		154,152		0.29	0.29	0.29	0.30	0.29
1,2-Dimethylnaphthalene		156,141		1.30	1.32	1.35	1.35	1.34
2,6-Dimethylnaphthalene		156,141		0.73	0.72	0.73	0.73	0.73
2,3,6-Trimethylnaphthalene		170,155		0.92	0.95	0.95	0.95	0.95
2,3,5-Trimethylnaphthalene		170,155		0.94	0.95	0.95	0.95	0.95
1,7-Dimethylfluorene		194,177		0.09	0.08	0.09	0.08	0.09
Dibenzothiophene		184,152		0.09	0.09	0.09	0.09	0.09
2/3-Methyldibenzothiophenes		198,197		0.72	0.71	0.72	0.72	0.72
2,4-Dimethyldibenzothiophene		212,197		0.52	0.50	0.52	0.53	0.54
4,6-Dimethyldibenzothiophene		212,197		0.17	0.17	0.17	0.17	0.17
3-Methylphenanthrene		192,191						
2-Methylphenanthrene		192,191		0.60	0.59	0.59	0.59	0.59
2-Methylantracene		192,191		0.49	0.51	0.51	0.51	0.51
9/4-Methylphenanthrene		192,191						
1-Methylphenanthrene		192,191		0.58	0.56	0.58	0.61	0.61
3,6-Dimethylphenanthrene		206,191		0.37	0.37	0.37	0.37	0.37
2,6-Dimethylphenanthrene		206,191						
1,7-Dimethylphenanthrene		206,191		0.36	0.36	0.36	0.36	0.35



COMPOUND	LAB FLAG <sup>1</sup>	M/Z's FORMING RATIO	ION ABUNDANCE RATIO					
			CS0	CS1	CS2	CS3	CS4	CS5
1,8-Dimethylphenanthrene		206,191						
1,2,6-Trimethylphenanthrene		220,205		0.62	0.63	0.64	0.61	0.62
Retene		234,219		1.68	1.71	1.67	1.71	1.68
3-Methylfluoranthene/Benzo[a]fluorene		216,215		1.06	1.13	1.09	1.10	1.09
5/6-Methylchrysene		242						
1-Methylchrysene		242						
5,9-Dimethylchrysene		256						
7-Methylbenzo[a]pyrene		266						
1,4,6,7-Tetramethylnaphthalene		184,139		0.04	0.03	0.03	0.03	0.03
Fluoranthene d-10		212,208		0.17	0.18	0.17	0.17	0.17
Dibenzo[a,h]anthracene d-14		292,288		0.32	0.33	0.32	0.32	0.33
Anthracene d-10		188,184		0.14	0.14	0.14	0.14	0.14

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Form3C.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_28-Jan-2022\_PH2S\_\_Form3C\_GS96049.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3D

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION ION ABUNDANCE RATIOS

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 28-Jan-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2S0507.D

CS2 Data Filename: PH2S0508.D

CS3 Data Filename: PH2S0509.D

CS4 Data Filename: PH2S0511.D

CS5 Data Filename: PH2S0510.D

CS6 Data Filename: N/A

LABELED COMPOUND	LAB FLAG <sup>1</sup>	M/Z's FORMING RATIO	ION ABUNDANCE RATIO						
			CS0	CS1	CS2	CS3	CS4	CS5	CS6
Naphthalene d-8		136,134		0.09	0.09	0.09	0.09	0.09	
2-Methylnaphthalene d-10		152,151		0.19	0.19	0.19	0.19	0.19	
Biphenyl d-10		164							
2,6-Dimethylnaphthalene d-12		168,150		0.80	0.80	0.81	0.81	0.81	
Acenaphthylene d-8		160,158		0.15	0.15	0.16	0.15	0.16	
Dibenzothiophene d-8		192,160		0.09	0.09	0.09	0.09	0.09	
Phenanthrene d-10		188,184		0.15	0.15	0.15	0.15	0.15	
Benzo[a]anthracene d-12		240,236		0.24	0.24	0.24	0.24	0.24	
Chrysene d-12		240,236		0.27	0.27	0.28	0.27	0.27	
Benzo[b]fluoranthene d-12		264,260		0.21	0.21	0.21	0.21	0.21	
Benzo[k]fluoranthene d-12		264,260		0.20	0.20	0.20	0.20	0.20	
Benzo[a]pyrene d-12		264,260		0.21	0.21	0.21	0.21	0.21	
Perylene d-12		264,260		0.25	0.25	0.25	0.25	0.25	
Indeno[1,2,3-cd]pyrene d-12		288,284		0.18	0.18	0.18	0.18	0.19	
Benzo[ghi]perylene d-12		288,284		0.20	0.20	0.20	0.20	0.20	

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

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Report Filename: GENERIC-SPECS\_PAH\_LO\_28-Jan-2022\_PH2S\_Form3D\_GS96049.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3A

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION RELATIVE RESPONSES

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 10-Feb-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2U0067.D

CS2 Data Filename: PH2U0068.D

CS3 Data Filename: PH2U0069.D

CS4 Data Filename: PH2U0071.D

CS5 Data Filename: PH2U0070.D

CS6 Data Filename: N/A

COMPOUND	LAB FLAG 1	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
Naphthalene			1.18	1.20	1.22	1.21	1.21	1.20	1.09
Acenaphthylene			1.18	1.17	1.22	1.20	1.19	1.19	1.62
Acenaphthene			0.64	0.64	0.66	0.66	0.65	0.65	1.78
2-Methylfluorene			0.55	0.55	0.58	0.60	0.61	0.58	4.73
Fluorene			0.84	0.82	0.84	0.83	0.85	0.84	1.14
Phenanthrene			1.29	1.26	1.29	1.26	1.26	1.27	1.19
Anthracene			1.32	1.29	1.32	1.29	1.29	1.30	1.27
Fluoranthene			1.50	1.50	1.53	1.48	1.52	1.51	1.22
Pyrene			1.54	1.54	1.55	1.54	1.53	1.54	0.63
Benz[a]anthracene			1.39	1.31	1.31	1.31	1.31	1.33	2.75
Chrysene			1.29	1.28	1.32	1.32	1.30	1.30	1.46
Benzo[b]fluoranthene			1.63	1.51	1.53	1.48	1.49	1.53	4.03
Benzo[j,k]fluoranthenes			1.35	1.32	1.34	1.38	1.33	1.34	1.65
Benzo[e]pyrene			1.38	1.37	1.41	1.40	1.35	1.38	1.75
Benzo[a]pyrene			1.27	1.27	1.31	1.33	1.33	1.30	2.42
Perylene			1.24	1.21	1.27	1.29	1.29	1.26	2.62
Dibenz[a,h]anthracene			1.18	1.09	1.10	1.16	1.19	1.15	4.11
Indeno[1,2,3-cd]pyrene			1.40	1.28	1.27	1.28	1.27	1.30	4.19
Benzo[ghi]perylene			1.34	1.28	1.32	1.32	1.31	1.31	1.52
2-Methylnaphthalene			1.23	1.21	1.29	1.28	1.27	1.26	2.64
1-Methylnaphthalene			1.18	1.15	1.21	1.20	1.20	1.19	1.97
Biphenyl			1.08	1.09	1.14	1.13	1.13	1.11	2.31
C1-Biphenyls			1.08	1.09	1.14	1.13	1.13	1.11	2.31
C2-Biphenyls			1.08	1.09	1.14	1.13	1.13	1.11	2.31
1,2-Dimethylnaphthalene			1.13	1.07	1.11	1.10	1.08	1.10	2.18
2,6-Dimethylnaphthalene			1.26	1.26	1.33	1.34	1.33	1.30	3.20
C3-Naphthalenes			1.20	1.16	1.25	1.26	1.25	1.22	3.53
2,3,6-Trimethylnaphthalene			1.21	1.17	1.27	1.29	1.28	1.24	4.07
2,3,5-Trimethylnaphthalene			1.18	1.15	1.22	1.24	1.22	1.20	2.96
C4-Naphthalenes			1.27	1.20	1.27	1.26	1.26	1.25	2.25
C1-Acenaphthenes			0.64	0.64	0.66	0.66	0.65	0.65	1.78
C1-Fluorenes			0.55	0.55	0.58	0.60	0.61	0.58	4.73
1,7-Dimethylfluorene			0.44	0.43	0.47	0.50	0.50	0.47	6.79
C2-Fluorenes			0.44	0.43	0.47	0.50	0.50	0.47	6.79
C3-Fluorenes			0.44	0.43	0.47	0.50	0.50	0.47	6.79
Dibenzothiophene			1.25	1.17	1.20	1.20	1.17	1.20	2.49
2/3-Methyldibenzothiophenes			0.81	0.80	0.85	0.88	0.88	0.84	4.33
C2-Dibenzothiophenes			0.69	0.69	0.72	0.76	0.74	0.72	3.96



COMPOUND	LAB FLAG 1	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
2,4-Dimethyldibenzothiophene			0.69	0.69	0.72	0.76	0.74	0.72	3.96
4,6-Dimethyldibenzothiophene			0.80	0.79	0.84	0.82	0.85	0.82	3.20
C3-Dibenzothiophenes			0.69	0.69	0.72	0.76	0.74	0.72	3.96
C4-Dibenzothiophenes			0.69	0.69	0.72	0.76	0.74	0.72	3.96
3-Methylphenanthrene			0.89	0.88	0.95	0.94	0.96	0.92	3.63
2-Methylphenanthrene			0.81	0.80	0.92	0.92	0.94	0.88	7.64
2-Methylanthracene			0.99	0.95	1.01	1.00	1.01	0.99	2.60
9/4-Methylphenanthrene			0.89	0.88	0.95	0.94	0.96	0.92	3.63
1-Methylphenanthrene			0.88	0.90	0.91	0.91	0.92	0.90	1.68
3,6-Dimethylphenanthrene			0.83	0.80	0.84	0.85	0.86	0.84	2.77
2,6-Dimethylphenanthrene			0.84	0.83	0.86	0.88	0.89	0.86	3.10
1,7-Dimethylphenanthrene			0.85	0.85	0.89	0.90	0.92	0.88	3.57
1,8-Dimethylphenanthrene			0.84	0.83	0.86	0.88	0.89	0.86	3.10
C3-Phenanthrenes/Anthracenes			0.74	0.73	0.73	0.75	0.76	0.74	1.61
1,2,6-Trimethylphenanthrene			0.74	0.73	0.73	0.75	0.76	0.74	1.61
Retene			0.31	0.30	0.31	0.31	0.32	0.31	2.24
C4-Phenanthrenes/Anthracenes			0.31	0.30	0.31	0.31	0.32	0.31	2.24
3-Methylfluoranthene/Benzo[a]fluorene			0.87	0.87	0.91	0.92	0.93	0.90	3.18
C2-Fluoranthenes/Pyrenes			0.87	0.87	0.91	0.92	0.93	0.90	3.18
C3-Fluoranthenes/Pyrenes			0.87	0.87	0.91	0.92	0.93	0.90	3.18
C4-Fluoranthenes/Pyrenes			0.87	0.87	0.91	0.92	0.93	0.90	3.18
C1-Benzo[a]anthracenes/Chrysenes			0.89	0.85	0.90	0.89	0.90	0.89	2.11
5/6-Methylchrysene			0.89	0.87	0.91	0.90	0.91	0.90	1.64
1-Methylchrysene			0.89	0.83	0.88	0.88	0.89	0.88	2.78
C2-Benzo[a]anthracenes/Chrysenes			0.80	0.78	0.82	0.81	0.81	0.80	1.80
5,9-Dimethylchrysene			0.80	0.78	0.82	0.81	0.81	0.80	1.80
C3-Benzo[a]anthracenes/Chrysenes			0.80	0.78	0.82	0.81	0.81	0.80	1.80
C4-Benzo[a]anthracenes/Chrysenes			0.80	0.78	0.82	0.81	0.81	0.80	1.80
C1-Benzo[a]anthracenes/Chrysenes			1.00	0.99	1.02	1.02	1.04	1.01	2.06
Benzofluoranthenes/Benzopyrenes									
7-Methylbenzo[a]pyrene			1.00	0.99	1.02	1.02	1.04	1.01	2.06
C2-Benzo[a]anthracenes/Chrysenes			1.00	0.99	1.02	1.02	1.04	1.01	2.06
Benzofluoranthenes/Benzopyrenes									
1,4,6,7-Tetramethylnaphthalene			1.27	1.20	1.27	1.26	1.26	1.25	2.25
Fluoranthene d-10			0.99	0.99	1.01	1.01	1.01	1.00	0.91
Dibenzo[a,h]anthracene d-14			0.83	0.81	0.81	0.84	0.90	0.84	4.34
Anthracene d-10			1.09	1.11	1.10	1.14	1.14	1.12	1.85

(1) Where applicable, custom lab flags have been used on this report.

(2) QC limit is 20% for native compounds with a labeled analog, 35% for those without a labeled analog.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Victoria Reesor \_\_\_\_\_



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3B

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION RELATIVE RESPONSES

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 10-Feb-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2U0067.D

CS2 Data Filename: PH2U0068.D

CS3 Data Filename: PH2U0069.D

CS4 Data Filename: PH2U0071.D

CS5 Data Filename: PH2U0070.D

CS6 Data Filename: N/A

Labeled Compound	LAB FLAG <sup>1</sup>	RELATIVE RESPONSE (RR)						MEAN RR	CV (%RSD) <sup>2</sup>
		CS0	CS1	CS2	CS3	CS4	CS5		
Naphthalene d-8			1.44	1.43	1.42	1.40	1.41	1.42	1.05
2-Methylnaphthalene d-10			0.97	0.96	0.96	0.94	0.95	0.96	0.88
Biphenyl d-10			1.38	1.38	1.36	1.35	1.36	1.36	1.00
2,6-Dimethylnaphthalene d-12			0.88	0.88	0.88	0.87	0.88	0.88	0.60
Acenaphthylene d-8			1.73	1.74	1.73	1.71	1.74	1.73	0.64
Dibenzothiophene d-8			0.86	0.87	0.87	0.85	0.87	0.87	0.91
Phenanthrene d-10			0.84	0.84	0.84	0.84	0.85	0.84	0.46
Benzo[a]anthracene d-12			0.95	0.96	0.94	0.95	0.95	0.95	0.58
Chrysene d-12			0.94	0.96	0.94	0.96	0.96	0.95	1.10
Benzo[b]fluoranthene d-12			0.96	0.97	0.97	0.97	0.99	0.97	1.23
Benzo[k]fluoranthene d-12			1.06	1.06	1.05	1.07	1.12	1.07	2.40
Benzo[a]pyrene d-12			0.95	0.95	0.95	0.95	0.99	0.96	2.06
Perylene d-12			1.02	1.03	1.02	1.03	1.05	1.03	1.12
Indeno[1,2,3-cd]pyrene d-12			1.01	1.01	1.01	1.03	1.10	1.03	3.81
Benzo[ghi]perylene d-12			1.08	1.09	1.08	1.10	1.14	1.10	2.28

(1) Where applicable, custom lab flags have been used on this report.

(2) QC limit is 35% for labeled compounds.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Form3B.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_10-Feb-2022\_PH2U\_\_Form3B\_GS96185.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3C

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION ION ABUNDANCE RATIOS

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 10-Feb-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2U0067.D

CS2 Data Filename: PH2U0068.D

CS3 Data Filename: PH2U0069.D

CS4 Data Filename: PH2U0071.D

CS5 Data Filename: PH2U0070.D

CS6 Data Filename: N/A

COMPOUND	LAB FLAG <sup>1</sup>	M/Z's FORMING RATIO	ION ABUNDANCE RATIO					
			CS0	CS1	CS2	CS3	CS4	CS5
Naphthalene		128,102		0.06	0.06	0.06	0.07	0.07
Acenaphthylene		152,151		0.20	0.19	0.20	0.19	0.19
Acenaphthene		154,153		1.16	1.12	1.13	1.13	1.13
2-Methylfluorene		180,165		1.20	1.20	1.19	1.19	1.20
Fluorene		166,165		0.95	0.97	0.98	0.97	0.97
Phenanthrene		178,176		0.18	0.19	0.19	0.19	0.19
Anthracene		178,176		0.18	0.18	0.18	0.18	0.18
Fluoranthene		202,200		0.20	0.20	0.20	0.20	0.20
Pyrene		202,200		0.20	0.20	0.20	0.20	0.20
Benz[a]anthracene		228,226		0.24	0.26	0.26	0.26	0.26
Chrysene		228,226		0.29	0.30	0.29	0.29	0.29
Benzo[b]fluoranthene		252,253		0.21	0.22	0.22	0.22	0.22
Benzo[j,k]fluoranthenes		252,253		0.21	0.22	0.21	0.22	0.22
Benzo[e]pyrene		252,253		0.21	0.21	0.22	0.22	0.22
Benzo[a]pyrene		252,253		0.23	0.21	0.22	0.22	0.22
Perylene		252,253		0.22	0.22	0.22	0.22	0.22
Dibenz[a,h]anthracene		278,139		0.14	0.14	0.14	0.14	0.14
Indeno[1,2,3-cd]pyrene		276,138		0.21	0.21	0.19	0.19	0.18
Benzo[ghi]perylene		276,138		0.20	0.21	0.20	0.20	0.20
2-Methylnaphthalene		142,141		0.89	0.87	0.89	0.88	0.88
1-Methylnaphthalene		142,141		0.92	0.91	0.92	0.91	0.91
Biphenyl		154,152		0.28	0.28	0.28	0.28	0.28
1,2-Dimethylnaphthalene		156,141		1.13	1.18	1.20	1.22	1.22
2,6-Dimethylnaphthalene		156,141		0.65	0.65	0.65	0.65	0.65
2,3,6-Trimethylnaphthalene		170,155		0.84	0.88	0.86	0.85	0.87
2,3,5-Trimethylnaphthalene		170,155		0.85	0.87	0.84	0.86	0.86
1,7-Dimethylfluorene		194,177		0.08	0.07	0.07	0.07	0.07
Dibenzothiophene		184,152		0.07	0.08	0.08	0.08	0.08
2/3-Methyldibenzothiophenes		198,197		0.68	0.69	0.70	0.69	0.69
2,4-Dimethyldibenzothiophene		212,197		0.48	0.47	0.48	0.47	0.48
4,6-Dimethyldibenzothiophene		212,197		0.14	0.14	0.15	0.14	0.15
3-Methylphenanthrene		192,191						
2-Methylphenanthrene		192,191		0.57	0.57	0.57	0.57	0.57
2-Methylantracene		192,191		0.49	0.49	0.49	0.49	0.49
9/4-Methylphenanthrene		192,191						
1-Methylphenanthrene		192,191		0.61	0.57	0.58	0.58	0.59
3,6-Dimethylphenanthrene		206,191		0.34	0.34	0.33	0.33	0.33
2,6-Dimethylphenanthrene		206,191						
1,7-Dimethylphenanthrene		206,191		0.32	0.32	0.33	0.32	0.32



COMPOUND	LAB FLAG <sup>1</sup>	M/Z's FORMING RATIO	ION ABUNDANCE RATIO						
			CS0	CS1	CS2	CS3	CS4	CS5	CS6
1,8-Dimethylphenanthrene		206,191							
1,2,6-Trimethylphenanthrene		220,205		0.56	0.57	0.58	0.57	0.57	
Retene		234,219		1.57	1.54	1.58	1.57	1.59	
3-Methylfluoranthene/Benzo[a]fluorene		216,215		1.04	1.05	1.05	1.06	1.06	
5/6-Methylchrysene		242							
1-Methylchrysene		242							
5,9-Dimethylchrysene		256							
7-Methylbenzo[a]pyrene		266							
1,4,6,7-Tetramethylnaphthalene		184,139		0.03	0.03	0.02	0.02	0.03	
Fluoranthene d-10		212,208		0.17	0.17	0.17	0.16	0.17	
Dibenzo[a,h]anthracene d-14		292,288		0.25	0.25	0.24	0.24	0.24	
Anthracene d-10		188,184		0.13	0.13	0.13	0.13	0.13	

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Form3C.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_10-Feb-2022\_PH2U\_\_Form3C\_GS96185.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 3D

## POLYAROMATIC HYDROCARBON INITIAL CALIBRATION ION ABUNDANCE RATIOS

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 10-Feb-2022

Instrument ID: LR GC/MS

GC Column ID: RTX5

CS0 Data Filename: N/A

CS1 Data Filename: PH2U0067.D

CS2 Data Filename: PH2U0068.D

CS3 Data Filename: PH2U0069.D

CS4 Data Filename: PH2U0071.D

CS5 Data Filename: PH2U0070.D

CS6 Data Filename: N/A

Labeled Compound	Lab Flag <sup>1</sup>	M/Z's Forming Ratio	ION ABUNDANCE RATIO						
			CS0	CS1	CS2	CS3	CS4	CS5	CS6
Naphthalene d-8		136,134		0.09	0.09	0.09	0.09	0.09	
2-Methylnaphthalene d-10		152,151		0.19	0.19	0.19	0.19	0.19	
Biphenyl d-10		164							
2,6-Dimethylnaphthalene d-12		168,150		0.72	0.72	0.71	0.71	0.71	
Acenaphthylene d-8		160,158		0.15	0.15	0.15	0.15	0.15	
Dibenzothiophene d-8		192,160		0.08	0.08	0.08	0.08	0.08	
Phenanthrene d-10		188,184		0.14	0.15	0.14	0.14	0.14	
Benzo[a]anthracene d-12		240,236		0.23	0.23	0.23	0.23	0.23	
Chrysene d-12		240,236		0.26	0.26	0.26	0.26	0.26	
Benzo[b]fluoranthene d-12		264,260		0.20	0.20	0.20	0.20	0.20	
Benzo[k]fluoranthene d-12		264,260		0.20	0.20	0.20	0.20	0.20	
Benzo[a]pyrene d-12		264,260		0.20	0.20	0.20	0.20	0.20	
Perylene d-12		264,260		0.24	0.24	0.24	0.24	0.24	
Indeno[1,2,3-cd]pyrene d-12		288,284		0.18	0.18	0.18	0.18	0.18	
Benzo[ghi]perylene d-12		288,284		0.19	0.19	0.19	0.19	0.19	

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

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Report Filename: GENERIC-SPECS\_PAH\_LO\_10-Feb-2022\_PH2U\_Form3D\_GS96185.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4A

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	28-Jan-2022	VER Data Filename:	PH2S0530.D
Instrument ID:	LR GC/MS	Analysis Date:	31-Jan-2022
GC Column ID:	RTX5	Analysis Time:	07:58:00

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene	91-20-3		128,102	0.08	0.06-0.10	2010	1510-2520
Acenaphthylene	208-96-8		152,151	0.20	0.16-0.24	2010	1510-2520
Acenaphthene	83-32-9		154,153	1.16	0.93-1.39	2020	1500-2500
2-Methylfluorene	1430-97-3		180,165	1.33	1.06-1.60	2060	1500-2510
Fluorene	86-73-7		166,165	1.00	0.80-1.20	1990	1500-2490
Phenanthrene	85-01-8		178,176	0.20	0.16-0.24	2000	1500-2510
Anthracene	120-12-7		178,176	0.19	0.15-0.23	1980	1500-2500
Fluoranthene	206-44-0		202,200	0.21	0.17-0.25	2030	1500-2500
Pyrene	129-00-0		202,200	0.21	0.17-0.25	1980	1500-2500
Benz[a]anthracene	56-55-3		228,226	0.28	0.22-0.34	2010	1500-2510
Chrysene	218-01-9		228,226	0.31	0.25-0.37	2010	1500-2510
Benzo[b]fluoranthene	205-99-2		252,253	0.22	0.18-0.26	2000	1510-2520
Benzo[j,k]fluoranthenes			252,253	0.22	0.18-0.26	1970	1500-2500
Benzo[e]pyrene	192-97-2		252,253	0.21	0.17-0.25	2100	1500-2500
Benzo[a]pyrene	50-32-8		252,253	0.22	0.18-0.26	2050	1510-2520
Perylene	198-55-0		252,253	0.22	0.18-0.26	2100	1500-2500
Dibenz[a,h]anthracene	53-70-3		278,139	0.17	0.11-0.23	2130	1500-2500
Indeno[1,2,3-cd]pyrene	193-39-5		276,138	0.21	0.14-0.28	2000	1500-2510
Benzo[ghi]perylene	191-24-2		276,138	0.23	0.15-0.31	2030	1500-2490
2-Methylnaphthalene	91-57-6		142,141	0.90	0.72-1.08	2000	1500-2500
1-Methylnaphthalene	90-12-0		142,141	0.93	0.74-1.12	2020	1510-2520
Biphenyl	92-52-4		154,152	0.29	0.23-0.35	2000	1510-2520
1,2-Dimethylnaphthalene	573-98-8		156,141	1.33	1.06-1.60	2000	1510-2520
2,6-Dimethylnaphthalene	581-42-0		156,141	0.71	0.57-0.85	2010	1500-2500
2,3,6-Trimethylnaphthalene	829-26-5		170,155	0.93	0.74-1.12	2040	1510-2510
2,3,5-Trimethylnaphthalene	2245-38-7		170,155	0.94	0.75-1.13	2040	1500-2500
1,7-Dimethylfluorene	442-66-0		194,177	0.09	0.07-0.11	2310	1510-2510
Dibenzothiophene	132-65-0		184,152	0.09	0.07-0.11	2010	1500-2500
2/3-Methyldibenzothiophenes	20928-02-3 3/16587-52-3		198,197	0.72	0.58-0.86	2230	1510-2520
2,4-Dimethyldibenzothiophene	31317-18-7		212,197	0.52	0.42-0.62	2240	1500-2500
4,6-Dimethyldibenzothiophene	1207-12-1		212,197	0.16	0.13-0.19	2260	1510-2520
2-Methylphenanthrene	2531-84-2		192,191	0.59	0.47-0.71	2220	1510-2520
2-Methylantracene	613-12-7		192,191	0.51	0.41-0.61	2100	1500-2500
1-Methylphenanthrene	832-69-9		192,191	0.61	0.49-0.73	2180	1500-2510
3,6-Dimethylphenanthrene	1576-67-6		206,191	0.37	0.30-0.44	2150	1510-2520
1,7-Dimethylphenanthrene	483-87-4		206,191	0.35	0.28-0.42	2080	1500-2500
1,2,6-Trimethylphenanthrene	30436-55-6		220,205	0.60	0.48-0.72	2160	1510-2510
Retene	483-65-8		234,219	1.67	1.34-2.00	2180	1510-2510
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0 0/238-84-6		216,215	1.09	0.87-1.31	1780	1280-2130
5/6-Methylchrysene	3697-24-3 3/1705-85-7		242	0	N/A	2120	1500-2500
1-Methylchrysene	3351-28-8		242	0	N/A	2170	1510-2510
5,9-Dimethylchrysene	139493-40-6		256	0	N/A	1710	1130-1880
7-Methylbenzo[a]pyrene	63041-77-0		266	0	N/A	2340	1510-2510
1,4,6,7-Tetramethylnaphthalene	13764-18-6		184,139	0.03	0.02-0.04	2100	1510-2520
Fluoranthene d-10	93951-69-0		212,208	0.17	0.14-0.20	1970	1490-2480
Dibenzo[a,h]anthracene d-14	13250-98-1		292,288	0.32	0.21-0.43	1980	1440-2390



(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axs Internal Use Only [ XSL Template: Pest4A.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2S0530.D\_\_Form4A\_SJ3021270.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4B

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

<b>Initial Calibration Date:</b>	28-Jan-2022	<b>VER Data Filename:</b>	PH2S0530.D
<b>Instrument ID:</b>	LR GC/MS	<b>Analysis Date:</b>	31-Jan-2022
<b>GC Column ID:</b>	RTX5	<b>Analysis Time:</b>	07:58:00

LABELED COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene d-8	1146-65-2		136,134	0.09	0.07-0.11	1970	1500-2510
2-Methylnaphthalene d-10	7297-45-2		152,151	0.19	0.15-0.23	1980	1510-2510
Biphenyl d-10	1486-01-7		164	0	N/A	2000	1510-2520
2,6-Dimethylnaphthalene d-12	350820-12-1		168,150	0.79	0.63-0.95	1990	1500-2510
Acenaphthylene d-8	93951-97-4		160,158	0.15	0.12-0.18	1990	1500-2510
Dibenzothiophene d-8	33262-29-2		192,160	0.09	0.07-0.11	1970	1510-2510
Phenanthrene d-10	1517-22-2		188,184	0.15	0.12-0.18	2010	1500-2510
Benzo[a]anthracene d-12	1718-53-2		240,236	0.24	0.19-0.29	2030	1510-2510
Chrysene d-12	1719-03-5		240,236	0.27	0.22-0.32	2070	1510-2510
Benzo[b]fluoranthene d-12	93951-98-5		264,260	0.21	0.17-0.25	1940	1500-2500
Benzo[k]fluoranthene d-12	93952-01-3		264,260	0.20	0.16-0.24	2050	1490-2490
Benzo[a]pyrene d-12	63466-71-7		264,260	0.21	0.17-0.25	1960	1500-2510
Perylene d-12	1520-96-3		264,260	0.25	0.20-0.30	1950	1500-2500
Indeno[1,2,3-cd]pyrene d-12	203578-33-0		288,284	0.18	0.12-0.24	1980	1500-2510
Benzo[ghi]perylene d-12	93951-66-7		288,284	0.19	0.12-0.26	1930	1440-2400

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest4B.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2S0530.D\_\_Form4B\_SJ3021270.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4A

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 28-Jan-2022 VER Data Filename: PH2S0545.D  
Instrument ID: LR GC/MS Analysis Date: 31-Jan-2022  
GC Column ID: RTX5 Analysis Time: 18:44:00

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene	91-20-3		128,102	0.08	0.06-0.10	2050	1510-2520
Acenaphthylene	208-96-8		152,151	0.20	0.16-0.24	2010	1510-2520
Acenaphthene	83-32-9		154,153	1.16	0.93-1.39	2020	1500-2500
2-Methylfluorene	1430-97-3		180,165	1.34	1.07-1.61	2090	1500-2510
Fluorene	86-73-7		166,165	1.00	0.80-1.20	2020	1500-2490
Phenanthrene	85-01-8		178,176	0.20	0.16-0.24	2000	1500-2510
Anthracene	120-12-7		178,176	0.19	0.15-0.23	2000	1500-2500
Fluoranthene	206-44-0		202,200	0.21	0.17-0.25	2000	1500-2500
Pyrene	129-00-0		202,200	0.21	0.17-0.25	1960	1500-2500
Benz[a]anthracene	56-55-3		228,226	0.28	0.22-0.34	1980	1500-2510
Chrysene	218-01-9		228,226	0.30	0.24-0.36	2030	1500-2510
Benzo[b]fluoranthene	205-99-2		252,253	0.22	0.18-0.26	1940	1510-2520
Benzo[j,k]fluoranthenes			252,253	0.22	0.18-0.26	2060	1500-2500
Benzo[e]pyrene	192-97-2		252,253	0.22	0.18-0.26	2080	1500-2500
Benzo[a]pyrene	50-32-8		252,253	0.22	0.18-0.26	2070	1510-2520
Perylene	198-55-0		252,253	0.22	0.18-0.26	2090	1500-2500
Dibenz[a,h]anthracene	53-70-3		278,139	0.17	0.11-0.23	2150	1500-2500
Indeno[1,2,3-cd]pyrene	193-39-5		276,138	0.21	0.14-0.28	1970	1500-2510
Benzo[ghi]perylene	191-24-2		276,138	0.22	0.14-0.30	2130	1500-2490
2-Methylnaphthalene	91-57-6		142,141	0.90	0.72-1.08	2000	1500-2500
1-Methylnaphthalene	90-12-0		142,141	0.92	0.74-1.10	2010	1510-2520
Biphenyl	92-52-4		154,152	0.29	0.23-0.35	2000	1510-2520
1,2-Dimethylnaphthalene	573-98-8		156,141	1.32	1.06-1.58	1990	1510-2520
2,6-Dimethylnaphthalene	581-42-0		156,141	0.72	0.58-0.86	1990	1500-2500
2,3,6-Trimethylnaphthalene	829-26-5		170,155	0.93	0.74-1.12	2030	1510-2510
2,3,5-Trimethylnaphthalene	2245-38-7		170,155	0.93	0.74-1.12	2030	1500-2500
1,7-Dimethylfluorene	442-66-0		194,177	0.08	0.06-0.10	2360	1510-2510
Dibenzothiophene	132-65-0		184,152	0.09	0.07-0.11	2010	1500-2500
2/3-Methyldibenzothiophenes	20928-02-3 3/16587-52-3		198,197	0.72	0.58-0.86	2240	1510-2520
2,4-Dimethyldibenzothiophene	31317-18-7		212,197	0.53	0.42-0.64	2240	1500-2500
4,6-Dimethyldibenzothiophene	1207-12-1		212,197	0.16	0.13-0.19	2260	1510-2520
2-Methylphenanthrene	2531-84-2		192,191	0.59	0.47-0.71	2230	1510-2520
2-Methylantracene	613-12-7		192,191	0.51	0.41-0.61	2130	1500-2500
1-Methylphenanthrene	832-69-9		192,191	0.61	0.49-0.73	2220	1500-2510
3,6-Dimethylphenanthrene	1576-67-6		206,191	0.37	0.30-0.44	2150	1510-2520
1,7-Dimethylphenanthrene	483-87-4		206,191	0.35	0.28-0.42	2110	1500-2500
1,2,6-Trimethylphenanthrene	30436-55-6		220,205	0.61	0.49-0.73	2230	1510-2510
Retene	483-65-8		234,219	1.67	1.34-2.00	2200	1510-2510
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0 0/238-84-6		216,215	1.09	0.87-1.31	1740	1280-2130
5/6-Methylchrysene	3697-24-3 3/1705-85-7		242	0	N/A	2160	1500-2500
1-Methylchrysene	3351-28-8		242	0	N/A	2190	1510-2510
5,9-Dimethylchrysene	139493-40-6		256	0	N/A	1760	1130-1880
7-Methylbenzo[a]pyrene	63041-77-0		266	0	N/A	2440	1510-2510
1,4,6,7-Tetramethylnaphthalene	13764-18-6		184,139	0.03	0.02-0.04	2090	1510-2520
Fluoranthene d-10	93951-69-0		212,208	0.17	0.14-0.20	2040	1490-2480
Dibenzo[a,h]anthracene d-14	13250-98-1		292,288	0.31	0.20-0.42	1960	1440-2390



(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axs Internal Use Only [ XSL Template: Pest4A.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2S0545.D\_\_Form4A\_SJ3021308.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4B

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	28-Jan-2022	VER Data Filename:	PH2S0545.D
Instrument ID:	LR GC/MS	Analysis Date:	31-Jan-2022
GC Column ID:	RTX5	Analysis Time:	18:44:00

LABELED COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene d-8	1146-65-2		136,134	0.09	0.07-0.11	1960	1500-2510
2-Methylnaphthalene d-10	7297-45-2		152,151	0.19	0.15-0.23	1980	1510-2510
Biphenyl d-10	1486-01-7		164	0	N/A	2000	1510-2520
2,6-Dimethylnaphthalene d-12	350820-12-1		168,150	0.79	0.63-0.95	2010	1500-2510
Acenaphthylene d-8	93951-97-4		160,158	0.15	0.12-0.18	1990	1500-2510
Dibenzothiophene d-8	33262-29-2		192,160	0.09	0.07-0.11	1970	1510-2510
Phenanthrene d-10	1517-22-2		188,184	0.15	0.12-0.18	2020	1500-2510
Benzo[a]anthracene d-12	1718-53-2		240,236	0.24	0.19-0.29	1960	1510-2510
Chrysene d-12	1719-03-5		240,236	0.27	0.22-0.32	1980	1510-2510
Benzo[b]fluoranthene d-12	93951-98-5		264,260	0.21	0.17-0.25	2010	1500-2500
Benzo[k]fluoranthene d-12	93952-01-3		264,260	0.20	0.16-0.24	2030	1490-2490
Benzo[a]pyrene d-12	63466-71-7		264,260	0.21	0.17-0.25	1990	1500-2510
Perylene d-12	1520-96-3		264,260	0.25	0.20-0.30	1990	1500-2500
Indeno[1,2,3-cd]pyrene d-12	203578-33-0		288,284	0.18	0.12-0.24	2070	1500-2510
Benzo[ghi]perylene d-12	93951-66-7		288,284	0.19	0.12-0.26	1930	1440-2400

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Victoria Reesor\_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest4B.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2S0545.D\_\_Form4B\_SJ3021308.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4A

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	10-Feb-2022	VER Data Filename:	PH2U0076.D
Instrument ID:	LR GC/MS	Analysis Date:	11-Feb-2022
GC Column ID:	RTX5	Analysis Time:	06:30:00

COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene	91-20-3		128,102	0.07	0.06-0.08	2060	1510-2520
Acenaphthylene	208-96-8		152,151	0.19	0.15-0.23	2050	1510-2520
Acenaphthene	83-32-9		154,153	1.13	0.90-1.36	2060	1500-2500
2-Methylfluorene	1430-97-3		180,165	1.19	0.95-1.43	2080	1500-2510
Fluorene	86-73-7		166,165	0.97	0.78-1.16	2010	1500-2490
Phenanthrene	85-01-8		178,176	0.19	0.15-0.23	1990	1500-2510
Anthracene	120-12-7		178,176	0.18	0.14-0.22	1980	1500-2500
Fluoranthene	206-44-0		202,200	0.20	0.16-0.24	1930	1500-2500
Pyrene	129-00-0		202,200	0.20	0.16-0.24	1980	1500-2500
Benz[a]anthracene	56-55-3		228,226	0.26	0.21-0.31	1960	1500-2510
Chrysene	218-01-9		228,226	0.29	0.23-0.35	2000	1500-2510
Benzo[b]fluoranthene	205-99-2		252,253	0.22	0.18-0.26	1990	1510-2520
Benzo[j,k]fluoranthenes			252,253	0.22	0.18-0.26	2010	1500-2500
Benzo[e]pyrene	192-97-2		252,253	0.21	0.17-0.25	2050	1500-2500
Benzo[a]pyrene	50-32-8		252,253	0.22	0.18-0.26	2070	1510-2520
Perylene	198-55-0		252,253	0.22	0.18-0.26	2020	1500-2500
Dibenz[a,h]anthracene	53-70-3		278,139	0.15	0.10-0.20	2010	1500-2500
Indeno[1,2,3-cd]pyrene	193-39-5		276,138	0.19	0.12-0.26	1960	1500-2510
Benzo[ghi]perylene	191-24-2		276,138	0.21	0.14-0.28	2020	1500-2490
2-Methylnaphthalene	91-57-6		142,141	0.89	0.71-1.07	2060	1500-2500
1-Methylnaphthalene	90-12-0		142,141	0.91	0.73-1.09	2060	1510-2520
Biphenyl	92-52-4		154,152	0.28	0.22-0.34	2060	1510-2520
1,2-Dimethylnaphthalene	573-98-8		156,141	1.22	0.98-1.46	2040	1510-2520
2,6-Dimethylnaphthalene	581-42-0		156,141	0.65	0.52-0.78	2080	1500-2500
2,3,6-Trimethylnaphthalene	829-26-5		170,155	0.86	0.69-1.03	2090	1510-2510
2,3,5-Trimethylnaphthalene	2245-38-7		170,155	0.86	0.69-1.03	2050	1500-2500
1,7-Dimethylfluorene	442-66-0		194,177	0.07	0.06-0.08	2160	1510-2510
Dibenzothiophene	132-65-0		184,152	0.08	0.06-0.10	1980	1500-2500
2/3-Methyldibenzothiophenes	20928-02-3 3/16587-52-3		198,197	0.70	0.56-0.84	2080	1510-2520
2,4-Dimethyldibenzothiophene	31317-18-7		212,197	0.47	0.38-0.56	2100	1500-2500
4,6-Dimethyldibenzothiophene	1207-12-1		212,197	0.15	0.12-0.18	2090	1510-2520
2-Methylphenanthrene	2531-84-2		192,191	0.57	0.46-0.68	2120	1510-2520
2-Methylantracene	613-12-7		192,191	0.49	0.39-0.59	1950	1500-2500
1-Methylphenanthrene	832-69-9		192,191	0.59	0.47-0.71	2060	1500-2510
3,6-Dimethylphenanthrene	1576-67-6		206,191	0.34	0.27-0.41	2030	1510-2520
1,7-Dimethylphenanthrene	483-87-4		206,191	0.32	0.26-0.38	2020	1500-2500
1,2,6-Trimethylphenanthrene	30436-55-6		220,205	0.58	0.46-0.70	1990	1510-2510
Retene	483-65-8		234,219	1.58	1.26-1.90	2030	1510-2510
3-Methylfluoranthene/Benzo[a]fluorene	1706-01-0 0/238-84-6		216,215	1.05	0.84-1.26	1740	1280-2130
5/6-Methylchrysene	3697-24-3 3/1705-85-7		242	0	N/A	2020	1500-2500
1-Methylchrysene	3351-28-8		242	0	N/A	2030	1510-2510
5,9-Dimethylchrysene	139493-40-6		256	0	N/A	1530	1130-1880
7-Methylbenzo[a]pyrene	63041-77-0		266	0	N/A	2060	1510-2510
1,4,6,7-Tetramethylnaphthalene	13764-18-6		184,139	0.02	0.02-0.02	2090	1510-2520
Fluoranthene d-10	93951-69-0		212,208	0.16	0.13-0.19	2020	1490-2480
Dibenzo[a,h]anthracene d-14	13250-98-1		292,288	0.24	0.16-0.32	1990	1440-2390



(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_Simin Yassari\_\_\_\_\_

For Axs Internal Use Only [ XSL Template: Pest4A.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2U0076.D\_\_Form4A\_SJ3026389.html; Workgroup: WG79135; Design ID: 4460 ]



## SGS AXYS METHOD MLA-021 Rev 12

## Form 4B

## POLYAROMATIC HYDROCARBON CALIBRATION VERIFICATION

## SGS AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 10-Feb-2022 VER Data Filename: PH2U0076.D  
Instrument ID: LR GC/MS Analysis Date: 11-Feb-2022  
GC Column ID: RTX5 Analysis Time: 06:30:00

LABELED COMPOUND	CAS NO.	LAB FLAG <sup>1</sup>	m/e ION CHANNELS	ION ABUND. RATIO	SAMPLE QC LIMITS	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL)
Naphthalene d-8	1146-65-2		136,134	0.09	0.07-0.11	2020	1500-2510
2-Methylnaphthalene d-10	7297-45-2		152,151	0.19	0.15-0.23	2000	1510-2510
Biphenyl d-10	1486-01-7		164	0	N/A	2020	1510-2520
2,6-Dimethylnaphthalene d-12	350820-12-1		168,150	0.72	0.58-0.86	2000	1500-2510
Acenaphthylene d-8	93951-97-4		160,158	0.15	0.12-0.18	1990	1500-2510
Dibenzothiophene d-8	33262-29-2		192,160	0.08	0.06-0.10	2030	1510-2510
Phenanthrene d-10	1517-22-2		188,184	0.14	0.11-0.17	2040	1500-2510
Benzo[a]anthracene d-12	1718-53-2		240,236	0.23	0.18-0.28	1990	1510-2510
Chrysene d-12	1719-03-5		240,236	0.26	0.21-0.31	2010	1510-2510
Benzo[b]fluoranthene d-12	93951-98-5		264,260	0.20	0.16-0.24	1990	1500-2500
Benzo[k]fluoranthene d-12	93952-01-3		264,260	0.20	0.16-0.24	1990	1490-2490
Benzo[a]pyrene d-12	63466-71-7		264,260	0.20	0.16-0.24	1980	1500-2510
Perylene d-12	1520-96-3		264,260	0.24	0.19-0.29	2010	1500-2500
Indeno[1,2,3-cd]pyrene d-12	203578-33-0		288,284	0.18	0.12-0.24	2090	1500-2510
Benzo[ghi]perylene d-12	93951-66-7		288,284	0.19	0.12-0.26	1960	1440-2400

(1) Where applicable, custom lab flags have been used on this report.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: \_\_\_\_\_ Simin Yassari \_\_\_\_\_

For Axys Internal Use Only [ XSL Template: Pest4B.xsl; Created: 18-Feb-2022 10:45:21; Application: XMLTransformer-1.18.33;  
Report Filename: GENERIC-SPECS\_PAH\_LO\_PH2U0076.D\_Form4B\_SJ3026389.html; Workgroup: WG79135; Design ID: 4460 ]











Accreditation Scope  
SGS AXYS Analytical Services Ltd.  
file ref.: ACC-103 Rev. 60

Accreditation Scope

SGS AXYS Analytical Services Ltd.

file ref.: ACC-103 Rev. 60

Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids												Tissue and Tissue Flora	Urine	Water	Water, Non-Potable												AFFF								
				ALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	ALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	ALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ALA	ALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *	ANAB DoD **	ANAB ISO 17025	
		SGS AXYS MLA-228	MLA-228					Y											Y	Y			Y																	
	Endrin aldehyde	EPA 608	MLA-007																									Y	Y	Y			Y							
		EPA 8081	MLA-007						Y	Y	Y			Y	Y	Y																								
		EPA 1699	MLA-028							Y									Y																					
		SGS AXYS MLA-028	MLA-028	Y					Y		Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y												Y																
		SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y									Y	Y					
	Endrin ketone	EPA 8081	MLA-007						Y	Y				Y		Y																								
		EPA 1699	MLA-028							Y									Y																					
		SGS AXYS MLA-028	MLA-028	Y					Y		Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Gamma-HCH (Lindane)	SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y										Y	Y				
		EPA 625	MLA-007																									Y	Y	Y			Y							
		EPA 8270	MLA-007							Y	Y	Y			Y	Y	Y																							
		EPA 1699	MLA-028								Y									Y																				
		SGS AXYS MLA-028	MLA-028	Y					Y		Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Heptachlor	SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y									Y	Y					
		EPA 625	MLA-007																									Y	Y	Y			Y							
		EPA 8270	MLA-007							Y	Y	Y			Y	Y	Y																							
		EPA 1699	MLA-028								Y									Y																				
		SGS AXYS MLA-028	MLA-028	Y					Y		Y								Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Heptachlor epoxide	SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y									Y	Y					
		EPA 608	MLA-007																									Y	Y	Y			Y							
		EPA 8081	MLA-007							Y	Y	Y			Y	Y	Y																							
		EPA 1699	MLA-028							Y										Y																				
		SGS AXYS MLA-028	MLA-028	Y					Y		Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Hexachlorobenzene	SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y										Y	Y				
		EPA 1625	MLA-007																									Y	Y				Y							
		EPA 8270	MLA-007								Y	Y			Y	Y	Y																							
		EPA 1699	MLA-028								Y									Y																				
		SGS AXYS MLA-028	MLA-028	Y							Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Methoxychlor	SGS AXYS MLA-228	MLA-228								Y				Y	Y			Y	Y			Y		Y										Y	Y				
		EPA 608	MLA-007																									Y					Y							
		EPA 8081	MLA-007							Y	Y	Y			Y	Y	Y																							
		EPA 1699	MLA-028								Y									Y																				
		SGS AXYS MLA-028	MLA-028	Y					Y		Y					Y			Y	Y				Y												Y				
		SGS AXYS MLA-007	MLA-007							Y		Y							Y					Y																
	Mirex	SGS AXYS MLA-228	MLA-228						Y		Y				Y	Y			Y	Y			Y		Y										Y	Y				
		EPA 8270	MLA-007								Y					Y													Y	Y			Y							
		EPA 1699	MLA-028								Y									Y																				







Accreditation Scope

SGS AXYS Analytical Services Ltd.  
file ref.: ACC-103 Rev. 60

Accreditation Scope																					Serum	Tissue and Tissue Flora	Urine	Water	Water, Non-Potable	AFFF																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids												Tissue and Tissue Flora	Urine	Water	Water, Non-Potable												AFFF																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *	ANAB DoD **	ANAB ISO 17025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		SGS AXYS MLA-908	MLA-908																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															



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Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids										Tissue and Tissue Flora	Urine	Water	Water, Non-Potable										AFFF																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
				Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *	ANAB DoD **	ANAB ISO 17025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		



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Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids												Tissue and Tissue Flora						Urine	Water	Water, Non-Potable												AFFF
				CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y					Y	Y				Y								
		SGS AXYS MLA-007	MLA-007					Y										Y						Y													
		SGS AXYS MLA-901	MLA-901	Y																																	
		SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y									Y			Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y						Y	Y		Y									Y			Y	Y	Y	Y	Y		
	PCB 181 2,2',3,4,4',5,6-Heptachlorobiphenyl	EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y									Y	Y		Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y								Y				Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
	PCB 182 2,2',3,4,4',5,6'-Heptachlorobiphenyl	EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y									Y	Y		Y	Y	Y	Y	Y	Y	
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y								Y				Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
	PCB 183 2,2',3,4,4',5',6-Heptachlorobiphenyl	EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y									Y	Y		Y	Y	Y	Y	Y	Y	
		EPA 8270	MLA-007													Y												Y	Y		Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-007	MLA-007					Y										Y					Y														
	PCB 184 2,2',3,4,4',6,6'-Heptachlorobiphenyl	SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y									Y				Y	Y	Y	Y	Y	
		SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
		EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y								Y	Y		Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007																																		
	PCB 185 2,2',3,4,5,5',6-Heptachlorobiphenyl	SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-007	MLA-007					Y										Y					Y														
		SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y								Y				Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
	PCB 186 2,2',3,4,5,6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y								Y	Y		Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007																																		
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y								Y				Y	Y	Y	Y	Y		
	PCB 187 2,2',3,4',5,5',6-Heptachlorobiphenyl	SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
		EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y								Y	Y		Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-901	MLA-901	Y																																	
	PCB 187/182	SGS AXYS MLA-210	MLA-210					Y	Y						Y				Y								Y										
		SGS AXYS MLA-908	MLA-908							Y					Y	Y			Y								Y			Y	Y	Y	Y	Y	Y		
		EPA 1668	MLA-010							Y	Y		Y	Y	Y	Y			Y								Y	Y		Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007													Y																					
	PCB 188 2,2',3,4',5,6,6'-Heptachlorobiphenyl	SGS AXYS MLA-010	MLA-010	Y				Y	Y									Y	Y				Y				Y										
		SGS AXYS MLA-210	MLA-210																																		



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file ref.: ACC-103 Rev. 60

				Serum	Solids												Tissue and Tissue Flora	Urine	Water	Water, Non-Potable												AFFF								
Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *	ANAB DoD **	ANAB ISO 17025	
		SGS AXYS MLA-210	MLA-210					Y		Y						Y	Y			Y	Y		Y	Y					Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y		Y	Y	Y	Y	Y	Y	Y			
	PCB 23/34	EPA 8270	MLA-007													Y																								
	PCB 24 2,3,6-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y		Y		Y	Y	Y	Y	Y			
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y			Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y		Y	Y	Y	Y	Y	Y	Y			
	PCB 24/27	EPA 8270	MLA-007													Y																								
		SGS AXYS MLA-007	MLA-007					Y											Y																					
	PCB 25 2,3',4'-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y		Y				Y	Y		Y	Y	Y	Y	Y	Y			
		EPA 8270	MLA-007													Y																								
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-007	MLA-007					Y											Y						Y															
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 26 2,3',5'-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007													Y																								
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-007	MLA-007					Y											Y						Y															
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 27 2,3',6'-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 28 2,4,4'-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007													Y																								
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-007	MLA-007					Y											Y						Y															
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 29 2,4,5-Trichlorobiphenyl	EPA 1668	MLA-010							Y				Y	Y	Y	Y			Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 3 4-Chlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007																																					
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 30 2,4,6-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-210	MLA-210					Y		Y						Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908							Y					Y	Y				Y			Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 31 2,4',5'-Trichlorobiphenyl	EPA 1668	MLA-010							Y	Y			Y	Y	Y	Y			Y			Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007													Y																								
		SGS AXYS MLA-010	MLA-010	Y				Y		Y									Y	Y					Y				Y											
		SGS AXYS MLA-007	MLA-007					Y																																







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Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids													Tissue and Tissue Flora	Urine	Water	Water, Non-Potable									AFFF								
				CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *	ANAB DoD **
	PCB 46 2,2',3,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010																																			
		EPA 8270	MLA-007																																			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y									Y	Y				Y															
		SGS AXYS MLA-007	MLA-007				Y												Y				Y															
		SGS AXYS MLA-210	MLA-210				Y		Y						Y				Y		Y							Y			Y	Y	Y	Y	Y			
		SGS AXYS MLA-908	MLA-908						Y					Y	Y				Y		Y						Y			Y	Y	Y	Y	Y	Y			
	PCB 47 2,2',4,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y									Y	Y				Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908						Y				Y	Y					Y		Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 47/48/75	EPA 8270	MLA-007												Y																							
		SGS AXYS MLA-007	MLA-007					Y										Y					Y															
	PCB 48 2,2',4,5-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908						Y				Y	Y					Y		Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 49 2,2',4,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908						Y					Y	Y				Y		Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 49/43	EPA 8270	MLA-007												Y																							
		SGS AXYS MLA-007	MLA-007															Y					Y															
	PCB 5 2,3-Dichlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908						Y				Y	Y					Y		Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 50 2,2',4,6-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		EPA 8270	MLA-007											Y																								
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
	PCB 51 2,2',4,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		EPA 8270	MLA-007																																			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
	PCB 51 2,2',4,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007																																			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
	PCB 51 2,2',4,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y	Y		
		EPA 8270	MLA-007																																			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
	PCB 52 2,2',5,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-210	MLA-210				Y		Y					Y					Y		Y						Y				Y	Y	Y	Y	Y	Y		
		SGS AXYS MLA-908	MLA-908						Y				Y	Y					Y		Y						Y			Y	Y	Y	Y	Y	Y	Y		
	PCB 52/73	EPA 8270	MLA-007												Y																							
		SGS AXYS MLA-007	MLA-007				Y												Y				Y															
	PCB 53 2,2',5,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010						Y	Y		Y	Y	Y	Y				Y		Y						Y	Y		Y	Y	Y	Y	Y	Y			
		EPA 8270	MLA-007																																			
		SGS AXYS MLA-010	MLA-010	Y			Y		Y										Y	Y			Y				Y											
		SGS AXYS MLA-2																																				



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Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	Solids													Tissue and Tissue Flora	Urine	Water	Water, Non-Potable									AFFF							
				CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	CALA	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	ANAB DoD **	ANAB ISO 17025	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	CALA	CALA	Alaska DEC	ANAB DoD **	ANAB ISO 17025	California WB	Florida DOH	Maine DOH	Minnesota DOH	New Jersey DEP	New York DOH	Pennsylvania DEP	Virginia DGS	Washington DE *
	Amitriptyline	SGS AXYS MLA-075	MLA-075					Y															Y														
	Amlodipine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Amphetamine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Anhydrochlortetracycline (ACTC)	EPA 1694	MLA-075								Y																										
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Anhydrotetracycline (ATC)	EPA 1694	MLA-075										Y																								
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Atenolol	SGS AXYS MLA-075	MLA-075					Y															Y														
	Atorvastatin	SGS AXYS MLA-075	MLA-075					Y															Y														
	Azithromycin	EPA 1694	MLA-075								Y																										
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Benzoyllecgonine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Benztropine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Betamethasone	SGS AXYS MLA-075	MLA-075					Y															Y														
	Bisphenol A	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Caffeine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Carbadox	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Carbamazepine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Cefotaxime	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Chlortetracycline (CTC)	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Cimetidine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Ciprofloxacin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Clarithromycin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Clinafloxacin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Clonidine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Cloxacillin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Cocaine	SGS AXYS MLA-075	MLA-075					Y															Y														
	Codeine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Cotinine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	DEET (N,N-diethyl-m-toluamide)	SGS AXYS MLA-075	MLA-075					Y															Y														
	Dehydronifedipine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Demeclocycline	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Desmethyldiltiazem	SGS AXYS MLA-075	MLA-075					Y															Y														
	Diazepam	SGS AXYS MLA-075	MLA-075					Y															Y														
	Digoxigenin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Digoxin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Diltiazem	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Diphenhydramine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Doxycycline	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Enalapril	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Enrofloxacin	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Erythromycin	SGS AXYS MLA-075	MLA-075					Y															Y														
	Erythromycin anydrate	EPA 1694	MLA-075									Y																									
	Flumequine	EPA 1694	MLA-075									Y																									
		SGS AXYS MLA-075	MLA-075								Y												Y														
	Fluocinonide	SGS AXYS MLA-075	MLA-075					Y																													



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Legend	
Y	Accreditation scope
AFFF	Aqueous film forming foam
BFR	Brominated flame retardants (non-PBDPE)
BPA and mPE	Bisphenol A and mono-Phthalate Esters
OC Pesticides	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PBDPE	Polybrominated diphenylethers
PCB	Polychlorinated Biphenyls
PCDDF	Polychlorinated dibenzodioxins/furans
PFAS	Per- and Polyfluoroalkyl Substances
PPCP	Pharmaceutical and Personal Care Products
TOP	Total Oxidizable Precursors
California WB	California Water Boards, Lab ID 2911
Florida DOH	Florida Department of Health, Lab ID E871007, (NELAC Standard)
Pennsylvania DEP	Pennsylvania Department of Environmental Protection
Minnesota DOH	Minnesota Department of Health, Lab ID 232-999-430, (NELAC Standard)
New Jersey DEP	New Jersey Department of Environmental Protection, Lab ID CANA005, (NELAC Standard)
New York DOH	New York Department of Health, Lab ID 11674, (NELAC Standard)
Washington DE	Washington Department of Ecology, Lab ID C404



Accreditation Scope

SGS AXYS Analytical Services Ltd.  
file ref.: ACC-103 Rev. 60

Accreditation Scope				SGS AXYS Analytical Services Ltd.	
file ref.: ACC-103 Rev. 60					
Compound Class	Compound	Accredited Method ID	SGS AXYS Method ID	Serum	
				Solids	
Virginia DGS	Virginia Department of General Services, Division of Consolidated Laboratory Services, Lab ID 460224, (NELAC Standard)			CALA	
Alaska DEC	Alaska Department of Environmental Conservation, Contaminated Sites Laboratory Approval 17-014			Alaska DEC	
Maine DOH	Maine Center for Disease Control and Prevention, Department of Health and Human Services, Lab ID CN00003			ANAB DoD **	
				ANAB ISO 17025	
				CALA	
				California WB	
				Florida DOH	
				Maine DOH	
				Minnesota DOH	
				New Jersey DEP	
				New York DOH	
				Virginia DGS	
				Washington DE	
				ANAB DoD **	Tissue and Tissue Flora
				ANAB ISO 17025	
				CALA	
				Florida DOH	
				Minnesota DOH	
				New Jersey DEP	
				Virginia DGS	
				CALA	Urine
				CALA	Water
				Alaska DEC	Water, Non-Potable
				ANAB DoD **	
				ANAB ISO 17025	
				California WB	
				Florida DOH	
				Maine DOH	
				Minnesota DOH	
				New Jersey DEP	
				New York DOH	
				Pennsylvania DEP	
				Virginia DGS	
				Washington DE *	
				ANAB DoD **	AFFF
				ANAB ISO 17025	

ANAB DoD      ANSI National Accreditation Board, certificate ADE-1861, (US DoD QSM 5.3 Standard)



CALA      Canadian Association for Laboratory Accreditation Inc., Lab ID A2637, (ISO/IEC 17025:2017 Standard)





## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene d-10	o[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	
Final PRC concentration ( $N$ , ng/SPMD) =			4200	75	
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.014	0.007		
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52		
$R_{S-PRC}$ ( $L d^{-1}$ ) =	2.8	0.4		
log $\alpha_{PRC}$ =	4.92	4.85		
$a_{oPRC}$ =	-4.46	-5.24		
			average $a_{oPRC}$ =	-4.85
			std. dev. $a_{oPRC}$ =	5.47E-01
			Rs uncertainty factor (* / +) =	3.521864997

Project / Site Name:

River tank 1

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.4	10.1	2353.8
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.8	1.47	119.2
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	0.9	7.36	513.1
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	1.0	5.73	346.4
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	1.0	40.6	2311.4
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	1.0	1.79	96.6
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	1.2	19	823.4
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	1.2	17.9	772.0
Benzo[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	1.0	92.8	4393.8
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	1.1	91.7	4046.9
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.8	5.24	321.5
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.8	4.83	296.4
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	1.1	4.34	198.3
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	0.9	4.18	220.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.9	4.36	245.5
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.7	4.71	329.1



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.8	3.29	200.8
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.6	86.4	6621.2
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0	4.41	
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.7	8.68	944.9
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.7	8.43	917.7
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.7	8.78	901.0
2,6-Dimethylnaphthalene	4.3	<a href="https://doi.org/10.1281/ci960028n">https://doi.org/10.1281/ci960028n</a>	-2.61	4.39	4.82	0.9	7.32	469.2
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	0.9	2.41	161.7
2,3,6-Trimethylnaphthalene	4.7	<a href="https://doi.org/10.1281/ci960028n">https://doi.org/10.1281/ci960028n</a>	-2.61	4.75	4.89	1.1	9.43	460.2
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	1.1	7.68	352.0
1,4,6,7-Tetramethylnaphthalene	5.0	<a href="https://doi.org/10.1281/ci960028n">https://doi.org/10.1281/ci960028n</a>	-2.61	4.96	4.91	1.2	5.12	228.2
2-methylfluorene	5.0		-2.61	4.93	4.91	1.1	1.52	68.4
1,7-Dimethylfluorene	4.3	<a href="https://doi.org/10.1281/ci960028n">g/10.1281/ci960028n</a>	-2.61	4.41	4.82	0.9		0.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	1.0	4.73	286.0
2/3-Methyldibenzothiophenes	3.5		-2.61	3.53	4.52	0.5	4.03	842.4
2,4-Dimethyldibenzothiophene	4.9		-2.61	4.90	4.91	1.1	2.31	105.0
4,6-Dimethyldibenzothiophene	5.2		-2.61	5.08	4.92	1.2	7.44	322.4
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	1.1	10.8	496.5
3-methylphenanthrene	4.9		-2.61	4.87	4.91	1.1	8.23	378.4
1-Methylphenanthrene	4.9		-2.61	4.89	4.91	1.1	6.38	290.7
9/4-Methylphenanthrene	4.9		-2.61	4.89	4.91	1.1	8.46	385.5
2-Methylanthracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	1.2	0.867	38.2
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	1.1	4.09	177.0
2,6-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	1.1	2.74	118.6
1,7-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	1.1	5.12	221.6
1,8-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	1.1		0.0
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	1.1	5.58	242.3
1,2,6-Trimethylphenanthrene	6.4		-2.61	5.61	4.78	0.9	3.5	198.0
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0	3.33	
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.8	4.34	250.4
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	1.0	8.34	423.3
Retene	6.1		-2.61	5.53	4.83	1.0	20	1015.0

Individual PCB Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	$C_{SPMD}$	average $C_w$
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	(ng/SPMD)	(pg/L)
Total PCB	6.38 <sup>m</sup>	-2.61	5.61	4.78	0.8		0.0

Individual PBDE Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	Total Analyte per SPMD	Estimated Water Concentration
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	$C_{SPMD}$ (ng/SPMD)	average $C_w$ (pg/L)

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log  $K_{ow}$  values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W.-Y.; Ma, K.-C. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

<sup>b</sup> Oliver, B.G.; Nilimi, A.J. Environ. Sci. Technol., 1985, 19:9, 842-849.

<sup>c</sup> Simpson, C.D.; Wilcock, R.J.; Smith, T.J.; Wilkins, A.L.; Langdon, A.G. Bull. Environ. Contam. Toxicol., 1995, 55:1, 149-153.

<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log  $K_{ow}$  Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

<sup>f</sup> Huckins, J.N.; Petty, J.D.; Orazio, C.E.; Lebo, J.A.; Clark, R.C.; Gibson, V.L.; Gala, W.R.; Echols, K.R. Environ. Sci. Technol., 1999, 33, 3918-3923.

<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillitt, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretney, W.; Ikonou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabalinas, D.; Lazutka, J.; Sabaliniene, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorpyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log  $K_{ow}$  values.

<sup>k</sup> Log  $K_{ow}$  values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol, 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

<sup>o</sup> US EPA EPI Suite 4.1



## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene d-10	o[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	
Final PRC concentration ( $N$ , ng/SPMD) =			4720	78	
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.008	0.005		
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52		
$R_{S-PRC}$ ( $L d^{-1}$ ) =	1.7	0.3		
log $\alpha_{PRC}$ =	4.92	4.85		
$a_{oPRC}$ =	-4.69	-5.41		
			average $a_{oPRC}$ =	-5.05
			std. dev. $a_{oPRC}$ =	5.09E-01
			Rs uncertainty factor (* / +) =	3.226342468

Project / Site Name: T-OSPW tank field blank

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.3	21.6	6195.8
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.5	0.371	42.9
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	0.6	2.04	206.9
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	0.6	4.27	382.9
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	0.6	1.94	165.2
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	0.6	0.662	53.8
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	0.7	8.95	605.7
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	0.7	5.23	353.2
Benz[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	0.6	0.187	14.0
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	0.7	0.606	42.2
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.5	9.34	910.6
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.5		0.0
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	0.7		0.0
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	0.6		0.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.5		0.0
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.4		0.0



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.5		0.0
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.4		0.0
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0		
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	3.17	471.7
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	1.64	244.0
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.4	5.96	843.0
2,6-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.39	4.82	0.6	5.01	472.6
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	0.6	1.27	124.6
2,3,6-Trimethylnaphthalene	4.7	<sup>e</sup>	-2.61	4.75	4.89	0.7	4.06	302.8
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	0.7	3.16	223.5
1,4,6,7-Tetramethylnaphthalene	5.0	<sup>e</sup>	-2.61	4.96	4.91	0.7		0.0
2-methylfluorene	5.0	<sup>e</sup>	-2.61	4.93	4.91	0.7		0.0
1,7-Dimethylfluorene	4.3	<sup>e</sup>	-2.61	4.41	4.82	0.6		0.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	0.6	1.88	168.6
2/3-Methyldibenzothiophenes	3.5	<sup>e</sup>	-2.61	3.53	4.52	0.3	0.439	114.6
2,4-Dimethyldibenzothiophene	4.9	<sup>e</sup>	-2.61	4.90	4.91	0.7		0.0
4,6-Dimethyldibenzothiophene	5.2	<sup>e</sup>	-2.61	5.08	4.92	0.7		0.0
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	0.7	3.17	224.8
3-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	0.7	2.64	187.2
1-Methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.89	4.91	0.7	1.64	115.4
9/4-Methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.89	4.91	0.7	1.72	121.1
2-Methylantracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	0.7		0.0
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.7		0.0
2,6-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.7		0.0
1,7-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.7	0.779	53.0
1,8-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.7		0.0
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	0.7	0.498	34.0
1,2,6-Trimethylphenanthrene	6.4	<sup>e</sup>	-2.61	5.61	4.78	0.5		0.0
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0		
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.5		0.0
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	0.6		0.0
Retene	6.1	<sup>e</sup>	-2.61	5.53	4.83	0.6	1.13	90.9

Individual PCB Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	$C_{SPMD}$	average $C_w$
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	(ng/SPMD)	(pg/L)
Total PCB	6.38 <sup>m</sup>	-2.61	5.61	4.78	0.5		0.0

Individual PBDE Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	Total Analyte per SPMD	Estimated Water Concentration
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	$C_{SPMD}$	average $C_w$
						(ng/SPMD)	(pg/L)

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log  $K_{ow}$  values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W-Y; Ma, K-C Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

<sup>b</sup> Oliver, B.G.; Niimi, A.J. Environ. Sci. Technol., 1985, 19:9, 842-849.

<sup>c</sup> Simpson, C.D.; Wilcock, R.J.; Smith, T.J.; Wilkins, A.L.; Langdon, A.G. Bull. Environ. Contam. Toxicol., 1995, 55:1, 149-153.

<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log  $K_{ow}$  Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

<sup>f</sup> Huckins, J.N.; Petty, J.D.; Orazio, C.E.; Lebo, J.A.; Clark, R.C.; Gibson, V.L.; Gala, W.R.; Echols, K.R. Environ. Sci. Technol., 1999, 33, 3918-3923.

<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillit, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretnay, W.; Ikonomou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabalunias, D.; Lazutka, J.; Sabalunienė, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorpyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log  $K_{ow}$  values.

<sup>k</sup> Log  $K_{ow}$  values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol., 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

<sup>o</sup> US EPA EPISuite 4.1





## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene d-10	o[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	430
Final PRC concentration ( $N$ , ng/SPMD) =			4390	79	407
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.011	0.004	0.003
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52	5.64
$R_{S-PRC}$ ( $L d^{-1}$ ) =	2.4	0.2	2.0
log $\alpha_{PRC}$ =	4.92	4.85	4.75
$a_{oPRC}$ =	-4.54	-5.46	-4.45

average  $a_{oPRC}$  = -4.82  
std. dev.  $a_{oPRC}$  = 5.58E-01  
Rs uncertainty factor (\* / +) = 3.61529323

Project / Site Name:

OSPW tank

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.5	37.2	8449.2
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.9	8.06	619.8
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	1.0	146	9609.3
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	1.0	100	5684.9
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	1.1	333	17796.7
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	1.1	4.14	209.5
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	1.3	21.5	866.8
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	1.3	53.7	2153.2
Benz[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	1.1		0.0
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	1.2	64.9	2659.2
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.8	2.85	162.1
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.8	3.46	196.8
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	1.2	1.24	52.6
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	1.0		0.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.9	85.7	4473.9
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.7	70.5	4565.0



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.9	407	23024.0
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.7	71.1	5048.8
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0		
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.7	103	10719.0
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.7	113	11759.7
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.8	19.5	1909.9
2,6-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.39	4.82	1.0	152	9177.2
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	1.0	113	7148.4
2,3,6-Trimethylnaphthalene	4.7	<sup>e</sup>	-2.61	4.75	4.89	1.2	302	13773.6
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	1.2	273	11669.7
1,4,6,7-Tetramethylnaphthalene	5.0	<sup>e</sup>	-2.61	4.96	4.91	1.2	65.3	2710.9
2-methylfluorene	5.0	<sup>e</sup>	-2.61	4.93	4.91	1.2	36.1	1513.0
1,7-Dimethylfluorene	4.3	<sup>e</sup>	-2.61	4.41	4.82	1.0	23.2	1376.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	1.0	147	8356.9
2/3-Methyldibenzothiophenes	3.5	<sup>e</sup>	-2.61	3.53	4.52	0.5	135	27434.4
2,4-Dimethyldibenzothiophene	4.9	<sup>e</sup>	-2.61	4.90	4.91	1.2	56.8	2406.4
4,6-Dimethyldibenzothiophene	5.2	<sup>e</sup>	-2.61	5.08	4.92	1.3	108	4354.2
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	1.2	171	7332.5
3-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	1.2	122	5231.4
1-Methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.89	4.91	1.2	114	4843.8
9/4-Methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.89	4.91	1.2	188	7988.0
2-Methylantracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	1.3		0.0
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	1.2	43.2	1737.2
2,6-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	1.2	28.6	1150.1
1,7-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	1.2	65.8	2646.0
1,8-Dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	1.2	15.9	639.4
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	1.2	15.6	629.2
1,2,6-Trimethylphenanthrene	6.4	<sup>e</sup>	-2.61	5.61	4.78	0.9	14.8	776.3
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0	1.09	
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.9	6.6	353.0
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	1.0	1.92	90.4
Retene	6.1	<sup>e</sup>	-2.61	5.53	4.83	1.0	17.6	828.3

Individual PCB Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,l}$	log $\alpha_1$	$R_{s,j}$	$C_{SPMD}$	average $C_w$
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	(ng/SPMD)	(pg/L)
Total PCB	6.38 <sup>m</sup>	-2.61	5.61	4.78	0.9		0.0
Individual PBDE Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,l}$	log $\alpha_1$	$R_{s,j}$	Total Analyte per SPMD	Estimated Water Concentration
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	$C_{SPMD}$	average $C_w$
						(ng/SPMD)	(pg/L)

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log  $K_{ow}$  values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W-Y; Ma, K-C Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

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<sup>c</sup> Simpson, C.D.; Wilcock, R.J.; Smith, T.J.; Wilkins, A.L.; Langdon, A.G. Bull. Environ. Contam. Toxicol., 1995, 55:1, 149-153.

<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log  $K_{ow}$  Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

<sup>f</sup> Huckins, J.N.; Petty, J.D.; Orazio, C.E.; Lebo, J.A.; Clark, R.C.; Gibson, V.L.; Gala, W.R.; Echols, K.R. Environ. Sci. Technol., 1999, 33, 3918-3923.

<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillit, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretney, W.; Ikonoumou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabalunias, D.; Lazutka, J.; Sabaluniene, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorypyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log  $K_{ow}$  values.

<sup>k</sup> Log  $K_{ow}$  values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol., 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

<sup>o</sup> US EPA EPI Suite 4.1





## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene d-10	1,2,3-benz[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	430
Final PRC concentration ( $N$ , ng/SPMD) =			4540	75	428
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.010	0.007	0.000	
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52	5.64	average $a_{oPRC}$ = -5.12
$R_{S-PRC}$ ( $L d^{-1}$ ) =	2.1	0.4	0.2	std. dev. $a_{oPRC}$ = 4.73E-01
log $\alpha_{PRC}$ =	4.92	4.85	4.75	Rs uncertainty factor (* / +) = 2.968589284
$a_{oPRC}$ =	-4.60	-5.24	-5.53	

Project / Site Name: River tank 2

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.2	10.8	3391.7
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.4	1.38	181.9
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	0.5	5.97	694.5
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	0.5	5.05	522.2
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	0.5	34.1	3355.2
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	0.6	1.79	168.5
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	0.6	15.3	1209.7
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	0.6	15	1184.5
Benzo[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	0.5	0.875	76.8
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	0.6	6.51	530.3
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.4	1.25	143.0
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.4	0.951	108.8
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	0.6		0.0
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	0.5		0.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.5		0.0
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.4		0.0



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.4		0.0
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.3		0.0
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0		
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	8.63	1448.8
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	8.43	1415.3
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.4	3.61	577.4
2,6-Dimethylnaphthalene	4.3	<sup>h</sup>	-2.61	4.39	4.82	0.5	6.53	708.8
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	0.5	2.51	282.9
2,3,6-Trimethylnaphthalene	4.7	<sup>h</sup>	-2.61	4.75	4.89	0.6	9.38	812.9
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	0.6	8.02	660.7
1,4,6,7-Tetramethylnaphthalene	5.0	<sup>h</sup>	-2.61	4.96	4.91	0.6	5.3	427.2
2-methylfluorene	5.0		-2.61	4.93	4.91	0.6	1.11	90.1
1,7-Dimethylfluorene	4.3	<sup>h</sup>	-2.61	4.41	4.82	0.5		0.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	0.5	3.93	406.4
2/3-Methyldibenzothiophenes	3.5		-2.61	3.53	4.52	0.3	3.95	1133.7
2,4-Dimethyldibenzothiophene	4.9		-2.61	4.90	4.91	0.6	3.08	252.0
4,6-Dimethyldibenzothiophene	5.2		-2.61	5.08	4.92	0.6	6.61	522.6
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	0.6	9.64	796.1
3-methylphenanthrene	4.9		-2.61	4.87	4.91	0.6	6.73	555.8
1-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.6	5.46	447.7
9/4-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.6	8.1	664.2
2-Methylantracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	0.6		0.0
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.6	3.47	276.1
2,6-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.6	2.5	198.9
1,7-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.6	5.6	445.6
1,8-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.6	1.02	81.2
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	0.6	4.8	383.6
1,2,6-Trimethylphenanthrene	6.4		-2.61	5.61	4.78	0.5		0.0
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0		
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.4	1.41	151.6
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	0.5	5.6	528.4
Retene	6.1		-2.61	5.53	4.83	0.5	17.6	1660.6

Individual PCB Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	$C_{SPMD}$	average $C_w$
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	(ng/SPMD)	(pg/L)
Total PCB	6.38 <sup>m</sup>	-2.61	5.61	4.78	0.5		0.0
Individual PBDE Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	Total Analyte per SPMD	Estimated Water Concentration
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	$C_{SPMD}$ (ng/SPMD)	average $C_w$ (pg/L)

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log  $K_{ow}$  values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W-Y; Ma, K-C. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

<sup>b</sup> Oliver, B.G.; Niimi, A.J. Environ. Sci. Technol., 1985, 19:9, 842-849.

<sup>c</sup> Simpson, C.D.; Wilcock, R.J.; Smith, T.J.; Wilkins, A.L.; Langdon, A.G. Bull. Environ. Contam. Toxicol., 1995, 55:1, 149-153.

<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log  $K_{ow}$  Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

<sup>f</sup> Huckins, J.N.; Petty, J.D.; Orazio, C.E.; Lebo, J.A.; Clark, R.C.; Gibson, V.L.; Gala, W.R.; Echols, K.R. Environ. Sci. Technol., 1999, 33, 3918-3923.

<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillit, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretney, W.; Ikononou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabalunias, D.; Lazutka, J.; Sabaluniene, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorypyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log  $K_{ow}$  values.

<sup>k</sup> Log  $K_{ow}$  values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol, 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

<sup>o</sup> US EPA EPI Suite 4.1

Created by the U.S. Geological Survey, Columbia Environmental Research Center  
4200 New Haven Road, Columbia, MO 65202  
Contact: David Alvarez, Ph.D. (573) 441-2970, [dalvarez@usgs.gov](mailto:dalvarez@usgs.gov)

SPMD Calculator version 5.2 Updated: 02/16/2016



## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene d-10	1,2,3-benz[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	430
Final PRC concentration ( $N$ , ng/SPMD) =			4170	77	426
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.014	0.006	0.000
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52	5.64
$R_{S-PRC}$ ( $L d^{-1}$ ) =	2.9	0.3	0.3
log $\alpha_{PRC}$ =	4.92	4.85	4.75
$a_{oPRC}$ =	-4.45	-5.33	-5.22

average  $a_{oPRC}$  = -5.00  
 std. dev.  $a_{oPRC}$  = 4.79E-01  
 Rs uncertainty factor (\* / +) = 3.013089636

Project / Site Name:

River tank 3

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.3	8.93	2412.6
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.6	1.74	183.2
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	0.6	5.9	542.9
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	0.7	5.29	428.7
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	0.7	35.7	2741.9
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	0.7	1.3	95.2
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	0.8	15	907.3
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	0.8	15.1	911.0
Benzo[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	0.7	0.604	40.3
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	0.8	5.62	348.8
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.6	1.11	96.4
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.6	0.719	62.4
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	0.8		0.0
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	0.6		0.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.6		0.0
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.5		0.0



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.6		0.0
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.4	86.9	9432.8
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0		
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.5	8.61	1178.2
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.5	9.46	1294.5
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.5	4.28	555.7
2,6-Dimethylnaphthalene	4.3	<a href="https://doi.org/10.1261/ci960028n">https://doi.org/10.1261/ci960028n</a>	-2.61	4.39	4.82	0.7	7.19	613.8
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	0.6	2.04	181.4
2,3,6-Trimethylnaphthalene	4.7	<a href="https://doi.org/10.1261/ci960028n">https://doi.org/10.1261/ci960028n</a>	-2.61	4.75	4.89	0.8	9.63	644.9
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	0.8	7.49	474.7
1,4,6,7-Tetramethylnaphthalene	5.0	<a href="https://doi.org/10.1261/ci960028n">https://doi.org/10.1261/ci960028n</a>	-2.61	4.96	4.91	0.8	4.75	293.8
2-methylfluorene	5.0		-2.61	4.93	4.91	0.8	1.55	96.6
1,7-Dimethylfluorene	4.3	<a href="https://doi.org/10.1261/ci960028n">https://doi.org/10.1261/ci960028n</a>	-2.61	4.41	4.82	0.7		0.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	0.7	4.63	375.2
2/3-Methyldibenzothiophenes	3.5		-2.61	3.53	4.52	0.3	3.38	828.1
2,4-Dimethyldibenzothiophene	4.9		-2.61	4.90	4.91	0.8		0.0
4,6-Dimethyldibenzothiophene	5.2		-2.61	5.08	4.92	0.8	6.28	379.9
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	0.8	9.33	592.8
3-methylphenanthrene	4.9		-2.61	4.87	4.91	0.8	7.45	473.4
1-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.8	5.57	351.2
9/4-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.8	7.56	476.7
2-Methylantracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	0.8		0.0
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.8	3.46	210.1
2,6-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.8	2.42	146.9
1,7-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.8	5.24	318.1
1,8-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.8	1.36	82.6
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	0.8	4.26	259.6
1,2,6-Trimethylphenanthrene	6.4		-2.61	5.61	4.78	0.6	1.89	151.2
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0		
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.6	0.981	80.1
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	0.7	4.34	311.1
Retene	6.1		-2.61	5.53	4.83	0.7	13.5	967.8

Individual PCB Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	$C_{SPMD}$	average $C_w$
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	(ng/SPMD)	(pg/L)
Total PCB	6.38 <sup>m</sup>	-2.61	5.61	4.78	0.6		0.0

Individual PBDE Congeners	Log $K_{ow}$	$a_o$	log $K_{sw,i}$	log $\alpha_i$	$R_{s,i}$	Total Analyte per SPMD	Estimated Water Concentration
IUPAC No.		(-2.61 or -3.20)	(mL/mL)		(L d <sup>-1</sup> )	$C_{SPMD}$ (ng/SPMD)	average $C_w$ (pg/L)

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log  $K_{ow}$  values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W-Y; Ma, K-C. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

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<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log  $K_{ow}$  Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

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<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillit, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretney, W.; Ikonomou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabaliunas, D.; Lazutka, J.; Sabaliuniene, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorypyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log  $K_{ow}$  values.

<sup>k</sup> Log  $K_{ow}$  values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol, 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

<sup>o</sup> US EPA EPI Suite 4.1

Created by the U.S. Geological Survey, Columbia Environmental Research Center  
4200 New Haven Road, Columbia, MO 65202  
Contact: David Alvarez, Ph.D. (573) 441-2970, [dalvarez@usgs.gov](mailto:dalvarez@usgs.gov)

SPMD Calculator version 5.2 Updated: 02/16/2016



## Estimated Water Concentration Calculator From SPMD Data Using PRCs

To calculate the estimated water concentrations ( $C_w$ ) from SPMD data, enter the appropriate information into the highlighted yellow cells.

The final Estimated Water Concentration values appear in the light blue highlighted cells.

All data should be entered as **mass of chemical per single SPMD** (i.e., ng/SPMD)

Exposure Time (d) = 21

Volume of SPMD (L) = 0.00172675 SPMD volumes can be calculated by methods on the 'SPMD volume calculator' tab

If multiple PRCs were used, enter the initial amount of each PRC added to the SPMD (ng/SPMD @  $t=0$ ) and the amount of each PRC remaining following deployment (ng/SPMD). Only enter data into cells for the number of PRCs used (i.e., PRC #1 if only one PRC is used).

	PRC #1	PRC #2	PRC #3	PRC #4	PRC #5
PRC Identification =	PCB-14	PCB-29	Fluoranthene d-10	Phenanthrene-d10	o[a,h]anthracene d-14
Initial PRC concentration ( $N_o$ , ng/SPMD) =			5580.00	87	
Final PRC concentration ( $N$ , ng/SPMD) =			4720	79	
Log $K_{ow}$ of PRC =	5.28	5.6	5.2	4.46	6.5
$a_o$ for log $K_{sw-PRC}$ determination =	-2.61	-2.61	-2.61	-2.61	-2.61

( $a_o = -2.61$  for PCBs, PAHs,  $p,p'$ -DDE, nonpolar pesticides;  $a_o = -3.20$  for moderately polar pesticides)

$k_{e-PRC}$ ( $d^{-1}$ ) =	0.008	0.004		
log $K_{sw-PRC}$ (mL/mL) =	5.08	4.52		
$R_{S-PRC}$ ( $L d^{-1}$ ) =	1.7	0.3		
log $\alpha_{PRC}$ =	4.92	4.85		
$a_{oPRC}$ =	-4.69	-5.44		
			average $a_{oPRC}$ =	-5.07
			std. dev. $a_{oPRC}$ =	5.29E-01
			Rs uncertainty factor (* / +) =	3.38059008

Project / Site Name: River water field blank

Organochlorine Pesticides	Log $K_{ow}$	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
PAHs and Related Heterocyclic Compounds	Log Kow	$a_o$ (-2.61 or -3.20)	log $K_{sw,i}$ (mL/mL)	log $\alpha_i$	$R_{S,i}$ ( $L d^{-1}$ )	Total Analyte per SPMD $C_{SPMD}$ (ng/SPMD)	Estimated Water Concentration average $C_w$ (pg/L)
Naphthalene	3.5 <sup>f</sup>	-2.61	3.47	4.50	0.3	23.3	6803.8
Acenaphthylene	4.1 <sup>f</sup>	-2.61	4.17	4.76	0.5	0.376	44.6
Acenaphthene	4.2 <sup>f</sup>	-2.61	4.30	4.80	0.5	1.99	207.5
Fluorene	4.4 <sup>f</sup>	-2.61	4.45	4.83	0.6	2.24	206.8
Phenanthrene	4.5 <sup>f</sup>	-2.61	4.52	4.85	0.6	19.8	1736.4
Anthracene	4.5 <sup>f</sup>	-2.61	4.59	4.86	0.6	0.756	63.4
Fluoranthene	5.2 <sup>f</sup>	-2.61	5.08	4.92	0.7	6.6	461.1
Pyrene	5.3 <sup>f</sup>	-2.61	5.15	4.92	0.7	3.28	228.7
Benzo[a]anthracene	5.9 <sup>f</sup>	-2.61	5.46	4.86	0.6		0.0
Chrysene	5.6 <sup>f</sup>	-2.61	5.32	4.90	0.7	0.208	14.9
1-Methylchrysene	6.5	-2.61	5.64	4.75	0.5		0.0
5/6-Methylchrysene	6.5	-2.61	5.64	4.75	0.5		0.0
Benzo[b]fluoranthene	5.8 <sup>f</sup>	-2.61	5.40	4.88	0.6		0.0
Benzo[j,k]fluoranthenes	6.2 <sup>f</sup>	-2.61	5.56	4.81	0.6		0.0
Benzo[a]pyrene	6.4 <sup>f</sup>	-2.61	5.60	4.78	0.5		0.0
Indeno[1,2,3-cd]pyrene	6.8 <sup>f</sup>	-2.61	5.68	4.69	0.4		0.0



Dibenz[a,h]anthracene	6.5	<sup>f</sup>	-2.61	5.64	4.75	0.5		0.0
Benzo[ghi]perylene	6.9	<sup>f</sup>	-2.61	5.70	4.65	0.4		0.0
5,9-Dimethylchrysene			-2.61	-2.61	0.00	0.0		
2-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	17.6	2683.2
1-methylnaphthalene	3.9	<sup>i</sup>	-2.61	3.94	4.68	0.4	9.39	1431.5
Biphenyl	3.9	<sup>i</sup>	-2.61	3.98	4.70	0.4	5.79	839.5
2,6-Dimethylnaphthalene	4.3	<a href="https://doi.org/10.1021/ci960028n">https://doi.org/10.1021/ci960028n</a>	-2.61	4.39	4.82	0.6	5.36	520.2
1,2-Dimethylnaphthalene	4.3	<sup>e</sup>	-2.61	4.34	4.81	0.5	1.2	121.1
2,3,6-Trimethylnaphthalene	4.7	<a href="https://doi.org/10.1021/ci960028n">https://doi.org/10.1021/ci960028n</a>	-2.61	4.75	4.89	0.7	3.93	302.2
2,3,5-trimethylnaphthalene	4.9	<sup>e</sup>	-2.61	4.88	4.91	0.7	3.35	244.4
1,4,6,7-Tetramethylnaphthalene	5.0	<a href="https://doi.org/10.1021/ci960028n">https://doi.org/10.1021/ci960028n</a>	-2.61	4.96	4.91	0.7		0.0
2-methylfluorene	5.0		-2.61	4.93	4.91	0.7		0.0
1,7-Dimethylfluorene	4.3	<a href="https://doi.org/10.1021/ci960028n">https://doi.org/10.1021/ci960028n</a>	-2.61	4.41	4.82	0.6		0.0
Dibenzothiophene	4.4	<sup>e</sup>	-2.61	4.45	4.83	0.6	1.73	159.7
2/3-Methyldibenzothiophenes	3.5		-2.61	3.53	4.52	0.3	0.387	102.9
2,4-Dimethyldibenzothiophene	4.9		-2.61	4.90	4.91	0.7	0.76	55.1
4,6-Dimethyldibenzothiophene	5.2		-2.61	5.08	4.92	0.7	0.577	40.3
2-methylphenanthrene	4.9	<sup>e</sup>	-2.61	4.87	4.91	0.7	2.87	209.9
3-methylphenanthrene	4.9		-2.61	4.87	4.91	0.7	2.17	158.7
1-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.7	1.37	99.5
9/4-Methylphenanthrene	4.9		-2.61	4.89	4.91	0.7	1.5	108.9
2-Methylanthracene	5.1	<sup>e</sup>	-2.61	5.00	4.92	0.7		0.0
3,6-dimethylphenanthrene	5.4	<sup>e</sup>	-2.61	5.23	4.91	0.7		0.0
2,6-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.7		0.0
1,7-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.7		0.0
1,8-Dimethylphenanthrene	5.4		-2.61	5.23	4.91	0.7		0.0
3-Methylfluoranthene/Benzo[a]fluorene	5.5	<sup>e</sup>	-2.61	5.25	4.91	0.7		0.0
1,2,6-Trimethylphenanthrene	6.4		-2.61	5.61	4.78	0.5		0.0
7-Methylbenzo[a]pyrene			-2.61	-2.61	0.00	0.0		
Benzo[e]pyrene	6.4	<sup>i</sup>	-2.61	5.62	4.77	0.5		0.0
Perylene	6.1	<sup>e</sup>	-2.61	5.53	4.83	0.6		0.0
Retene	6.1		-2.61	5.53	4.83	0.6	0.926	77.0
<b>Individual PCB Congeners</b>	<b>Log K<sub>ow</sub></b>		<b>a<sub>o</sub></b>	<b>log K<sub>sw,i</sub></b>	<b>log α<sub>i</sub></b>	<b>R<sub>s,i</sub></b>	<b>C<sub>SPMD</sub></b>	<b>average C<sub>w</sub></b>
IUPAC No.			<b>(-2.61 or -3.20)</b>	<b>(mL/mL)</b>		<b>(L d<sup>-1</sup>)</b>	<b>(ng/SPMD)</b>	<b>(pg/L)</b>
Total PCB	6.38	<sup>m</sup>	-2.61	5.61	4.78	0.5		0.0
<b>Individual PBDE Congeners</b>	<b>Log K<sub>ow</sub></b>		<b>a<sub>o</sub></b>	<b>log K<sub>sw,i</sub></b>	<b>log α<sub>i</sub></b>	<b>R<sub>s,i</sub></b>	<b>Total Analyte per SPMD</b>	<b>Estimated Water Concentration</b>
IUPAC No.			<b>(-2.61 or -3.20)</b>	<b>(mL/mL)</b>		<b>(L d<sup>-1</sup>)</b>	<b>C<sub>SPMD</sub></b>	<b>average C<sub>w</sub></b>
							<b>(ng/SPMD)</b>	<b>(pg/L)</b>

This calculator applies only to SPMDs which conform to the surface area-to-volume ratio of a standard SPMD.

If multiple log K<sub>ow</sub> values were found in the literature, a mean value was selected using the t test at 95% Confidence for rejection of outliers.

<sup>a</sup> Mackay, D.; Shiu, W-Y; Ma, K-C Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Volume V, Lewis Publishers, Boca Raton, 1997.

<sup>b</sup> Oliver, B.G.; Nimi, A.J. Environ. Sci. Technol., 1985, 19:9, 842-849.

<sup>c</sup> Simpson, C.D.; Wilcock, R.J.; Smith, T.J.; Wilkins, A.L.; Langdon, A.G. Bull. Environ. Contam. Toxicol., 1995, 55:1, 149-153.

<sup>d</sup> Veith, G.D.; DeFoe, D.L.; Bergstedt, B.V. J. Fish Res. Board Can., 1979, 36, 1040-1048.

<sup>e</sup> Syracuse Research Corporation, On-Line Log K<sub>ow</sub> Estimator (KowWin), <http://esc.syrres.com/interkow/logkow.htm>.

<sup>f</sup> Huckins, J.N.; Petty, J.D.; Orazio, C.E.; Lebo, J.A.; Clark, R.C.; Gibson, V.L.; Gala, W.R.; Echols, K.R. Environ. Sci. Technol., 1999, 33, 3918-3923.

<sup>g</sup> Meadows, J.C.; Echols, K.R.; Huckins, J.N.; Borsuk, F.A.; Carline, R.F.; Tillit, D.E. Environ. Sci. Technol., 1998, 32, 1847-1852.

<sup>h</sup> Rantalainen, A.L.; Cretney, W.; Ikononou, M.G. Chemosphere, 2000, 40, 147-158.

<sup>i</sup> Sabaliunas, D.; Lazutka, J.; Sabaliuniene, I.; Sodergren, A. Environ. Tox. Chem., 1998, 17, 1815-1824.

<sup>j</sup> Chlorpyrifos and Diazinon values estimated from Endrin and Lindane, respectively, due to their proximity in Log K<sub>ow</sub> values.

<sup>k</sup> Log K<sub>ow</sub> values estimated from similar congeners.

<sup>l</sup> Luellen, D.R.; Shea, D. Environ. Sci. Technol., 2002, 36, 1791-1797.

<sup>m</sup> Hawker, D.W. and Connell, D.W. Environ. Sci. Technol., 1988, 22, 382-387.

<sup>n</sup> Beyer, A.; Wania, F.; Gouin, T.; Mackay, D.; Matthies, M. Environ. Toxicol. Chem. 2002, 21, 941-953.

Created by the U.S. Geological Survey, Columbia Environmental Research Center

4200 New Haven Road, Columbia, MO 65202

Contact: David Alvarez, Ph.D. (573) 441-2970, [dalvarez@usgs.gov](mailto:dalvarez@usgs.gov)

SPMD Calculator version 5.2 Updated: 02/16/2016



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**Appendix A1.6**  
**Tissue Metals Data (Periphyton)**

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## CERTIFICATE OF ANALYSIS

**Work Order** : **VA21C3063**  
**Client** : **Hatfield Consultants LLP**  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 39  
**No. of samples analysed** : 8

**Page** : 1 of 8  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby BC Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 11:50  
**Date Analysis Commenced** : 26-Jan-2022  
**Issue Date** : 17-Feb-2022 09:36

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
%	percent
mg/kg	milligrams per kilogram
mg/kg ww	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	1 Composite	2 Composite	3 Composite	4 Composite	5 Composite
(Matrix: Biota)										
Client sampling date / time					25-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C3063-032	VA21C3063-033	VA21C3063-034	VA21C3063-035	VA21C3063-036	
					Result	Result	Result	Result	Result	
<b>Physical Tests</b>										
moisture	----	E144-H	2.0	%	92.2	87.1	84.5	88.5	87.4	
<b>Metals</b>										
aluminum	7429-90-5	E472	5.0	mg/kg	15400	27200	25700	21400	26300	
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	1200	3520	4000	2470	3310	
antimony	7440-36-0	E472	0.010	mg/kg	0.104	0.039	0.033	0.038	0.036	
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0081	0.0051	0.0051	0.0044	0.0045	
arsenic	7440-38-2	E472	0.030	mg/kg	31.0	18.7	13.3	11.3	13.4	
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	2.42	2.42	2.07	1.31	1.68	
barium	7440-39-3	E472	0.050	mg/kg	524	397	320	277	350	
barium	7440-39-3	E472A	0.010	mg/kg wwt	41.0	51.4	49.8	32.0	44.1	
beryllium	7440-41-7	E472	0.010	mg/kg	0.926	1.40	1.31	1.07	1.39	
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	0.0724	0.181	0.204	0.123	0.175	
bismuth	7440-69-9	E472	0.010	mg/kg	0.381	0.351	0.294	0.248	0.324	
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	0.0298	0.0454	0.0458	0.0286	0.0408	
boron	7440-42-8	E472	1.0	mg/kg	104	47.1	38.5	35.0	36.4	
boron	7440-42-8	E472A	0.20	mg/kg wwt	8.10	6.09	5.98	4.04	4.58	
cadmium	7440-43-9	E472	0.010	mg/kg	0.194	0.362	0.336	0.316	0.405	
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0152	0.0469	0.0522	0.0364	0.0510	
calcium	7440-70-2	E472	20	mg/kg	21300	53800	52800	47400	59400	
calcium	7440-70-2	E472A	4.0	mg/kg wwt	1660	6960	8200	5470	7480	
cesium	7440-46-2	E472	0.0050	mg/kg	3.27	4.81	3.94	3.30	3.87	
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.256	0.622	0.613	0.381	0.487	
chromium	7440-47-3	E472	0.20	mg/kg	34.1	50.3	37.4	37.3	44.1	
chromium	7440-47-3	E472A	0.040	mg/kg wwt	2.67	6.51	5.81	4.30	5.55	
cobalt	7440-48-4	E472	0.020	mg/kg	15.8	17.4	15.4	13.8	17.2	
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	1.24	2.26	2.40	1.60	2.16	
copper	7440-50-8	E472	0.20	mg/kg	10.9	25.8	24.8	24.0	29.3	
copper	7440-50-8	E472A	0.040	mg/kg wwt	0.851	3.34	3.86	2.77	3.69	
iron	7439-89-6	E472	5.0	mg/kg	61300	48200	39500	32300	41300	
iron	7439-89-6	E472A	1.0	mg/kg wwt	4790	6240	6130	3720	5200	
lead	7439-92-1	E472	0.050	mg/kg	16.5	19.3	17.0	14.2	18.6	





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	1 Composite	2 Composite	3 Composite	4 Composite	5 Composite
(Matrix: Biota)										
Client sampling date / time						25-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C3063-032	VA21C3063-033	VA21C3063-034	VA21C3063-035	VA21C3063-036
						Result	Result	Result	Result	Result
<b>Metals</b>										
lead	7439-92-1	E472A	0.010	mg/kg wwt		1.29	2.49	2.64	1.64	2.35
lithium	7439-93-2	E472	0.50	mg/kg		28.4	40.6	38.3	30.3	39.8
lithium	7439-93-2	E472A	0.10	mg/kg wwt		2.22	5.25	5.95	3.50	5.01
magnesium	7439-95-4	E472	2.0	mg/kg		4280	12500	11900	10600	13000
magnesium	7439-95-4	E472A	0.40	mg/kg wwt		334	1620	1840	1230	1630
manganese	7439-96-5	E472	0.050	mg/kg		1990	1960	1650	1410	1740
manganese	7439-96-5	E472A	0.010	mg/kg wwt		155	253	257	162	219
mercury	7439-97-6	E511	0.0050	mg/kg		0.0342	0.0659	0.0625	0.0510	0.0682
mercury	7439-97-6	E511A	0.0010	mg/kg wwt		0.0027	0.0085	0.0097	0.0059	0.0086
molybdenum	7439-98-7	E472	0.040	mg/kg		19.9	4.09	1.66	1.30	1.30
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt		1.56	0.530	0.259	0.150	0.164
nickel	7440-02-0	E472	0.20	mg/kg		47.0	48.0	36.8	33.4	40.4
nickel	7440-02-0	E472A	0.040	mg/kg wwt		3.67	6.21	5.72	3.85	5.08
phosphorus	7723-14-0	E472	10	mg/kg		1610	1630	1300	1240	1540
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt		126	212	203	143	194
potassium	7440-09-7	E472	20	mg/kg		4570	6000	5180	5370	6540
potassium	7440-09-7	E472A	4.0	mg/kg wwt		357	777	804	619	824
rubidium	7440-17-7	E472	0.050	mg/kg		31.6	43.1	38.2	34.2	41.2
rubidium	7440-17-7	E472A	0.010	mg/kg wwt		2.47	5.57	5.94	3.94	5.19
selenium	7782-49-2	E472	0.10	mg/kg		6.45	2.53	1.81	1.61	1.82
selenium	7782-49-2	E472A	0.020	mg/kg wwt		0.504	0.327	0.282	0.186	0.229
sodium	7440-23-5	E472	20	mg/kg		12700	2630	990	680	534
sodium	7440-23-5	E472A	4.0	mg/kg wwt		995	340	154	78.4	67.3
strontium	7440-24-6	E472	0.10	mg/kg		379	220	166	149	180
strontium	7440-24-6	E472A	0.020	mg/kg wwt		29.6	28.5	25.8	17.2	22.7
tellurium	13494-80-9	E472	0.020	mg/kg		0.077	0.071	0.061	0.053	0.072
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt		0.0060	0.0092	0.0095	0.0061	0.0091
thallium	7440-28-0	E472	0.0020	mg/kg		0.260	0.328	0.288	0.248	0.316
thallium	7440-28-0	E472A	0.00040	mg/kg wwt		0.0204	0.0424	0.0448	0.0286	0.0398
tin	7440-31-5	E472	0.10	mg/kg		2.08	1.31	0.82	0.72	0.88
tin	7440-31-5	E472A	0.020	mg/kg wwt		0.162	0.170	0.128	0.083	0.110
uranium	7440-61-1	E472	0.0020	mg/kg		1.23	1.24	1.08	0.893	1.13





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	1 Composite	2 Composite	3 Composite	4 Composite	5 Composite
Client sampling date / time						25-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C3063-032	VA21C3063-033	VA21C3063-034	VA21C3063-035	VA21C3063-036	
					Result	Result	Result	Result	Result	
<b>Metals</b>										
uranium	7440-61-1	E472A	0.00040	mg/kg ww	0.0961	0.160	0.168	0.103	0.143	
vanadium	7440-62-2	E472	0.10	mg/kg	3520	1070	551	289	210	
vanadium	7440-62-2	E472A	0.020	mg/kg ww	275	139	85.6	33.3	26.4	
zinc	7440-66-6	E472	1.0	mg/kg	261	168	133	117	143	
zinc	7440-66-6	E472A	0.20	mg/kg ww	20.4	21.7	20.7	13.5	18.1	
zirconium	7440-67-7	E472	0.20	mg/kg	30.2	23.7	17.4	17.2	18.5	
zirconium	7440-67-7	E472A	0.040	mg/kg ww	2.36	3.06	2.70	1.99	2.33	

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	6 Composite	7 Composite	8 Composite	----	----
(Matrix: Biota)										
Client sampling date / time					25-Sep-2021	25-Sep-2021	26-Sep-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C3063-037	VA21C3063-038	VA21C3063-039	-----	-----	-----
					Result	Result	Result	----	----	----
<b>Physical Tests</b>										
moisture	----	E144-H	2.0	%	85.6	74.7	89.0	----	----	----
<b>Metals</b>										
aluminum	7429-90-5	E472	5.0	mg/kg	21000	11600	15200	----	----	----
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	3030	2930	1680	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg	0.039	0.019	0.046	----	----	----
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0057	0.0048	0.0051	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg	11.3	7.10	8.93	----	----	----
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	1.63	1.79	0.984	----	----	----
barium	7440-39-3	E472	0.050	mg/kg	271	164	200	----	----	----
barium	7440-39-3	E472A	0.010	mg/kg wwt	39.1	41.3	22.0	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg	1.04	0.592	0.737	----	----	----
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	0.150	0.150	0.0811	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg	0.234	0.140	0.171	----	----	----
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	0.0339	0.0354	0.0189	----	----	----
boron	7440-42-8	E472	1.0	mg/kg	28.2	15.2	21.7	----	----	----
boron	7440-42-8	E472A	0.20	mg/kg wwt	4.08	3.84	2.39	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg	0.315	0.189	0.215	----	----	----
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0454	0.0477	0.0236	----	----	----
calcium	7440-70-2	E472	20	mg/kg	45300	26600	33400	----	----	----
calcium	7440-70-2	E472A	4.0	mg/kg wwt	6550	6720	3680	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg	2.87	1.53	2.17	----	----	----
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.414	0.387	0.239	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg	31.7	17.5	28.0	----	----	----
chromium	7440-47-3	E472A	0.040	mg/kg wwt	4.57	4.42	3.09	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg	13.7	8.34	10.1	----	----	----
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	1.98	2.10	1.12	----	----	----
copper	7440-50-8	E472	0.20	mg/kg	25.7	15.5	18.8	----	----	----
copper	7440-50-8	E472A	0.040	mg/kg wwt	3.71	3.92	2.07	----	----	----
iron	7439-89-6	E472	5.0	mg/kg	30300	18100	22100	----	----	----
iron	7439-89-6	E472A	1.0	mg/kg wwt	4380	4580	2440	----	----	----
lead	7439-92-1	E472	0.050	mg/kg	14.1	8.16	9.86	----	----	----
lead	7439-92-1	E472A	0.010	mg/kg wwt	2.03	2.06	1.08	----	----	----





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	6 Composite	7 Composite	8 Composite	----	----
(Matrix: Biota)										
Client sampling date / time					25-Sep-2021	25-Sep-2021	26-Sep-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C3063-037	VA21C3063-038	VA21C3063-039	-----	-----	-----
					Result	Result	Result	----	----	----
<b>Metals</b>										
lithium	7439-93-2	E472	0.50	mg/kg	29.6	16.9	20.9	----	----	----
lithium	7439-93-2	E472A	0.10	mg/kg wwt	4.27	4.27	2.30	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg	10200	6130	7640	----	----	----
magnesium	7439-95-4	E472A	0.40	mg/kg wwt	1480	1550	841	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg	1230	840	1030	----	----	----
manganese	7439-96-5	E472A	0.010	mg/kg wwt	178	212	114	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg	0.0667	0.0301	0.0298	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0096	0.0076	0.0033	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg	1.08	0.616	0.897	----	----	----
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.157	0.156	0.0988	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg	30.3	18.3	24.4	----	----	----
nickel	7440-02-0	E472A	0.040	mg/kg wwt	4.38	4.62	2.69	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg	1480	944	1100	----	----	----
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	214	238	122	----	----	----
potassium	7440-09-7	E472	20	mg/kg	6350	4070	5460	----	----	----
potassium	7440-09-7	E472A	4.0	mg/kg wwt	918	1030	601	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg	34.3	18.5	25.1	----	----	----
rubidium	7440-17-7	E472A	0.010	mg/kg wwt	4.95	4.68	2.76	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg	1.64	0.96	1.19	----	----	----
selenium	7782-49-2	E472A	0.020	mg/kg wwt	0.238	0.243	0.132	----	----	----
sodium	7440-23-5	E472	20	mg/kg	460	347	428	----	----	----
sodium	7440-23-5	E472A	4.0	mg/kg wwt	66.5	87.6	47.1	----	----	----
strontium	7440-24-6	E472	0.10	mg/kg	136	87.8	110	----	----	----
strontium	7440-24-6	E472A	0.020	mg/kg wwt	19.7	22.2	12.2	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg	0.054	0.027	0.036	----	----	----
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	0.0078	0.0069	<0.0040	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg	0.245	0.133	0.179	----	----	----
thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.0354	0.0337	0.0197	----	----	----
tin	7440-31-5	E472	0.10	mg/kg	0.65	0.34	0.56	----	----	----
tin	7440-31-5	E472A	0.020	mg/kg wwt	0.094	0.086	0.062	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg	0.858	0.502	0.620	----	----	----
uranium	7440-61-1	E472A	0.00040	mg/kg wwt	0.124	0.127	0.0683	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	6 Composite	7 Composite	8 Composite	----	----
Client sampling date / time						25-Sep-2021	25-Sep-2021	26-Sep-2021	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C3063-037	VA21C3063-038	VA21C3063-039	-----	-----	
					Result	Result	Result	----	----	
<b>Metals</b>										
vanadium	7440-62-2	E472	0.10	mg/kg	76.9	26.4	35.3	----	----	
vanadium	7440-62-2	E472A	0.020	mg/kg ww	11.1	6.68	3.89	----	----	
zinc	7440-66-6	E472	1.0	mg/kg	128	72.3	89.8	----	----	
zinc	7440-66-6	E472A	0.20	mg/kg ww	18.4	18.3	9.89	----	----	
zirconium	7440-67-7	E472	0.20	mg/kg	16.8	9.22	13.2	----	----	
zirconium	7440-67-7	E472A	0.040	mg/kg ww	2.43	2.33	1.45	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: <b>VA21C3063</b>	Page	: 1 of 8
Client	: <b>Hatfield Consultants LLP</b>	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 15-Oct-2021 11:50
PO	: ----	Issue Date	: 17-Feb-2022 09:36
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 39		
No. of samples analysed	: 8		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

### Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

### Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 2 Composite	E511	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 3 Composite	E511	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 4 Composite	E511	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 5 Composite	E511	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 8 Composite	E511	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 1 Composite	E511	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 6 Composite	E511	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag 7 Composite	E511	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 2 Composite	E511A	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 3 Composite	E511A	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 4 Composite	E511A	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 5 Composite	E511A	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 8 Composite	E511A	26-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	143 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 1 Composite	E511A	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 6 Composite	E511A	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag 7 Composite	E511A	25-Sep-2021	11-Feb-2022	----	----		16-Feb-2022	365 days	144 days	✓





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 2 Composite	E472	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 3 Composite	E472	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 4 Composite	E472	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 5 Composite	E472	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 8 Composite	E472	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 1 Composite	E472	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 6 Composite	E472	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag 7 Composite	E472	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 2 Composite	E472A	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 3 Composite	E472A	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 4 Composite	E472A	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 5 Composite	E472A	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 8 Composite	E472A	26-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	138 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 1 Composite	E472A	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 6 Composite	E472A	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag 7 Composite	E472A	25-Sep-2021	11-Feb-2022	----	----		11-Feb-2022	730 days	139 days	✓
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 1 Composite	E144-H	25-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 2 Composite	E144-H	26-Sep-2021	----	----	----		26-Jan-2022	----	----	





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 3 Composite	E144-H	26-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 4 Composite	E144-H	26-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 5 Composite	E144-H	26-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 6 Composite	E144-H	25-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 7 Composite	E144-H	25-Sep-2021	----	----	----		26-Jan-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag 8 Composite	E144-H	26-Sep-2021	----	----	----		26-Jan-2022	----	----	

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota** Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	395315	1	8	12.5	5.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	395314	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	395312	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	395313	1	8	12.5	5.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	395316	1	8	12.5	5.0	✔
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	395315	2	8	25.0	10.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	395314	2	8	25.0	10.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	395312	2	8	25.0	10.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	395313	2	8	25.0	10.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	395316	1	8	12.5	5.0	✔
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	395315	1	8	12.5	5.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	395314	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	395312	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	395313	1	8	12.5	5.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	395316	1	8	12.5	5.0	✔





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Micro)	E144-H  Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at <60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> . Analysis is by Collision/Reaction Cell ICPMS.  Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> . Analysis is by Collision/Reaction Cell ICPMS.  Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Micro)	E511  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Micro)	E511A  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Micro)	EP472  Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> and is intended to provide a conservative estimate of bio-available metals.



## QUALITY CONTROL REPORT

**Work Order** : **VA21C3063**

**Page** : 1 of 13

**Client** : Hatfield Consultants LLP  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 39  
**No. of samples analysed** : 8

**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 11:50  
**Date Analysis Commenced** : 26-Jan-2022  
**Issue Date** : 17-Feb-2022 09:36

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia





## General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

### Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percentage Difference

# = Indicates a QC result that did not meet the ALS DQO.





## Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
<b>Physical Tests (QC Lot: 395316)</b>											
VA21C3063-039	8 Composite	moisture	----	E144-H	2.0	%	89.0	87.6	1.60%	20%	----
<b>Metals (QC Lot: 395312)</b>											
VA21C3063-039	8 Composite	aluminum	7429-90-5	E472	5.0	mg/kg	15200	15600	2.09%	40%	----
		antimony	7440-36-0	E472	0.010	mg/kg	0.046	0.045	0.0007	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	8.93	8.58	4.07%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	200	202	1.03%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	0.737	0.731	0.820%	40%	----
		bismuth	7440-69-9	E472	0.010	mg/kg	0.171	0.165	3.62%	40%	----
		boron	7440-42-8	E472	1.0	mg/kg	21.7	24.2	11.0%	40%	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.215	0.209	2.68%	40%	----
		calcium	7440-70-2	E472	20	mg/kg	33400	31900	4.71%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	2.17	2.09	3.95%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	28.0	25.1	11.2%	40%	----
		cobalt	7440-48-4	E472	0.020	mg/kg	10.1	9.79	3.49%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	18.8	18.2	3.51%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	22100	21300	3.91%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	9.86	9.59	2.72%	40%	----
		lithium	7439-93-2	E472	0.50	mg/kg	20.9	20.0	4.25%	40%	----
		magnesium	7439-95-4	E472	2.0	mg/kg	7640	7400	3.12%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	1030	998	3.23%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.897	0.830	7.73%	40%	----
		nickel	7440-02-0	E472	0.20	mg/kg	24.4	22.6	8.00%	40%	----
		phosphorus	7723-14-0	E472	10	mg/kg	1100	1110	0.351%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	5460	5200	4.94%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	25.1	25.2	0.769%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	1.19	1.18	1.02%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	428	426	0.320%	40%	----
		strontium	7440-24-6	E472	0.10	mg/kg	110	100	9.72%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	0.036	0.032	0.004	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.179	0.177	1.37%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	0.56	0.57	1.22%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.620	0.615	0.833%	40%	----





Sub-Matrix: **Biota**

Sub-Matrix: Biota					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 395312) - continued											
VA21C3063-039	8 Composite	vanadium	7440-62-2	E472	0.10	mg/kg	35.3	35.7	1.14%	40%	----
		zinc	7440-66-6	E472	1.0	mg/kg	89.8	84.0	6.78%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	13.2	12.8	2.82%	40%	----
Metals (QC Lot: 395313)											
VA21C3063-039	8 Composite	aluminum	7429-90-5	E472A	1.0	mg/kg wwt	1680	1710	2.09%	40%	----
		antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0051	0.0050	0.00008	Diff <2x LOR	----
		arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	0.984	0.944	4.07%	40%	----
		barium	7440-39-3	E472A	0.010	mg/kg wwt	22.0	22.2	1.03%	40%	----
		beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	0.0811	0.0805	0.820%	40%	----
		bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	0.0189	0.0182	3.62%	40%	----
		boron	7440-42-8	E472A	0.20	mg/kg wwt	2.39	2.67	11.0%	40%	----
		cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0236	0.0230	2.68%	40%	----
		calcium	7440-70-2	E472A	4.0	mg/kg wwt	3680	3510	4.71%	60%	----
		cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.239	0.230	3.95%	40%	----
		chromium	7440-47-3	E472A	0.040	mg/kg wwt	3.09	2.76	11.2%	40%	----
		cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	1.12	1.08	3.49%	40%	----
		copper	7440-50-8	E472A	0.040	mg/kg wwt	2.07	2.00	3.51%	40%	----
		iron	7439-89-6	E472A	1.0	mg/kg wwt	2440	2340	3.91%	40%	----
		lead	7439-92-1	E472A	0.010	mg/kg wwt	1.08	1.06	2.72%	40%	----
		lithium	7439-93-2	E472A	0.10	mg/kg wwt	2.30	2.20	4.25%	40%	----
		magnesium	7439-95-4	E472A	0.40	mg/kg wwt	841	815	3.12%	40%	----
		manganese	7439-96-5	E472A	0.010	mg/kg wwt	114	110	3.23%	40%	----
		molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.0988	0.0914	7.73%	40%	----
		nickel	7440-02-0	E472A	0.040	mg/kg wwt	2.69	2.48	8.00%	40%	----
		phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	122	122	0.351%	40%	----
		potassium	7440-09-7	E472A	4.0	mg/kg wwt	601	572	4.94%	40%	----
		rubidium	7440-17-7	E472A	0.010	mg/kg wwt	2.76	2.78	0.769%	40%	----
		selenium	7782-49-2	E472A	0.020	mg/kg wwt	0.132	0.130	1.02%	40%	----
		sodium	7440-23-5	E472A	4.0	mg/kg wwt	47.1	46.9	0.320%	40%	----
		strontium	7440-24-6	E472A	0.020	mg/kg wwt	12.2	11.0	9.72%	60%	----
		tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.0197	0.0195	1.37%	40%	----
		tin	7440-31-5	E472A	0.020	mg/kg wwt	0.062	0.063	0.0008	Diff <2x LOR	----
		uranium	7440-61-1	E472A	0.00040	mg/kg wwt	0.0683	0.0677	0.833%	40%	----
		vanadium	7440-62-2	E472A	0.020	mg/kg wwt	3.89	3.94	1.14%	40%	----





Sub-Matrix: Biota					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 395313) - continued											
VA21C3063-039	8 Composite	zinc	7440-66-6	E472A	0.20	mg/kg ww	9.89	9.24	6.78%	40%	----
		zirconium	7440-67-7	E472A	0.040	mg/kg ww	1.45	1.41	2.82%	40%	----
Metals (QC Lot: 395314)											
VA21C3063-039	8 Composite	mercury	7439-97-6	E511A	0.0010	mg/kg ww	0.0033	0.0040	0.0007	Diff <2x LOR	----
Metals (QC Lot: 395315)											
VA21C3063-039	8 Composite	mercury	7439-97-6	E511	0.0050	mg/kg	0.0298	0.0362	19.4%	40%	----





## Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Physical Tests (QCLot: 395316)</b>						
moisture	----	E144-H	2	%	<2.0	----
<b>Metals (QCLot: 395312)</b>						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 395312) - continued</b>						
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
<b>Metals (QCLot: 395313)</b>						
aluminum	7429-90-5	E472A	1	mg/kg ww	<1.0	----
antimony	7440-36-0	E472A	0.002	mg/kg ww	<0.0020	----
arsenic	7440-38-2	E472A	0.006	mg/kg ww	<0.0060	----
barium	7440-39-3	E472A	0.01	mg/kg ww	<0.010	----
beryllium	7440-41-7	E472A	0.002	mg/kg ww	<0.0020	----
bismuth	7440-69-9	E472A	0.002	mg/kg ww	<0.0020	----
boron	7440-42-8	E472A	0.2	mg/kg ww	<0.20	----
cadmium	7440-43-9	E472A	0.002	mg/kg ww	<0.0020	----
calcium	7440-70-2	E472A	4	mg/kg ww	<4.0	----
cesium	7440-46-2	E472A	0.001	mg/kg ww	<0.0010	----
chromium	7440-47-3	E472A	0.04	mg/kg ww	<0.040	----
cobalt	7440-48-4	E472A	0.004	mg/kg ww	<0.0040	----
copper	7440-50-8	E472A	0.04	mg/kg ww	<0.040	----
iron	7439-89-6	E472A	1	mg/kg ww	<1.0	----
lead	7439-92-1	E472A	0.01	mg/kg ww	<0.010	----
lithium	7439-93-2	E472A	0.1	mg/kg ww	<0.10	----
magnesium	7439-95-4	E472A	0.4	mg/kg ww	<0.40	----
manganese	7439-96-5	E472A	0.01	mg/kg ww	<0.010	----
molybdenum	7439-98-7	E472A	0.008	mg/kg ww	<0.0080	----
nickel	7440-02-0	E472A	0.04	mg/kg ww	<0.040	----
phosphorus	7723-14-0	E472A	2	mg/kg ww	<2.0	----
potassium	7440-09-7	E472A	4	mg/kg ww	<4.0	----
rubidium	7440-17-7	E472A	0.01	mg/kg ww	<0.010	----
selenium	7782-49-2	E472A	0.02	mg/kg ww	<0.020	----
sodium	7440-23-5	E472A	4	mg/kg ww	<4.0	----
strontium	7440-24-6	E472A	0.02	mg/kg ww	<0.020	----
tellurium	13494-80-9	E472A	0.004	mg/kg ww	<0.0040	----
thallium	7440-28-0	E472A	0.0004	mg/kg ww	<0.00040	----
tin	7440-31-5	E472A	0.02	mg/kg ww	<0.020	----
uranium	7440-61-1	E472A	0.0004	mg/kg ww	<0.00040	----
vanadium	7440-62-2	E472A	0.02	mg/kg ww	<0.020	----
zinc	7440-66-6	E472A	0.2	mg/kg ww	<0.20	----
zirconium	7440-67-7	E472A	0.04	mg/kg ww	<0.040	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 395314)						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 395315)						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----





Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 395316)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Metals (QCLot: 395312)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	100	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	99.3	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	100	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	97.1	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	95.6	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	99.3	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	95.7	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	97.5	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	97.1	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	99.8	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	97.8	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	96.1	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	102	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	98.6	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	102	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	98.9	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	99.9	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	101	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	95.6	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	102	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	94.0	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	96.3	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	99.9	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	99.8	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	95.5	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	94.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	99.2	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	96.0	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	102	80.0	120	----



### Laboratory Control Sample (LCS) Report

Metals (QCLot: 395314)





Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 395314) - continued									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	98.8	80.0	120	----
Metals (QCLot: 395315)									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	98.8	80.0	120	----





## Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Biota**

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	
Metals (QCLot: 395312)									
QC-395312-003	RM	aluminum	7429-90-5	E472	11.2 mg/kg	99.7	70.0	130	----
QC-395312-003	RM	arsenic	7440-38-2	E472	34.6 mg/kg	96.0	70.0	130	----
QC-395312-003	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	82.0	60.0	140	----
QC-395312-003	RM	cadmium	7440-43-9	E472	14.5 mg/kg	91.3	70.0	130	----
QC-395312-003	RM	calcium	7440-70-2	E472	550 mg/kg	91.3	70.0	130	----
QC-395312-003	RM	cesium	7440-46-2	E472	0.0712 mg/kg	88.4	70.0	130	----
QC-395312-003	RM	chromium	7440-47-3	E472	1.96 mg/kg	104	70.0	130	----
QC-395312-003	RM	cobalt	7440-48-4	E472	0.267 mg/kg	93.8	70.0	130	----
QC-395312-003	RM	copper	7440-50-8	E472	35 mg/kg	93.4	70.0	130	----
QC-395312-003	RM	iron	7439-89-6	E472	1070 mg/kg	94.2	70.0	130	----
QC-395312-003	RM	lead	7439-92-1	E472	0.162 mg/kg	84.4	70.0	130	----
QC-395312-003	RM	magnesium	7439-95-4	E472	940 mg/kg	92.5	70.0	130	----
QC-395312-003	RM	manganese	7439-96-5	E472	8.91 mg/kg	94.2	70.0	130	----
QC-395312-003	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	93.2	70.0	130	----
QC-395312-003	RM	nickel	7440-02-0	E472	1.57 mg/kg	93.5	70.0	130	----
QC-395312-003	RM	phosphorus	7723-14-0	E472	11500 mg/kg	95.0	70.0	130	----
QC-395312-003	RM	potassium	7440-09-7	E472	14400 mg/kg	91.9	70.0	130	----
QC-395312-003	RM	rubidium	7440-17-7	E472	5.11 mg/kg	93.9	70.0	130	----
QC-395312-003	RM	selenium	7782-49-2	E472	8 mg/kg	96.5	70.0	130	----
QC-395312-003	RM	sodium	7440-23-5	E472	10673 mg/kg	95.1	70.0	130	----
QC-395312-003	RM	strontium	7440-24-6	E472	3.92 mg/kg	89.7	70.0	130	----
QC-395312-003	RM	thallium	7440-28-0	E472	0.013 mg/kg	82.6	70.0	130	----
QC-395312-003	RM	uranium	7440-61-1	E472	0.0786 mg/kg	89.8	70.0	130	----
QC-395312-003	RM	vanadium	7440-62-2	E472	0.51 mg/kg	93.8	70.0	130	----
QC-395312-003	RM	zinc	7440-66-6	E472	105.3 mg/kg	92.1	70.0	130	----
Metals (QCLot: 395313)									
QC-395313-003	RM	aluminum	7429-90-5	E472A	11.2 mg/kg wwt	99.7	70.0	130	----
QC-395313-003	RM	arsenic	7440-38-2	E472A	34.6 mg/kg wwt	96.0	70.0	130	----





Sub-Matrix: Biota

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	
Metals (QCLot: 395313) - continued									
QC-395313-003	RM	bismuth	7440-69-9	E472A	0.0247 mg/kg wwt	82.0	60.0	140	----
QC-395313-003	RM	cadmium	7440-43-9	E472A	14.5 mg/kg wwt	91.3	70.0	130	----
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QC-395313-003	RM	iron	7439-89-6	E472A	1070 mg/kg wwt	94.2	70.0	130	----
QC-395313-003	RM	lead	7439-92-1	E472A	0.162 mg/kg wwt	84.4	70.0	130	----
QC-395313-003	RM	magnesium	7439-95-4	E472A	940 mg/kg wwt	92.5	70.0	130	----
QC-395313-003	RM	manganese	7439-96-5	E472A	8.91 mg/kg wwt	94.2	70.0	130	----
QC-395313-003	RM	molybdenum	7439-98-7	E472A	1.41 mg/kg wwt	93.2	70.0	130	----
QC-395313-003	RM	nickel	7440-02-0	E472A	1.57 mg/kg wwt	93.5	70.0	130	----
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QC-395313-003	RM	potassium	7440-09-7	E472A	14400 mg/kg wwt	91.9	70.0	130	----
QC-395313-003	RM	rubidium	7440-17-7	E472A	5.11 mg/kg wwt	93.9	70.0	130	----
QC-395313-003	RM	selenium	7782-49-2	E472A	8 mg/kg wwt	96.5	70.0	130	----
QC-395313-003	RM	sodium	7440-23-5	E472A	10673 mg/kg wwt	95.1	70.0	130	----
QC-395313-003	RM	strontium	7440-24-6	E472A	3.92 mg/kg wwt	89.7	70.0	130	----
QC-395313-003	RM	thallium	7440-28-0	E472A	0.013 mg/kg wwt	82.6	70.0	130	----
QC-395313-003	RM	uranium	7440-61-1	E472A	0.0786 mg/kg wwt	89.8	70.0	130	----
QC-395313-003	RM	vanadium	7440-62-2	E472A	0.51 mg/kg wwt	93.8	70.0	130	----
QC-395313-003	RM	zinc	7440-66-6	E472A	105.3 mg/kg wwt	92.1	70.0	130	----
Metals (QCLot: 395314)									
QC-395314-003	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	105	70.0	130	----
Metals (QCLot: 395315)									
QC-395315-003	RM	mercury	7439-97-6	E511	0.331 mg/kg	105	70.0	130	----





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# Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 21 -

Page 1 of 3

Environmental Division  
Vancouver

Work Order Reference

VA21C3063



Telephone : + 1 604 253 4188

<b>Report To</b> Contact and company name below will appear on the final report			<b>Reports / Recipients</b>			<b>Turnaround Time (TAT) Requested</b>																																																																																																																																																																																															
Company:	Hatfield Consultants		Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			<input type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply																																																																																																																																																																																															
Contact:	Morgan Edwards		Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A			<input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 120% rush surcharge minimum																																																																																																																																																																																															
Phone:	604-926-3261		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked			<input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum																																																																																																																																																																																															
Company address below will appear on the final report			Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			<input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum																																																																																																																																																																																															
Street:	200-850 Harbourside Dr.		Email 1 or Fax medwards@hatfieldgroup.com			<input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum																																																																																																																																																																																															
City/Province:	North Vancouver, BC		Email 2 zmueller@hatfieldgroup.com			<input type="checkbox"/> Same day [E2] if received by 10am M-S - 200% rush surcharge																																																																																																																																																																																															
Postal Code:	V7P 0A3		Email 3			Additional fees may apply to rush requests on weekends, etc.																																																																																																																																																																																															
<b>Invoice To</b>			<b>Invoice Recipients</b>			<b>Date and Time Required for all E&amp;P TATs:</b>																																																																																																																																																																																															
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			For all tests with rush TATs requested, please contact:																																																																																																																																																																																															
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Email 1 or Fax accounting-canada@hatfieldgroup.com			<b>Analysis Request</b>																																																																																																																																																																																															
Company: Hatfield Consultants			Email 2 medwards@hatfieldgroup.com			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																																																																																																																																															
Contact:						<table border="1"> <tr> <th rowspan="2">NUMBER OF CONTAINERS</th> <th colspan="10"></th> <th rowspan="2">SAMPLES ON HOLD</th> <th rowspan="2">EXTENDED STORAGE REQUIRED</th> <th rowspan="2">SUSPECTED HAZARD (see notes)</th> </tr> <tr> <th>Moisture by Gravimetry (Micro)</th> <th>Biota Digestion (Micro)</th> <th>Metals+Mercury (dry/wet, micro)</th> <th></th><th></th><th></th><th></th><th></th><th></th><th></th> </tr> <tr><td>1</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1B</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1C</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1D</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2A</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2B</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2C</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2D</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3A</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3B</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3C</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			NUMBER OF CONTAINERS											SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)	Moisture by Gravimetry (Micro)	Biota Digestion (Micro)	Metals+Mercury (dry/wet, micro)								1	R	R	R												1B	R	R	R												1C	R	R	R												1D	R	R	R												2A	R	R	R												2B	R	R	R												2C	R	R	R												2D	R	R	R												3A	R	R	R												3B	R	R	R												3C	R	R	R											
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<b>Project Information</b>			<b>Oil and Gas Required Fields (client use)</b>																																																																																																																																																																																																		
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ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																																																																																																																																																																																
	1A		25-Sep-21		Tissue	1	R	R	R																																																																																																																																																																																												
	1B		25-Sep-21		Tissue	1	R	R	R																																																																																																																																																																																												
	1C		25-Sep-21		Tissue	1	R	R	R																																																																																																																																																																																												
	1D		25-Sep-21		Tissue	1	R	R	R																																																																																																																																																																																												
	2A		26-Sep-21		Tissue	1	R	R	R																																																																																																																																																																																												
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<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)</b>		<b>SAMPLE RECEIPT DETAILS (ALS use only)</b>			
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO		Sample 3D not collected, but container included in shipment for record-keeping. Please combine samples by NUMBER (i.e. 1A, 1B, 1C, 1D together)		Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO			
				Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A			
				INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
						-2°C	
<b>SHIPMENT RELEASE (client use)</b>		<b>INITIAL SHIPMENT RECEPTION (ALS use only)</b>		<b>FINAL SHIPMENT RECEPTION (ALS use only)</b>			
Released by: ZACUTMULLER	Date: OCT 12 2021	Time:	Received by:	Date:	Time:	Received by: JA	Date: 15/10/2021
							1150

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FORM

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 A1.7**

### **Tissue Metals Data (Benthic Invertebrates)**

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# Trich Analytics Inc.

## Tissue Microchemistry Analysis Report

**Client:** Martin Davies  
Senior Vice-President and Partner  
Hatfield Environmental  
**Phone:** (604) 926-3261  
**Email:** mdavies@hatfieldgroup.com

**Date Received:** 08 Sep 2022  
**Date of Analysis:** 09 Sep 2022  
**Final Report Date:** 12 Sep 2022  
**Project No.:** 2022-382  
**Method No.:** MET-002.06

**Client Project:** Syncrude Mesocosm Data Post Experiment

**Analytical Request:** Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 8 samples.  
See chain of custody form provided for sample identification numbers.

### Notes:

Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg).  
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.  
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.  
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

Date

12 Sep 2022

[The analytical report shall not be reproduced except in full under the expressed written consent of TrichAnalytics Inc.]

TrichAnalytics Inc.  
207-1753 Sean Heights  
Saanichton, BC V8M 0B3  
[www.trichanalytics.com](http://www.trichanalytics.com)



**CALA**  
Testing  
Accreditation No. A4196



# Hatfield Environmental Tissue Analysis Results

			Client ID	1A 1B 1C 1D	2A 2B 2C 2D	3A 3B 3C 3D	4A 4B 4C 4D	5A 5B 5C 5D
			Lab ID	001	002	003	004	005
			Wet Weight (g)	0.4051	0.6151	0.5557	1.8891	0.5599
			Dry Weight (g)	0.0501	0.0668	0.0889	0.2700	0.0488
			Moisture (%)	87.6	89.1	84.0	85.7	91.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	0.896	1.3	4.3	1.2	2.1	
11B	0.206	0.687	43	48	69	33	61	
23Na	2.9	9.7	329	344	599	271	389	
24Mg	0.070	0.233	1,869	1,693	1,962	1,552	2,076	
27Al	0.054	0.180	1,829	3,100	11,019	2,703	5,183	
31P	46	153	3,313	3,449	2,983	4,604	3,951	
39K	2.6	8.7	344	530	1,817	608	1,003	
44Ca	7.3	24	7,393	8,097	7,524	9,933	9,844	
49Ti	0.001	0.003	96	183	500	180	340	
51V	0.030	0.100	20	21	71	19	16	
52Cr	0.181	0.603	25	35	92	13	34	
55Mn	0.009	0.030	125	178	163	271	192	
57Fe	1.2	4.0	2,064	2,331	7,190	2,123	3,613	
59Co	0.011	0.037	1.6	2.3	8.1	2.4	4.4	
60Ni	0.046	0.153	37	66	157	21	53	
63Cu	0.015	0.050	53	17	57	29	32	
66Zn	0.305	1.0	176	106	171	143	120	
75As	0.378	1.3	0.401	0.432	1.4	0.447	0.571	
77Se	0.229	0.763	2.1	2.2	1.9	1.7	1.4	
88Sr	0.001	0.003	66	35	25	37	20	
95Mo	0.001	0.003	3.4	4.9	9.8	2.2	4.2	
107Ag	0.001	0.003	0.071	0.028	0.061	0.033	0.047	
111Cd	0.040	0.133	0.109	0.082	0.245	0.381	0.449	
118Sn	0.018	0.060	0.683	0.749	1.3	0.514	0.568	
121Sb	0.004	0.013	0.040	0.038	0.110	0.069	0.058	
137Ba	0.001	0.003	100	111	178	179	211	
202Hg	0.018	0.060	0.115	0.107	0.085	0.085	0.075	
205Tl	0.001	0.003	0.010	0.014	0.047	0.021	0.028	
208Pb	0.002	0.007	1.6	1.4	3.9	1.1	1.7	
238U	0.001	0.003	0.111	0.081	0.461	0.170	0.232	

## Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent



# Hatfield Environmental Tissue Analysis Results

			Client ID	6A 6B 6C 6D	7A 7B 7C 7D	8A 8B 8C 8D
			Lab ID	006	007	008
			Wet Weight (g)	1.3418	1.5243	1.4394
			Dry Weight (g)	0.1667	0.1863	0.2013
			Moisture (%)	87.6	87.8	86.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	
7Li	0.009	0.030	1.6	1.8	1.5	
11B	0.206	0.687	40	34	27	
23Na	2.9	9.7	249	246	251	
24Mg	0.070	0.233	1,447	1,592	1,431	
27Al	0.054	0.180	3,106	3,666	2,633	
31P	46	153	4,917	5,007	5,434	
39K	2.6	8.7	656	804	685	
44Ca	7.3	24	9,979	8,828	8,846	
49Ti	0.001	0.003	207	241	167	
51V	0.030	0.100	6.2	5.2	4.2	
52Cr	0.181	0.603	13	18	11	
55Mn	0.009	0.030	280	274	282	
57Fe	1.2	4.0	2,984	2,666	1,936	
59Co	0.011	0.037	3.4	3.6	2.5	
60Ni	0.046	0.153	23	27	16	
63Cu	0.015	0.050	32	30	28	
66Zn	0.305	1.0	131	184	145	
75As	0.378	1.3	0.463	0.493	0.493	
77Se	0.229	0.763	2.1	1.3	1.7	
88Sr	0.001	0.003	28	29	27	
95Mo	0.001	0.003	1.9	2.2	2.3	
107Ag	0.001	0.003	0.033	0.033	0.019	
111Cd	0.040	0.133	0.354	0.354	0.258	
118Sn	0.018	0.060	0.541	0.390	0.291	
121Sb	0.004	0.013	0.066	0.057	0.075	
137Ba	0.001	0.003	216	205	192	
202Hg	0.018	0.060	0.145	0.115	0.195	
205Tl	0.001	0.003	0.022	0.023	0.018	
208Pb	0.002	0.007	1.6	1.3	1.1	
238U	0.001	0.003	0.117	0.179	0.083	

## Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent



Hatfield Environmental  
Tissue QA/QC Relative Percent Difference Results

	Client ID	4A 4B 4C 4D			
	Lab ID	004			
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	
7Li	0.009	1.2	1.6	29	
11B	0.206	33	34	3.0	
23Na	2.9	271	268	1.1	
24Mg	0.070	1,552	1,365	13	
27Al	0.054	2,703	3,021	11	
31P	46	4,604	4,232	8.4	
39K	2.6	608	755	22	
44Ca	7.3	9,933	7,867	23	
49Ti	0.001	180	206	14	
51V	0.030	19	25	27	
52Cr	0.181	13	13	0.0	
55Mn	0.009	271	232	16	
57Fe	1.2	2,123	2,388	12	
59Co	0.011	2.4	2.5	4.1	
60Ni	0.046	21	21	0.0	
63Cu	0.015	29	25	15	
66Zn	0.305	143	115	22	
75As	0.378	0.447	0.524	-	
77Se	0.229	1.7	1.4	-	
88Sr	0.001	37	34	8.5	
95Mo	0.001	2.2	2.3	4.4	
107Ag	0.001	0.033	0.033	0.0	
111Cd	0.040	0.381	0.245	-	
118Sn	0.018	0.514	0.439	16	
121Sb	0.004	0.069	0.069	0.0	
137Ba	0.001	179	164	8.7	
202Hg	0.018	0.085	0.110	-	
205Tl	0.001	0.021	0.021	0.0	
208Pb	0.002	1.1	1.1	0.0	
238U	0.001	0.170	0.122	33	

**Notes:**

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

**Data Quality Objectives:**

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL



Hatfield Environmental  
Tissue QA/QC Accuracy and Precision Results

Sample Group ID		01			
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.009	1.21	1.5	124	6.7
11B	0.206	4.5	4.5	100	1.9
23Na	2.9	14,000	16,029	114	5.3
24Mg	0.070	910	1,027	113	8.6
27Al	0.054	197.2	184	93	9.9
31P	46	8,000	8,737	109	5.6
39K	2.6	15,500	17,087	110	4.5
44Ca	7.3	2,360	2,634	112	5.9
49Ti	0.001	12.24	12	100	14
51V	0.030	1.57	1.8	117	12
52Cr	0.181	1.87	2.2	119	7.4
55Mn	0.009	3.17	3.5	110	11
57Fe	1.2	343	383	112	6.8
59Co	0.011	0.25	0.281	112	9.4
60Ni	0.046	1.34	1.5	112	8.2
63Cu	0.015	15.7	19	122	6.8
66Zn	0.305	51.6	59	114	7.1
75As	0.378	6.87	8.0	116	9.5
77Se	0.229	3.45	3.9	112	12
88Sr	0.001	10.1	12	115	7.7
95Mo	0.001	0.29	0.310	107	14
107Ag	0.001	0.0252	0.027	107	14
111Cd	0.040	0.299	0.383	128	12
118Sn	0.018	0.061	0.073	119	8.4
121Sb	0.004	0.011	0.009	84	10
137Ba	0.001	8.6	8.1	94	2.3
202Hg	0.018	0.412	0.482	117	7.0
205Tl	0.001	0.0013	-	-	-
208Pb	0.002	0.404	0.414	102	14
238U	0.001	0.05	0.052	105	7.2

**Notes:**

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

**Data Quality Objectives:**

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.

Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.

Precision: DQO of ≤20% for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Tl certified concentration from NIST-2976.

Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.



Hatfield Environmental  
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	1A 1B 1C 1D	001	09 Sep 2022
	2A 2B 2C 2D	002	
	3A 3B 3C 3D	003	
	4A 4B 4C 4D	004	
	5A 5B 5C 5D	005	
	6A 6B 6C 6D	006	
	7A 7B 7C 7D	007	
	8A 8B 8C 8D	008	



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## **Appendix A1.8**

### **Tissue Metals Data (Fathead Minnows)**

---



## CERTIFICATE OF ANALYSIS

**Work Order** : **VA22A7596**  
**Client** : **Hatfield Consultants LLP**  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 8  
**No. of samples analysed** : 8

**Page** : 1 of 8  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby BC Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 08-Apr-2022 08:10  
**Date Analysis Commenced** : 02-May-2022  
**Issue Date** : 24-May-2022 10:16

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
%	percent
mg/kg	milligrams per kilogram
mg/kg ww	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 Site Control Juvenile	PJ2021-006 0.32% Juvenile	PJ2021-006 1.0% Juvenile	PJ2021-006 3.2% Juvenile	PJ2021-006 10% Juvenile
Client sampling date / time					08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-001	VA22A7596-002	VA22A7596-003	VA22A7596-004	VA22A7596-005	VA22A7596-005
					Result	Result	Result	Result	Result	Result
<b>Physical Tests</b>										
moisture	----	E144-H	2.0	%	71.3	71.6	72.3	71.4	73.4	
<b>Metals</b>										
aluminum	7429-90-5	E472	5.0	mg/kg	266	343	188	340	260	
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	76.3	97.4	52.2	97.5	69.0	
antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	<0.010	0.013	<0.010	
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0024	0.0026	0.0020	0.0036	0.0025	
arsenic	7440-38-2	E472	0.030	mg/kg	0.768	0.740	0.806	0.857	0.870	
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	0.220	0.210	0.223	0.246	0.231	
barium	7440-39-3	E472	0.050	mg/kg	15.9	17.4	12.2	14.6	15.0	
barium	7440-39-3	E472A	0.010	mg/kg wwt	4.57	4.93	3.36	4.18	4.00	
beryllium	7440-41-7	E472	0.010	mg/kg	0.011	0.014	<0.010	0.013	<0.010	
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	0.0031	0.0040	0.0021	0.0037	0.0026	
bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	
boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	
boron	7440-42-8	E472A	0.20	mg/kg wwt	<0.20	<0.20	<0.20	0.24	<0.20	
cadmium	7440-43-9	E472	0.010	mg/kg	0.029	0.027	0.027	0.026	0.026	
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0082	0.0076	0.0076	0.0076	0.0070	
calcium	7440-70-2	E472	20	mg/kg	25400	25700	19400	22000	22100	
calcium	7440-70-2	E472A	4.0	mg/kg wwt	7270	7310	5360	6300	5860	
cesium	7440-46-2	E472	0.0050	mg/kg	0.0408	0.0476	0.0320	0.0707	0.0470	
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.0117	0.0135	0.0089	0.0202	0.0125	
chromium	7440-47-3	E472	0.20	mg/kg	0.41	0.53	0.30	0.53	0.52	
chromium	7440-47-3	E472A	0.040	mg/kg wwt	0.119	0.152	0.083	0.151	0.139	
cobalt	7440-48-4	E472	0.020	mg/kg	0.191	0.224	0.173	0.250	0.210	
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	0.0549	0.0638	0.0480	0.0717	0.0560	
copper	7440-50-8	E472	0.20	mg/kg	4.69	4.98	4.44	4.59	4.94	
copper	7440-50-8	E472A	0.040	mg/kg wwt	1.34	1.42	1.23	1.31	1.31	
iron	7439-89-6	E472	5.0	mg/kg	448	551	334	600	442	
iron	7439-89-6	E472A	1.0	mg/kg wwt	128	156	92.4	172	117	





## Analytical Results

Sub-Matrix: Tissue

(Matrix: Biota)

Client sample ID

					PJ2021-006 Site Control Juvenile	PJ2021-006 0.32% Juvenile	PJ2021-006 1.0% Juvenile	PJ2021-006 3.2% Juvenile	PJ2021-006 10% Juvenile
Client sampling date / time					08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-001	VA22A7596-002	VA22A7596-003	VA22A7596-004	VA22A7596-005
					Result	Result	Result	Result	Result
<b>Metals</b>									
lead	7439-92-1	E472	0.050	mg/kg	0.204	0.254	0.189	0.252	0.190
lead	7439-92-1	E472A	0.010	mg/kg wwt	0.058	0.072	0.052	0.072	0.050
lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E472A	0.10	mg/kg wwt	0.10	0.13	<0.10	0.13	<0.10
magnesium	7439-95-4	E472	2.0	mg/kg	1230	1330	1060	1250	1260
magnesium	7439-95-4	E472A	0.40	mg/kg wwt	353	377	295	359	334
manganese	7439-96-5	E472	0.050	mg/kg	28.0	29.8	20.2	29.5	24.7
manganese	7439-96-5	E472A	0.010	mg/kg wwt	8.04	8.46	5.61	8.46	6.55
mercury	7439-97-6	E511	0.0050	mg/kg	0.492	0.451	0.436	0.496	0.418
mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.141	0.128	0.121	0.142	0.111
molybdenum	7439-98-7	E472	0.040	mg/kg	0.169	0.173	0.197	0.337	0.262
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.0484	0.0492	0.0546	0.0965	0.0698
nickel	7440-02-0	E472	0.20	mg/kg	0.43	0.52	0.37	0.59	0.60
nickel	7440-02-0	E472A	0.040	mg/kg wwt	0.122	0.147	0.102	0.170	0.159
phosphorus	7723-14-0	E472	10	mg/kg	20900	21500	17400	19000	20100
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	5980	6110	4840	5450	5340
potassium	7440-09-7	E472	20	mg/kg	8960	9040	8550	9530	9750
potassium	7440-09-7	E472A	4.0	mg/kg wwt	2570	2570	2370	2730	2590
rubidium	7440-17-7	E472	0.050	mg/kg	4.51	4.56	4.41	7.17	5.79
rubidium	7440-17-7	E472A	0.010	mg/kg wwt	1.29	1.30	1.22	2.05	1.54
selenium	7782-49-2	E472	0.10	mg/kg	3.27	3.27	3.15	3.74	3.74
selenium	7782-49-2	E472A	0.020	mg/kg wwt	0.938	0.929	0.873	1.07	0.992
sodium	7440-23-5	E472	20	mg/kg	3230	3180	3000	3240	3480
sodium	7440-23-5	E472A	4.0	mg/kg wwt	925	905	830	928	924
strontium	7440-24-6	E472	0.10	mg/kg	65.3	65.3	49.3	61.2	58.8
strontium	7440-24-6	E472A	0.020	mg/kg wwt	18.7	18.6	13.6	17.5	15.6
tellurium	13494-80-9	E472	0.020	mg/kg	0.039	0.035	0.035	0.036	0.038
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	0.0112	0.0100	0.0096	0.0104	0.0100
thallium	7440-28-0	E472	0.0020	mg/kg	0.0110	0.0106	0.0101	0.0105	0.0101
thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.00316	0.00303	0.00281	0.00300	0.00269
tin	7440-31-5	E472	0.10	mg/kg	1.17	1.23	1.22	2.27	1.25





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 Site Control Juvenile	PJ2021-006 0.32% Juvenile	PJ2021-006 1.0% Juvenile	PJ2021-006 3.2% Juvenile	PJ2021-006 10% Juvenile
Client sampling date / time						08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021	08-Oct-2021
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-001	VA22A7596-002	VA22A7596-003	VA22A7596-004	VA22A7596-005	
					Result	Result	Result	Result	Result	
<b>Metals</b>										
tin	7440-31-5	E472A	0.020	mg/kg ww	0.335	0.349	0.339	0.650	0.331	
uranium	7440-61-1	E472	0.0020	mg/kg	0.0430	0.0428	0.0435	0.0459	0.0477	
uranium	7440-61-1	E472A	0.00040	mg/kg ww	0.0123	0.0121	0.0120	0.0131	0.0127	
vanadium	7440-62-2	E472	0.10	mg/kg	0.80	2.62	3.34	22.8	11.4	
vanadium	7440-62-2	E472A	0.020	mg/kg ww	0.228	0.745	0.925	6.54	3.02	
zinc	7440-66-6	E472	1.0	mg/kg	139	130	117	134	140	
zinc	7440-66-6	E472A	0.20	mg/kg ww	40.0	37.0	32.5	38.3	37.4	
zirconium	7440-67-7	E472	0.20	mg/kg	0.36	0.39	<0.20	<1.00 <sup>DLM</sup>	0.31	
zirconium	7440-67-7	E472A	0.040	mg/kg ww	0.103	0.111	0.055	<0.200 <sup>DLM</sup>	0.082	

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% Juvenile	PJ2021-006 56% Juvenile	PJ2021-006 100% Juvenile	----	----
Client sampling date / time					08-Oct-2021	08-Oct-2021	08-Oct-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-006	VA22A7596-007	VA22A7596-008	-----	-----	-----
					Result	Result	Result	----	----	----
<b>Physical Tests</b>										
moisture	----	E144-H	2.0	%	72.0	75.7	87.4	----	----	----
<b>Metals</b>										
aluminum	7429-90-5	E472	5.0	mg/kg	72.3	66.5	16.4	----	----	----
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	20.2	16.2	2.1	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0.022	----	----	----
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	0.0028	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg	0.718	0.569	1.09	----	----	----
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	0.201	0.138	0.138	----	----	----
barium	7440-39-3	E472	0.050	mg/kg	11.6	17.6	51.1	----	----	----
barium	7440-39-3	E472A	0.010	mg/kg wwt	3.26	4.29	6.43	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	<0.010	----	----	----
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	<0.010	----	----	----
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	----	----	----
boron	7440-42-8	E472	1.0	mg/kg	<1.0	1.4	8.3	----	----	----
boron	7440-42-8	E472A	0.20	mg/kg wwt	0.23	0.34	1.05	----	----	----
cadmium	7440-43-9	E472	0.010	mg/kg	0.019	0.025	0.030	----	----	----
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0054	0.0061	0.0038	----	----	----
calcium	7440-70-2	E472	20	mg/kg	28300	32200	69900	----	----	----
calcium	7440-70-2	E472A	4.0	mg/kg wwt	7920	7830	8800	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg	0.0382	0.0380	0.0228	----	----	----
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.0107	0.0092	0.0029	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg	<0.20	<0.20	6.16	----	----	----
chromium	7440-47-3	E472A	0.040	mg/kg wwt	<0.040	<0.040	0.775	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg	0.098	0.075	0.190	----	----	----
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	0.0274	0.0183	0.0240	----	----	----
copper	7440-50-8	E472	0.20	mg/kg	5.38	4.52	5.08	----	----	----
copper	7440-50-8	E472A	0.040	mg/kg wwt	1.51	1.10	0.640	----	----	----
iron	7439-89-6	E472	5.0	mg/kg	156	153	138	----	----	----
iron	7439-89-6	E472A	1.0	mg/kg wwt	43.7	37.2	17.4	----	----	----
lead	7439-92-1	E472	0.050	mg/kg	0.078	0.067	0.367	----	----	----
lead	7439-92-1	E472A	0.010	mg/kg wwt	0.022	0.016	0.046	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% Juvenile	PJ2021-006 56% Juvenile	PJ2021-006 100% Juvenile	----	----
Client sampling date / time					08-Oct-2021	08-Oct-2021	08-Oct-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-006	VA22A7596-007	VA22A7596-008	-----	-----	-----
					Result	Result	Result	----	----	----
<b>Metals</b>										
lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	<0.50	----	----	----
lithium	7439-93-2	E472A	0.10	mg/kg wwt	<0.10	<0.10	<0.10	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg	1160	1360	1290	----	----	----
magnesium	7439-95-4	E472A	0.40	mg/kg wwt	326	332	163	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg	16.3	11.5	14.0	----	----	----
manganese	7439-96-5	E472A	0.010	mg/kg wwt	4.58	2.80	1.77	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg	0.561	0.615	1.50	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.157	0.150	0.189	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg	0.570	0.572	0.980	----	----	----
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.160	0.139	0.123	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg	0.26	<0.20	5.95	----	----	----
nickel	7440-02-0	E472A	0.040	mg/kg wwt	0.072	<0.040	0.749	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg	22100	25300	54900	----	----	----
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	6200	6160	6920	----	----	----
potassium	7440-09-7	E472	20	mg/kg	8840	9960	3580	----	----	----
potassium	7440-09-7	E472A	4.0	mg/kg wwt	2480	2420	450	----	----	----
rubidium	7440-17-7	E472	0.050	mg/kg	7.77	10.6	5.37	----	----	----
rubidium	7440-17-7	E472A	0.010	mg/kg wwt	2.18	2.59	0.676	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg	3.65	3.82	4.11	----	----	----
selenium	7782-49-2	E472A	0.020	mg/kg wwt	1.02	0.930	0.518	----	----	----
sodium	7440-23-5	E472	20	mg/kg	3230	4000	20500	----	----	----
sodium	7440-23-5	E472A	4.0	mg/kg wwt	906	972	2580	----	----	----
strontium	7440-24-6	E472	0.10	mg/kg	92.5	130	391	----	----	----
strontium	7440-24-6	E472A	0.020	mg/kg wwt	25.9	31.6	49.2	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg	0.032	0.030	0.026	----	----	----
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	0.0089	0.0072	<0.0040	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg	0.0059	0.0059	0.0039	----	----	----
thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.00164	0.00144	0.00049	----	----	----
tin	7440-31-5	E472	0.10	mg/kg	0.83	0.69	4.83	----	----	----
tin	7440-31-5	E472A	0.020	mg/kg wwt	0.233	0.168	0.609	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg	0.0321	0.0318	0.408	----	----	----
uranium	7440-61-1	E472A	0.00040	mg/kg wwt	0.00899	0.00774	0.0513	----	----	----





Analytical Results

Sub-Matrix: Tissue					Client sample ID	PJ2021-006 32% Juvenile	PJ2021-006 56% Juvenile	PJ2021-006 100% Juvenile	----	----
(Matrix: Biota)										
					Client sampling date / time	08-Oct-2021	08-Oct-2021	08-Oct-2021	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7596-006	VA22A7596-007	VA22A7596-008	-----	-----	
					Result	Result	Result	----	----	
Metals										
vanadium	7440-62-2	E472	0.10	mg/kg	46.6	56.8	136	----	----	
vanadium	7440-62-2	E472A	0.020	mg/kg ww	13.0	13.8	17.1	----	----	
zinc	7440-66-6	E472	1.0	mg/kg	139	161	361	----	----	
zinc	7440-66-6	E472A	0.20	mg/kg ww	39.0	39.2	45.5	----	----	
zirconium	7440-67-7	E472	0.20	mg/kg	<0.20	<0.20	1.14	----	----	
zirconium	7440-67-7	E472A	0.040	mg/kg ww	0.048	<0.040	0.144	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: <b>VA22A7596</b>	Page	: 1 of 10
Client	: <b>Hatfield Consultants LLP</b>	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 08-Apr-2022 08:10
PO	: ----	Issue Date	: 24-May-2022 10:16
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

### **Workorder Comments**

Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

### **Summary of Outliers**

#### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

#### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

#### **Outliers : Analysis Holding Time Compliance (Breaches)**

- No Analysis Holding Time Outliers exist.

#### **Outliers : Frequency of Quality Control Samples**

- No Quality Control Sample Frequency Outliers occur.









## Outliers : Quality Control Samples

*Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes*

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
<b>Duplicate (DUP) RPDs</b>								
Metals	VA22A7596-001	PJ2021-006 Site Control Juvenile	aluminum	7429-90-5	E472	47.3 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	VA22A7596-001	PJ2021-006 Site Control Juvenile	aluminum	7429-90-5	E472A	47.3 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

## Result Qualifiers

*Qualifier Description*

*DUP-H Duplicate results outside ALS DQO, due to sample heterogeneity.*

## Laboratory Control Sample (LCS) Recoveries

Metals	QC-MRG4-4751890 02	----	boron	7440-42-8	E472	79.6 % MES	80.0-120%	Recovery less than lower control limit
Metals	QC-MRG4-4751890 02	----	boron	7440-42-8	E472A	79.6 % MES	80.0-120%	Recovery less than lower control limit

## Result Qualifiers

*Qualifier Description*

*MES Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 0.32% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 1.0% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 10% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 100% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 3.2% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 32% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 56% Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 Site Control Juvenile	E511	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 0.32% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 1.0% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 10% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 100% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 3.2% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 32% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 56% Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 Site Control Juvenile	E511A	08-Oct-2021	11-May-2022	----	----		11-May-2022	365 days	215 days	✓





Matrix: Biota

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 0.32% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 1.0% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 10% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 100% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 3.2% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 32% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 56% Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 Site Control Juvenile	E472	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 0.32% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 1.0% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 10% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 100% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 3.2% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 32% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 56% Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 Site Control Juvenile	E472A	08-Oct-2021	11-May-2022	----	----		11-May-2022	730 days	216 days	✓
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 0.32% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 1.0% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 10% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 100% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 3.2% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 32% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 56% Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 Site Control Juvenile	E144-H	08-Oct-2021	----	----	----		02-May-2022	----	----	

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	475190	1	8	12.5	5.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	475191	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	475192	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	475189	1	8	12.5	5.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	474573	1	8	12.5	5.0	✔
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	475190	2	8	25.0	10.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	475191	2	8	25.0	10.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	475192	2	8	25.0	10.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	475189	2	8	25.0	10.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	474573	1	8	12.5	5.0	✔
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	475190	1	8	12.5	5.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	475191	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	475192	1	8	12.5	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	475189	1	8	12.5	5.0	✔
Moisture Content by Gravimetry (Micro)	E144-H	474573	1	8	12.5	5.0	✔





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Micro)	E144-H  Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at <60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	<p>Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO<sub>3</sub>, HCl, and H<sub>2</sub>O<sub>2</sub>. Analysis is by Collision/Reaction Cell ICPMS.</p> <p>Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.</p>
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	<p>Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO<sub>3</sub>, HCl, and H<sub>2</sub>O<sub>2</sub>. Analysis is by Collision/Reaction Cell ICPMS.</p> <p>Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.</p>
Mercury in Biota by CVAAS (DRY units, Micro)	E511  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Micro)	E511A  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion (Micro)	EP472  Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> and is intended to provide a conservative estimate of bio-available metals.



## QUALITY CONTROL REPORT

<b>Work Order</b>	<b>: VA22A7596</b>	<b>Page</b>	<b>: 1 of 13</b>
Client	: Hatfield Consultants LLP	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 08-Apr-2022 08:10
PO	: ----	Date Analysis Commenced	: 02-May-2022
C-O-C number	: ----	Issue Date	: 24-May-2022 10:16
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Caleb Deroche	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia





## General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

# = Indicates a QC result that did not meet the ALS DQO.

## Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.





## Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: Biota

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
<b>Physical Tests (QC Lot: 474573)</b>											
VA22A7596-001	PJ2021-006 Site Control Juvenile	moisture	----	E144-H	2.0	%	71.3	71.0	0.506%	20%	----
<b>Metals (QC Lot: 475189)</b>											
VA22A7596-001	PJ2021-006 Site Control Juvenile	aluminum	7429-90-5	E472A	1.0	mg/kg ww	76.3	47.1	47.3%	40%	DUP-H
		antimony	7440-36-0	E472A	0.0020	mg/kg ww	0.0024	0.0025	0.00010	Diff <2x LOR	----
		arsenic	7440-38-2	E472A	0.0060	mg/kg ww	0.220	0.202	8.54%	40%	----
		barium	7440-39-3	E472A	0.010	mg/kg ww	4.57	3.67	21.8%	40%	----
		beryllium	7440-41-7	E472A	0.0020	mg/kg ww	0.0031	<0.0020	0.0011	Diff <2x LOR	----
		bismuth	7440-69-9	E472A	0.0020	mg/kg ww	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E472A	0.20	mg/kg ww	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472A	0.0020	mg/kg ww	0.0082	0.0077	0.0005	Diff <2x LOR	----
		calcium	7440-70-2	E472A	4.0	mg/kg ww	7270	6740	7.51%	60%	----
		cesium	7440-46-2	E472A	0.0010	mg/kg ww	0.0117	0.0080	37.8%	40%	----
		chromium	7440-47-3	E472A	0.040	mg/kg ww	0.119	0.081	0.038	Diff <2x LOR	----
		cobalt	7440-48-4	E472A	0.0040	mg/kg ww	0.0549	0.0433	23.6%	40%	----
		copper	7440-50-8	E472A	0.040	mg/kg ww	1.34	1.37	1.76%	40%	----
		iron	7439-89-6	E472A	1.0	mg/kg ww	128	88.7	36.7%	40%	----
		lead	7439-92-1	E472A	0.010	mg/kg ww	0.058	0.042	32.3%	40%	----
		lithium	7439-93-2	E472A	0.10	mg/kg ww	0.10	<0.10	0.005	Diff <2x LOR	----
		magnesium	7439-95-4	E472A	0.40	mg/kg ww	353	337	4.48%	40%	----
		manganese	7439-96-5	E472A	0.010	mg/kg ww	8.04	6.86	15.8%	40%	----
		molybdenum	7439-98-7	E472A	0.0080	mg/kg ww	0.0484	0.0441	9.17%	40%	----
		nickel	7440-02-0	E472A	0.040	mg/kg ww	0.122	0.096	0.026	Diff <2x LOR	----
		phosphorus	7723-14-0	E472A	2.0	mg/kg ww	5980	5670	5.35%	40%	----
		potassium	7440-09-7	E472A	4.0	mg/kg ww	2570	2580	0.426%	40%	----
		rubidium	7440-17-7	E472A	0.010	mg/kg ww	1.29	1.28	1.17%	40%	----
		selenium	7782-49-2	E472A	0.020	mg/kg ww	0.938	0.952	1.55%	40%	----
		sodium	7440-23-5	E472A	4.0	mg/kg ww	925	924	0.0955%	40%	----
		strontium	7440-24-6	E472A	0.020	mg/kg ww	18.7	16.6	11.6%	60%	----
		tellurium	13494-80-9	E472A	0.0040	mg/kg ww	0.0112	0.0112	0.00005	Diff <2x LOR	----
		thallium	7440-28-0	E472A	0.00040	mg/kg ww	0.00316	0.00265	17.8%	40%	----
		tin	7440-31-5	E472A	0.020	mg/kg ww	0.335	0.300	11.2%	40%	----





Sub-Matrix: **Biota**

Sub-Matrix: Biota					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 475189) - continued											
VA22A7596-001	PJ2021-006 Site Control Juvenile	uranium	7440-61-1	E472A	0.00040	mg/kg ww	0.0123	0.0101	19.4%	40%	----
		vanadium	7440-62-2	E472A	0.020	mg/kg ww	0.228	0.159	35.8%	40%	----
		zinc	7440-66-6	E472A	0.20	mg/kg ww	40.0	36.7	8.57%	40%	----
		zirconium	7440-67-7	E472A	0.040	mg/kg ww	0.103	0.069	0.034	Diff <2x LOR	----
Metals (QC Lot: 475190)											
VA22A7596-001	PJ2021-006 Site Control Juvenile	mercury	7439-97-6	E511	0.0050	mg/kg	0.492	0.511	3.76%	40%	----
Metals (QC Lot: 475191)											
VA22A7596-001	PJ2021-006 Site Control Juvenile	mercury	7439-97-6	E511A	0.0010	mg/kg ww	0.141	0.146	3.76%	40%	----
Metals (QC Lot: 475192)											
VA22A7596-001	PJ2021-006 Site Control Juvenile	aluminum	7429-90-5	E472	5.0	mg/kg	266	164	47.3%	40%	DUP-H
		antimony	7440-36-0	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E472	0.030	mg/kg	0.768	0.705	8.54%	40%	----
		barium	7440-39-3	E472	0.050	mg/kg	15.9	12.8	21.8%	40%	----
		beryllium	7440-41-7	E472	0.010	mg/kg	0.011	<0.010	0.0008	Diff <2x LOR	----
		bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E472	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E472	0.010	mg/kg	0.029	0.027	0.002	Diff <2x LOR	----
		calcium	7440-70-2	E472	20	mg/kg	25400	23500	7.51%	60%	----
		cesium	7440-46-2	E472	0.0050	mg/kg	0.0408	0.0278	37.8%	40%	----
		chromium	7440-47-3	E472	0.20	mg/kg	0.41	0.28	0.13	Diff <2x LOR	----
		cobalt	7440-48-4	E472	0.020	mg/kg	0.191	0.151	23.6%	40%	----
		copper	7440-50-8	E472	0.20	mg/kg	4.69	4.77	1.76%	40%	----
		iron	7439-89-6	E472	5.0	mg/kg	448	309	36.7%	40%	----
		lead	7439-92-1	E472	0.050	mg/kg	0.204	0.147	0.057	Diff <2x LOR	----
		lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E472	2.0	mg/kg	1230	1180	4.48%	40%	----
		manganese	7439-96-5	E472	0.050	mg/kg	28.0	23.9	15.8%	40%	----
		molybdenum	7439-98-7	E472	0.040	mg/kg	0.169	0.154	0.015	Diff <2x LOR	----
		nickel	7440-02-0	E472	0.20	mg/kg	0.43	0.33	0.09	Diff <2x LOR	----
		phosphorus	7723-14-0	E472	10	mg/kg	20900	19800	5.35%	40%	----
		potassium	7440-09-7	E472	20	mg/kg	8960	9000	0.426%	40%	----
		rubidium	7440-17-7	E472	0.050	mg/kg	4.51	4.45	1.17%	40%	----
		selenium	7782-49-2	E472	0.10	mg/kg	3.27	3.32	1.55%	40%	----
		sodium	7440-23-5	E472	20	mg/kg	3230	3220	0.0955%	40%	----





Sub-Matrix: Biota					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 475192) - continued											
VA22A7596-001	PJ2021-006 Site Control Juvenile	strontium	7440-24-6	E472	0.10	mg/kg	65.3	58.1	11.6%	60%	----
		tellurium	13494-80-9	E472	0.020	mg/kg	0.039	0.039	0.0002	Diff <2x LOR	----
		thallium	7440-28-0	E472	0.0020	mg/kg	0.0110	0.0092	17.8%	40%	----
		tin	7440-31-5	E472	0.10	mg/kg	1.17	1.04	11.2%	40%	----
		uranium	7440-61-1	E472	0.0020	mg/kg	0.0430	0.0354	19.4%	40%	----
		vanadium	7440-62-2	E472	0.10	mg/kg	0.80	0.56	35.8%	40%	----
		zinc	7440-66-6	E472	1.0	mg/kg	139	128	8.57%	40%	----
		zirconium	7440-67-7	E472	0.20	mg/kg	0.36	0.24	0.12	Diff <2x LOR	----

Qualifiers

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.





## Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

### Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Physical Tests (QCLot: 474573)</b>						
moisture	----	E144-H	2	%	<2.0	----
<b>Metals (QCLot: 475189)</b>						
aluminum	7429-90-5	E472A	1	mg/kg ww	<1.0	----
antimony	7440-36-0	E472A	0.002	mg/kg ww	<0.0020	----
arsenic	7440-38-2	E472A	0.006	mg/kg ww	<0.0060	----
barium	7440-39-3	E472A	0.01	mg/kg ww	<0.010	----
beryllium	7440-41-7	E472A	0.002	mg/kg ww	<0.0020	----
bismuth	7440-69-9	E472A	0.002	mg/kg ww	<0.0020	----
boron	7440-42-8	E472A	0.2	mg/kg ww	<0.20	----
cadmium	7440-43-9	E472A	0.002	mg/kg ww	<0.0020	----
calcium	7440-70-2	E472A	4	mg/kg ww	<4.0	----
cesium	7440-46-2	E472A	0.001	mg/kg ww	<0.0010	----
chromium	7440-47-3	E472A	0.04	mg/kg ww	<0.040	----
cobalt	7440-48-4	E472A	0.004	mg/kg ww	<0.0040	----
copper	7440-50-8	E472A	0.04	mg/kg ww	<0.040	----
iron	7439-89-6	E472A	1	mg/kg ww	<1.0	----
lead	7439-92-1	E472A	0.01	mg/kg ww	<0.010	----
lithium	7439-93-2	E472A	0.1	mg/kg ww	<0.10	----
magnesium	7439-95-4	E472A	0.4	mg/kg ww	<0.40	----
manganese	7439-96-5	E472A	0.01	mg/kg ww	<0.010	----
molybdenum	7439-98-7	E472A	0.008	mg/kg ww	<0.0080	----
nickel	7440-02-0	E472A	0.04	mg/kg ww	<0.040	----
phosphorus	7723-14-0	E472A	2	mg/kg ww	<2.0	----
potassium	7440-09-7	E472A	4	mg/kg ww	<4.0	----
rubidium	7440-17-7	E472A	0.01	mg/kg ww	<0.010	----
selenium	7782-49-2	E472A	0.02	mg/kg ww	<0.020	----
sodium	7440-23-5	E472A	4	mg/kg ww	<4.0	----
strontium	7440-24-6	E472A	0.02	mg/kg ww	<0.020	----
tellurium	13494-80-9	E472A	0.004	mg/kg ww	<0.0040	----
thallium	7440-28-0	E472A	0.0004	mg/kg ww	<0.00040	----
tin	7440-31-5	E472A	0.02	mg/kg ww	<0.020	----
uranium	7440-61-1	E472A	0.0004	mg/kg ww	<0.00040	----
vanadium	7440-62-2	E472A	0.02	mg/kg ww	<0.020	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 475189) - continued</b>						
zinc	7440-66-6	E472A	0.2	mg/kg ww	<0.20	----
zirconium	7440-67-7	E472A	0.04	mg/kg ww	<0.040	----
<b>Metals (QCLot: 475190)</b>						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
<b>Metals (QCLot: 475191)</b>						
mercury	7439-97-6	E511A	0.001	mg/kg ww	<0.0010	----
<b>Metals (QCLot: 475192)</b>						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 475192) - continued						
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----





Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Biota					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 474573)									
moisture	----	E144-H	2	%	100 %	100	90.0	110	----
Metals (QCLot: 475189)									
aluminum	7429-90-5	E472A	1	mg/kg ww	20 mg/kg ww	90.3	80.0	120	----
antimony	7440-36-0	E472A	0.002	mg/kg ww	10 mg/kg ww	86.2	80.0	120	----
arsenic	7440-38-2	E472A	0.006	mg/kg ww	10 mg/kg ww	92.2	80.0	120	----
barium	7440-39-3	E472A	0.01	mg/kg ww	2.5 mg/kg ww	94.3	80.0	120	----
beryllium	7440-41-7	E472A	0.002	mg/kg ww	1 mg/kg ww	80.2	80.0	120	----
bismuth	7440-69-9	E472A	0.002	mg/kg ww	10 mg/kg ww	86.4	80.0	120	----
boron	7440-42-8	E472A	0.2	mg/kg ww	10 mg/kg ww	# 79.6	80.0	120	MES
cadmium	7440-43-9	E472A	0.002	mg/kg ww	1 mg/kg ww	85.9	80.0	120	----
calcium	7440-70-2	E472A	4	mg/kg ww	500 mg/kg ww	84.2	80.0	120	----
cesium	7440-46-2	E472A	0.001	mg/kg ww	0.5 mg/kg ww	88.3	80.0	120	----
chromium	7440-47-3	E472A	0.04	mg/kg ww	2.5 mg/kg ww	91.2	80.0	120	----
cobalt	7440-48-4	E472A	0.004	mg/kg ww	2.5 mg/kg ww	89.5	80.0	120	----
copper	7440-50-8	E472A	0.04	mg/kg ww	2.5 mg/kg ww	88.6	80.0	120	----
iron	7439-89-6	E472A	1	mg/kg ww	10 mg/kg ww	91.7	80.0	120	----
lead	7439-92-1	E472A	0.01	mg/kg ww	5 mg/kg ww	86.0	80.0	120	----
lithium	7439-93-2	E472A	0.1	mg/kg ww	2.5 mg/kg ww	82.1	80.0	120	----
magnesium	7439-95-4	E472A	0.4	mg/kg ww	500 mg/kg ww	90.8	80.0	120	----
manganese	7439-96-5	E472A	0.01	mg/kg ww	2.5 mg/kg ww	90.7	80.0	120	----
molybdenum	7439-98-7	E472A	0.008	mg/kg ww	2.5 mg/kg ww	89.2	80.0	120	----
nickel	7440-02-0	E472A	0.04	mg/kg ww	5 mg/kg ww	88.2	80.0	120	----
phosphorus	7723-14-0	E472A	2	mg/kg ww	100 mg/kg ww	93.7	80.0	120	----
potassium	7440-09-7	E472A	4	mg/kg ww	500 mg/kg ww	90.1	80.0	120	----
rubidium	7440-17-7	E472A	0.01	mg/kg ww	1 mg/kg ww	94.9	80.0	120	----
selenium	7782-49-2	E472A	0.02	mg/kg ww	10 mg/kg ww	87.7	80.0	120	----
sodium	7440-23-5	E472A	4	mg/kg ww	500 mg/kg ww	89.6	80.0	120	----
strontium	7440-24-6	E472A	0.02	mg/kg ww	2.5 mg/kg ww	88.6	80.0	120	----
tellurium	13494-80-9	E472A	0.004	mg/kg ww	1 mg/kg ww	86.0	80.0	120	----
thallium	7440-28-0	E472A	0.0004	mg/kg ww	10 mg/kg ww	86.6	80.0	120	----
tin	7440-31-5	E472A	0.02	mg/kg ww	5 mg/kg ww	85.8	80.0	120	----
uranium	7440-61-1	E472A	0.0004	mg/kg ww	0.05 mg/kg ww	90.7	80.0	120	----
vanadium	7440-62-2	E472A	0.02	mg/kg ww	5 mg/kg ww	93.1	80.0	120	----





Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
<b>Metals (QCLot: 475189) - continued</b>									
zinc	7440-66-6	E472A	0.2	mg/kg wwt	5 mg/kg wwt	87.3	80.0	120	----
zirconium	7440-67-7	E472A	0.04	mg/kg wwt	1 mg/kg wwt	88.6	80.0	120	----
<b>Metals (QCLot: 475190)</b>									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	91.4	80.0	120	----
<b>Metals (QCLot: 475191)</b>									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	91.4	80.0	120	----
<b>Metals (QCLot: 475192)</b>									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	90.3	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	86.2	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	92.2	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	94.3	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	80.2	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	86.4	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	# 79.6	80.0	120	MES
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	85.9	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	84.2	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	88.3	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	91.2	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	89.5	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	88.6	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	91.7	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	86.0	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	82.1	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	90.8	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	90.7	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	89.2	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	88.2	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	93.7	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	90.1	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	94.9	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	87.7	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	89.6	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	88.6	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	86.0	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	86.6	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	85.8	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	90.7	80.0	120	----





Sub-Matrix: Biota					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 475192) - continued									
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	93.1	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	87.3	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	88.6	80.0	120	----

Qualifiers

Qualifier	Description
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).





## Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Sub-Matrix:					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	
Metals (QCLot: 475189)									
	RM	aluminum	7429-90-5	E472A	11.2 mg/kg wwt	97.4	70.0	130	----
	RM	arsenic	7440-38-2	E472A	34.6 mg/kg wwt	98.7	70.0	130	----
	RM	cadmium	7440-43-9	E472A	14.5 mg/kg wwt	88.2	70.0	130	----
	RM	calcium	7440-70-2	E472A	550 mg/kg wwt	108	70.0	130	----
	RM	cesium	7440-46-2	E472A	0.0712 mg/kg wwt	93.4	70.0	130	----
	RM	chromium	7440-47-3	E472A	1.96 mg/kg wwt	87.0	70.0	130	----
	RM	cobalt	7440-48-4	E472A	0.267 mg/kg wwt	91.3	70.0	130	----
	RM	copper	7440-50-8	E472A	35 mg/kg wwt	94.8	70.0	130	----
	RM	iron	7439-89-6	E472A	1070 mg/kg wwt	97.2	70.0	130	----
	RM	lead	7439-92-1	E472A	0.162 mg/kg wwt	127	70.0	130	----
	RM	magnesium	7439-95-4	E472A	940 mg/kg wwt	94.0	70.0	130	----
	RM	manganese	7439-96-5	E472A	8.91 mg/kg wwt	95.6	70.0	130	----
	RM	molybdenum	7439-98-7	E472A	1.41 mg/kg wwt	93.8	70.0	130	----
	RM	nickel	7440-02-0	E472A	1.57 mg/kg wwt	128	70.0	130	----
	RM	phosphorus	7723-14-0	E472A	11500 mg/kg wwt	98.8	70.0	130	----
	RM	potassium	7440-09-7	E472A	14400 mg/kg wwt	95.8	70.0	130	----
	RM	rubidium	7440-17-7	E472A	5.11 mg/kg wwt	96.0	70.0	130	----
	RM	selenium	7782-49-2	E472A	8 mg/kg wwt	101	70.0	130	----
	RM	sodium	7440-23-5	E472A	10673 mg/kg wwt	96.1	70.0	130	----
	RM	strontium	7440-24-6	E472A	3.92 mg/kg wwt	95.2	70.0	130	----
	RM	thallium	7440-28-0	E472A	0.013 mg/kg wwt	89.7	70.0	130	----
	RM	uranium	7440-61-1	E472A	0.0786 mg/kg wwt	98.5	70.0	130	----
	RM	vanadium	7440-62-2	E472A	0.51 mg/kg wwt	95.6	70.0	130	----
	RM	zinc	7440-66-6	E472A	105.3 mg/kg wwt	96.0	70.0	130	----
Metals (QCLot: 475190)									
	RM	mercury	7439-97-6	E511	0.331 mg/kg	110	70.0	130	----
Metals (QCLot: 475191)									
	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	110	70.0	130	----



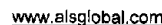


Sub-Matrix:

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					
Metals (QCLot: 475192)									
	RM	aluminum	7429-90-5	E472	11.2 mg/kg	97.4	70.0	130	----
	RM	arsenic	7440-38-2	E472	34.6 mg/kg	98.7	70.0	130	----
	RM	cadmium	7440-43-9	E472	14.5 mg/kg	88.2	70.0	130	----
	RM	calcium	7440-70-2	E472	550 mg/kg	108	70.0	130	----
	RM	cesium	7440-46-2	E472	0.0712 mg/kg	93.4	70.0	130	----
	RM	chromium	7440-47-3	E472	1.96 mg/kg	87.0	70.0	130	----
	RM	cobalt	7440-48-4	E472	0.267 mg/kg	91.3	70.0	130	----
	RM	copper	7440-50-8	E472	35 mg/kg	94.8	70.0	130	----
	RM	iron	7439-89-6	E472	1070 mg/kg	97.2	70.0	130	----
	RM	lead	7439-92-1	E472	0.162 mg/kg	127	70.0	130	----
	RM	magnesium	7439-95-4	E472	940 mg/kg	94.0	70.0	130	----
	RM	manganese	7439-96-5	E472	8.91 mg/kg	95.6	70.0	130	----
	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	93.8	70.0	130	----
	RM	nickel	7440-02-0	E472	1.57 mg/kg	128	70.0	130	----
	RM	phosphorus	7723-14-0	E472	11500 mg/kg	98.8	70.0	130	----
	RM	potassium	7440-09-7	E472	14400 mg/kg	95.8	70.0	130	----
	RM	rubidium	7440-17-7	E472	5.11 mg/kg	96.0	70.0	130	----
	RM	selenium	7782-49-2	E472	8 mg/kg	101	70.0	130	----
	RM	sodium	7440-23-5	E472	10673 mg/kg	96.1	70.0	130	----
	RM	strontium	7440-24-6	E472	3.92 mg/kg	95.2	70.0	130	----
	RM	thallium	7440-28-0	E472	0.013 mg/kg	89.7	70.0	130	----
	RM	uranium	7440-61-1	E472	0.0786 mg/kg	98.5	70.0	130	----
	RM	vanadium	7440-62-2	E472	0.51 mg/kg	95.6	70.0	130	----
	RM	zinc	7440-66-6	E472	105.3 mg/kg	96.0	70.0	130	----





**Affix ALS barcode label here**  
(lab use only)

COC Number: 17 -

Page of

**Canada Toll Free: 1 800 668 9878**

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

NEW 2015 FROM



## CERTIFICATE OF ANALYSIS

**Work Order** : **VA22A7600**  
**Client** : **Hatfield Consultants LLP**  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 8  
**No. of samples analysed** : 8

**Page** : 1 of 10  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby BC Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 08-Apr-2022 08:10  
**Date Analysis Commenced** : 27-Apr-2022  
**Issue Date** : 02-May-2022 14:45

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
%	percent
mg/kg	milligrams per kilogram
mg/kg ww	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 Site Control ELS	PJ2021-006 0.32% ELS	PJ2021-006 1.0% ELS	PJ2021-006 3.2% ELS	PJ2021-006 10% ELS
Client sampling date / time					12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021	
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-001	VA22A7600-002	VA22A7600-003	VA22A7600-004	VA22A7600-005	
					Result	Result	Result	Result	Result	
Physical Tests										
moisture	----	E144-H	2.0	%	81.4	81.6	81.5	81.1	81.9	
Metals										
aluminum	7429-90-5	E472	5.0	mg/kg	449	209	280	394	248	
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	83.6	38.4	51.8	74.5	44.9	
antimony	7440-36-0	E472	0.010	mg/kg	0.016	0.014	0.015	0.014	0.019	
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0030	0.0026	0.0028	0.0027	0.0034	
arsenic	7440-38-2	E472	0.030	mg/kg	2.14	2.24	2.28	2.32	2.20	
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	0.399	0.411	0.421	0.439	0.400	
barium	7440-39-3	E472	0.050	mg/kg	12.4	11.7	13.2	15.1	13.5	
barium	7440-39-3	E472A	0.010	mg/kg wwt	2.31	2.15	2.44	2.86	2.45	
beryllium	7440-41-7	E472	0.010	mg/kg	0.013	<0.010	0.012	0.017	<0.010	
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	0.0024	<0.0020	0.0022	0.0032	<0.0020	
bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
boron	7440-42-8	E472	1.0	mg/kg	2.8	2.9	3.0	3.0	3.9	
boron	7440-42-8	E472A	0.20	mg/kg wwt	0.53	0.53	0.56	0.56	0.70	
cadmium	7440-43-9	E472	0.010	mg/kg	0.049	0.044	0.049	0.044	0.044	
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0092	0.0082	0.0091	0.0084	0.0079	
calcium	7440-70-2	E472	20	mg/kg	20700	20500	21100	20800	22200	
calcium	7440-70-2	E472A	4.0	mg/kg wwt	3840	3760	3910	3920	4020	
cesium	7440-46-2	E472	0.0050	mg/kg	0.104	0.0962	0.101	0.122	0.118	
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.0194	0.0177	0.0188	0.0230	0.0214	
chromium	7440-47-3	E472	0.20	mg/kg	0.47	0.34	0.45	0.63	0.35	
chromium	7440-47-3	E472A	0.040	mg/kg wwt	0.087	0.062	0.084	0.119	0.063	
cobalt	7440-48-4	E472	0.020	mg/kg	0.276	0.198	0.217	0.288	0.225	
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	0.0512	0.0363	0.0401	0.0544	0.0408	
copper	7440-50-8	E472	0.20	mg/kg	7.54	8.99	8.70	7.38	6.91	
copper	7440-50-8	E472A	0.040	mg/kg wwt	1.40	1.65	1.61	1.40	1.25	
iron	7439-89-6	E472	5.0	mg/kg	544	380	492	681	398	
iron	7439-89-6	E472A	1.0	mg/kg wwt	101	69.8	91.0	129	72.2	





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 Site Control ELS	PJ2021-006 0.32% ELS	PJ2021-006 1.0% ELS	PJ2021-006 3.2% ELS	PJ2021-006 10% ELS
Client sampling date / time					12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021	
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-001	VA22A7600-002	VA22A7600-003	VA22A7600-004	VA22A7600-005	
					Result	Result	Result	Result	Result	
Metals										
lead	7439-92-1	E472	0.050	mg/kg	0.209	0.150	0.195	0.268	0.174	
lead	7439-92-1	E472A	0.010	mg/kg wwt	0.039	0.027	0.036	0.051	0.032	
lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	<0.50	0.53	<0.50	
lithium	7439-93-2	E472A	0.10	mg/kg wwt	<0.10	<0.10	<0.10	0.10	<0.10	
magnesium	7439-95-4	E472	2.0	mg/kg	1350	1400	1460	1430	1430	
magnesium	7439-95-4	E472A	0.40	mg/kg wwt	251	258	270	271	259	
manganese	7439-96-5	E472	0.050	mg/kg	20.0	15.3	20.9	30.2	22.4	
manganese	7439-96-5	E472A	0.010	mg/kg wwt	3.72	2.82	3.86	5.71	4.07	
mercury	7439-97-6	E511	0.0050	mg/kg	0.427	0.394	0.385	0.358	0.326	
mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0794	0.0722	0.0713	0.0678	0.0591	
molybdenum	7439-98-7	E472	0.040	mg/kg	0.473	0.222	0.290	0.428	0.537	
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.0880	0.0407	0.0538	0.0810	0.0974	
nickel	7440-02-0	E472	0.20	mg/kg	0.53	0.45	0.51	0.66	0.52	
nickel	7440-02-0	E472A	0.040	mg/kg wwt	0.098	0.082	0.094	0.124	0.095	
phosphorus	7723-14-0	E472	10	mg/kg	20800	21700	21500	20900	22000	
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	3870	3980	3970	3960	3990	
potassium	7440-09-7	E472	20	mg/kg	14000	14100	13500	14300	13900	
potassium	7440-09-7	E472A	4.0	mg/kg wwt	2610	2580	2500	2700	2520	
rubidium	7440-17-7	E472	0.050	mg/kg	30.7	31.5	29.8	31.2	31.6	
rubidium	7440-17-7	E472A	0.010	mg/kg wwt	5.71	5.78	5.52	5.89	5.74	
selenium	7782-49-2	E472	0.10	mg/kg	2.32	2.33	2.33	2.44	2.44	
selenium	7782-49-2	E472A	0.020	mg/kg wwt	0.431	0.428	0.430	0.461	0.442	
sodium	7440-23-5	E472	20	mg/kg	5330	5400	5290	5350	5300	
sodium	7440-23-5	E472A	4.0	mg/kg wwt	992	992	979	1010	960	
strontium	7440-24-6	E472	0.10	mg/kg	57.5	59.6	62.0	64.1	73.5	
strontium	7440-24-6	E472A	0.020	mg/kg wwt	10.7	10.9	11.5	12.1	13.3	
tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	
thallium	7440-28-0	E472	0.0020	mg/kg	0.0122	0.0104	0.0118	0.0136	0.0114	
thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.00227	0.00191	0.00219	0.00258	0.00207	
tin	7440-31-5	E472	0.10	mg/kg	0.56	0.12	0.11	<0.10	0.10	





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 Site Control ELS	PJ2021-006 0.32% ELS	PJ2021-006 1.0% ELS	PJ2021-006 3.2% ELS	PJ2021-006 10% ELS
Client sampling date / time						12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021	12-Oct-2021
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-001	VA22A7600-002	VA22A7600-003	VA22A7600-004	VA22A7600-005	
					Result	Result	Result	Result	Result	
<b>Metals</b>										
tin	7440-31-5	E472A	0.020	mg/kg ww	0.104	0.021	0.021	<0.020	<0.020	
uranium	7440-61-1	E472	0.0020	mg/kg	0.0264	0.0217	0.0254	0.0328	0.0304	
uranium	7440-61-1	E472A	0.00040	mg/kg ww	0.00491	0.00399	0.00470	0.00621	0.00551	
vanadium	7440-62-2	E472	0.10	mg/kg	1.22	4.16	12.4	22.3	33.3	
vanadium	7440-62-2	E472A	0.020	mg/kg ww	0.228	0.763	2.29	4.21	6.03	
zinc	7440-66-6	E472	1.0	mg/kg	178	172	191	187	195	
zinc	7440-66-6	E472A	0.20	mg/kg ww	33.1	31.5	35.3	35.4	35.4	
zirconium	7440-67-7	E472	0.20	mg/kg	0.42	0.31	0.38	0.56	0.44	
zirconium	7440-67-7	E472A	0.040	mg/kg ww	0.078	0.057	0.070	0.107	0.079	

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	PJ2021-006 32% ELS	PJ2021-006 56% ELS	PJ2021-006 100% ELS	----	----
(Matrix: Biota)										
Client sampling date / time					12-Oct-2021	12-Oct-2021	12-Oct-2021	----	----	
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-006	VA22A7600-007	VA22A7600-008	-----	-----	
					Result	Result	Result	----	----	
<b>Physical Tests</b>										
moisture	----	E144A	2	%	----	----	81.66	----	----	----
moisture	----	E144-H	2.0	%	81.5	83.1	----	----	----	----
<b>Metals</b>										
aluminum	7429-90-5	E475	5.0	mg/kg	----	----	19.7	----	----	----
aluminum	7429-90-5	E472	5.0	mg/kg	182	54.8	----	----	----	----
aluminum	7429-90-5	E475A	1.0	mg/kg wwt	----	----	3.6	----	----	----
aluminum	7429-90-5	E472A	1.0	mg/kg wwt	33.6	9.2	----	----	----	----
antimony	7440-36-0	E472	0.010	mg/kg	0.015	0.013	----	----	----	----
antimony	7440-36-0	E475	0.020	mg/kg	----	----	0.031	----	----	----
antimony	7440-36-0	E472A	0.0020	mg/kg wwt	0.0028	0.0022	----	----	----	----
antimony	7440-36-0	E475A	0.0040	mg/kg wwt	----	----	0.0057	----	----	----
arsenic	7440-38-2	E472	0.030	mg/kg	2.29	1.85	----	----	----	----
arsenic	7440-38-2	E475	0.050	mg/kg	----	----	2.43	----	----	----
arsenic	7440-38-2	E472A	0.0060	mg/kg wwt	0.423	0.312	----	----	----	----
arsenic	7440-38-2	E475A	0.010	mg/kg wwt	----	----	0.446	----	----	----
barium	7440-39-3	E475	0.050	mg/kg	----	----	12.4	----	----	----
barium	7440-39-3	E472	0.050	mg/kg	12.2	13.6	----	----	----	----
barium	7440-39-3	E475A	0.010	mg/kg wwt	----	----	2.28	----	----	----
barium	7440-39-3	E472A	0.010	mg/kg wwt	2.26	2.30	----	----	----	----
beryllium	7440-41-7	E475	0.010	mg/kg	----	----	<0.010	----	----	----
beryllium	7440-41-7	E472	0.010	mg/kg	<0.010	<0.010	----	----	----	----
beryllium	7440-41-7	E475A	0.0020	mg/kg wwt	----	----	<0.0020	----	----	----
beryllium	7440-41-7	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	----	----	----	----
bismuth	7440-69-9	E475	0.010	mg/kg	----	----	<0.010	----	----	----
bismuth	7440-69-9	E472	0.010	mg/kg	<0.010	<0.010	----	----	----	----
bismuth	7440-69-9	E475A	0.0020	mg/kg wwt	----	----	<0.0020	----	----	----
bismuth	7440-69-9	E472A	0.0020	mg/kg wwt	<0.0020	<0.0020	----	----	----	----
boron	7440-42-8	E475	1.0	mg/kg	----	----	12.6	----	----	----
boron	7440-42-8	E472	1.0	mg/kg	4.4	8.2	----	----	----	----
boron	7440-42-8	E475A	0.20	mg/kg wwt	----	----	2.31	----	----	----
boron	7440-42-8	E472A	0.20	mg/kg wwt	0.81	1.39	----	----	----	----
cadmium	7440-43-9	E475	0.010	mg/kg	----	----	0.012	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% ELS	PJ2021-006 56% ELS	PJ2021-006 100% ELS	----	----
Client sampling date / time						12-Oct-2021	12-Oct-2021	12-Oct-2021	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-006	VA22A7600-007	VA22A7600-008	-----	-----	
					Result	Result	Result	----	----	
<b>Metals</b>										
cadmium	7440-43-9	E472	0.010	mg/kg	0.018	0.017	----	----	----	----
cadmium	7440-43-9	E475A	0.0020	mg/kg wwt	----	----	0.0022	----	----	----
cadmium	7440-43-9	E472A	0.0020	mg/kg wwt	0.0034	0.0028	----	----	----	----
calcium	7440-70-2	E475	20	mg/kg	----	----	16100	----	----	----
calcium	7440-70-2	E472	20	mg/kg	20300	28200	----	----	----	----
calcium	7440-70-2	E475A	4.0	mg/kg wwt	----	----	2960	----	----	----
calcium	7440-70-2	E472A	4.0	mg/kg wwt	3750	4750	----	----	----	----
cesium	7440-46-2	E475	0.0050	mg/kg	----	----	0.118	----	----	----
cesium	7440-46-2	E472	0.0050	mg/kg	0.127	0.129	----	----	----	----
cesium	7440-46-2	E475A	0.0010	mg/kg wwt	----	----	0.0217	----	----	----
cesium	7440-46-2	E472A	0.0010	mg/kg wwt	0.0234	0.0218	----	----	----	----
chromium	7440-47-3	E475	0.20	mg/kg	----	----	<0.20	----	----	----
chromium	7440-47-3	E472	0.20	mg/kg	0.30	<0.20	----	----	----	----
chromium	7440-47-3	E475A	0.040	mg/kg wwt	----	----	<0.040	----	----	----
chromium	7440-47-3	E472A	0.040	mg/kg wwt	0.055	<0.040	----	----	----	----
cobalt	7440-48-4	E475	0.020	mg/kg	----	----	0.086	----	----	----
cobalt	7440-48-4	E472	0.020	mg/kg	0.161	0.097	----	----	----	----
cobalt	7440-48-4	E475A	0.0040	mg/kg wwt	----	----	0.0157	----	----	----
cobalt	7440-48-4	E472A	0.0040	mg/kg wwt	0.0297	0.0163	----	----	----	----
copper	7440-50-8	E475	0.20	mg/kg	----	----	2.54	----	----	----
copper	7440-50-8	E472	0.20	mg/kg	5.06	5.02	----	----	----	----
copper	7440-50-8	E475A	0.040	mg/kg wwt	----	----	0.466	----	----	----
copper	7440-50-8	E472A	0.040	mg/kg wwt	0.936	0.846	----	----	----	----
iron	7439-89-6	E475	5.0	mg/kg	----	----	54.5	----	----	----
iron	7439-89-6	E472	5.0	mg/kg	269	119	----	----	----	----
iron	7439-89-6	E475A	1.0	mg/kg wwt	----	----	10.0	----	----	----
iron	7439-89-6	E472A	1.0	mg/kg wwt	49.8	20.1	----	----	----	----
lead	7439-92-1	E475	0.050	mg/kg	----	----	<0.050	----	----	----
lead	7439-92-1	E472	0.050	mg/kg	0.115	<0.050	----	----	----	----
lead	7439-92-1	E475A	0.010	mg/kg wwt	----	----	<0.010	----	----	----
lead	7439-92-1	E472A	0.010	mg/kg wwt	0.021	<0.010	----	----	----	----
lithium	7439-93-2	E475	0.50	mg/kg	----	----	<0.50	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% ELS	PJ2021-006 56% ELS	PJ2021-006 100% ELS	----	----
Client sampling date / time						12-Oct-2021	12-Oct-2021	12-Oct-2021	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-006	VA22A7600-007	VA22A7600-008	-----	-----	
					Result	Result	Result	----	----	
<b>Metals</b>										
lithium	7439-93-2	E472	0.50	mg/kg	<0.50	<0.50	----	----	----	----
lithium	7439-93-2	E475A	0.10	mg/kg wwt	----	----	<0.10	----	----	----
lithium	7439-93-2	E472A	0.10	mg/kg wwt	<0.10	<0.10	----	----	----	----
magnesium	7439-95-4	E475	2.0	mg/kg	----	----	1440	----	----	----
magnesium	7439-95-4	E472	2.0	mg/kg	1340	1410	----	----	----	----
magnesium	7439-95-4	E475A	0.40	mg/kg wwt	----	----	264	----	----	----
magnesium	7439-95-4	E472A	0.40	mg/kg wwt	248	238	----	----	----	----
manganese	7439-96-5	E475	0.050	mg/kg	----	----	8.23	----	----	----
manganese	7439-96-5	E472	0.050	mg/kg	17.3	11.6	----	----	----	----
manganese	7439-96-5	E475A	0.010	mg/kg wwt	----	----	1.51	----	----	----
manganese	7439-96-5	E472A	0.010	mg/kg wwt	3.20	1.96	----	----	----	----
mercury	7439-97-6	E511	0.0050	mg/kg	0.292	0.310	----	----	----	----
mercury	7439-97-6	E512	0.010	mg/kg	----	----	0.328	----	----	----
mercury	7439-97-6	E511A	0.0010	mg/kg wwt	0.0539	0.0523	----	----	----	----
mercury	7439-97-6	E512A	0.0020	mg/kg wwt	----	----	0.0601	----	----	----
molybdenum	7439-98-7	E475	0.040	mg/kg	----	----	1.34	----	----	----
molybdenum	7439-98-7	E472	0.040	mg/kg	0.956	1.78	----	----	----	----
molybdenum	7439-98-7	E475A	0.0080	mg/kg wwt	----	----	0.246	----	----	----
molybdenum	7439-98-7	E472A	0.0080	mg/kg wwt	0.177	0.300	----	----	----	----
nickel	7440-02-0	E475	0.20	mg/kg	----	----	0.32	----	----	----
nickel	7440-02-0	E472	0.20	mg/kg	0.54	0.33	----	----	----	----
nickel	7440-02-0	E475A	0.040	mg/kg wwt	----	----	0.059	----	----	----
nickel	7440-02-0	E472A	0.040	mg/kg wwt	0.100	0.056	----	----	----	----
phosphorus	7723-14-0	E472	10	mg/kg	21100	25400	----	----	----	----
phosphorus	7723-14-0	E475	20	mg/kg	----	----	19700	----	----	----
phosphorus	7723-14-0	E472A	2.0	mg/kg wwt	3900	4280	----	----	----	----
phosphorus	7723-14-0	E475A	4.0	mg/kg wwt	----	----	3610	----	----	----
potassium	7440-09-7	E475	20	mg/kg	----	----	15400	----	----	----
potassium	7440-09-7	E472	20	mg/kg	13900	14500	----	----	----	----
potassium	7440-09-7	E475A	4.0	mg/kg wwt	----	----	2820	----	----	----
potassium	7440-09-7	E472A	4.0	mg/kg wwt	2570	2450	----	----	----	----
rubidium	7440-17-7	E475	0.050	mg/kg	----	----	40.3	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% ELS	PJ2021-006 56% ELS	PJ2021-006 100% ELS	----	----
Client sampling date / time						12-Oct-2021	12-Oct-2021	12-Oct-2021	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-006	VA22A7600-007	VA22A7600-008	-----	-----	
					Result	Result	Result	----	----	
<b>Metals</b>										
rubidium	7440-17-7	E472	0.050	mg/kg	33.4	36.2	----	----	----	----
rubidium	7440-17-7	E475A	0.010	mg/kg wwt	----	----	7.39	----	----	----
rubidium	7440-17-7	E472A	0.010	mg/kg wwt	6.17	6.10	----	----	----	----
selenium	7782-49-2	E475	0.10	mg/kg	----	----	2.53	----	----	----
selenium	7782-49-2	E472	0.10	mg/kg	2.46	2.70	----	----	----	----
selenium	7782-49-2	E475A	0.020	mg/kg wwt	----	----	0.464	----	----	----
selenium	7782-49-2	E472A	0.020	mg/kg wwt	0.455	0.455	----	----	----	----
sodium	7440-23-5	E475	20	mg/kg	----	----	5220	----	----	----
sodium	7440-23-5	E472	20	mg/kg	5310	6730	----	----	----	----
sodium	7440-23-5	E475A	4.0	mg/kg wwt	----	----	957	----	----	----
sodium	7440-23-5	E472A	4.0	mg/kg wwt	982	1130	----	----	----	----
strontium	7440-24-6	E475	0.10	mg/kg	----	----	191	----	----	----
strontium	7440-24-6	E472	0.10	mg/kg	88.2	175	----	----	----	----
strontium	7440-24-6	E475A	0.020	mg/kg wwt	----	----	35.1	----	----	----
strontium	7440-24-6	E472A	0.020	mg/kg wwt	16.3	29.5	----	----	----	----
tellurium	13494-80-9	E475	0.020	mg/kg	----	----	<0.020	----	----	----
tellurium	13494-80-9	E472	0.020	mg/kg	<0.020	<0.020	----	----	----	----
tellurium	13494-80-9	E475A	0.0040	mg/kg wwt	----	----	<0.0040	----	----	----
tellurium	13494-80-9	E472A	0.0040	mg/kg wwt	<0.0040	<0.0040	----	----	----	----
thallium	7440-28-0	E475	0.0020	mg/kg	----	----	0.0159	----	----	----
thallium	7440-28-0	E472	0.0020	mg/kg	0.0094	0.0092	----	----	----	----
thallium	7440-28-0	E475A	0.00040	mg/kg wwt	----	----	0.00291	----	----	----
thallium	7440-28-0	E472A	0.00040	mg/kg wwt	0.00173	0.00155	----	----	----	----
tin	7440-31-5	E475	0.10	mg/kg	----	----	<0.10	----	----	----
tin	7440-31-5	E472	0.10	mg/kg	<0.10	<0.10	----	----	----	----
tin	7440-31-5	E475A	0.020	mg/kg wwt	----	----	<0.020	----	----	----
tin	7440-31-5	E472A	0.020	mg/kg wwt	<0.020	<0.020	----	----	----	----
uranium	7440-61-1	E475	0.0020	mg/kg	----	----	0.0185	----	----	----
uranium	7440-61-1	E472	0.0020	mg/kg	0.0274	0.0188	----	----	----	----
uranium	7440-61-1	E475A	0.00040	mg/kg wwt	----	----	0.00340	----	----	----
uranium	7440-61-1	E472A	0.00040	mg/kg wwt	0.00507	0.00318	----	----	----	----
vanadium	7440-62-2	E475	0.10	mg/kg	----	----	31.5	----	----	----





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	PJ2021-006 32% ELS	PJ2021-006 56% ELS	PJ2021-006 100% ELS	----	----
Client sampling date / time					12-Oct-2021	12-Oct-2021	12-Oct-2021	----	----	
Analyte	CAS Number	Method	LOR	Unit	VA22A7600-006	VA22A7600-007	VA22A7600-008	-----	-----	
					Result	Result	Result	----	----	
Metals										
vanadium	7440-62-2	E472	0.10	mg/kg	45.6	58.6	----	----	----	
vanadium	7440-62-2	E475A	0.020	mg/kg wwt	----	----	5.78	----	----	
vanadium	7440-62-2	E472A	0.020	mg/kg wwt	8.43	9.87	----	----	----	
zinc	7440-66-6	E475	1.0	mg/kg	----	----	133	----	----	
zinc	7440-66-6	E472	1.0	mg/kg	196	213	----	----	----	
zinc	7440-66-6	E475A	0.20	mg/kg wwt	----	----	24.4	----	----	
zinc	7440-66-6	E472A	0.20	mg/kg wwt	36.2	35.9	----	----	----	
zirconium	7440-67-7	E475	0.20	mg/kg	----	----	0.21	----	----	
zirconium	7440-67-7	E472	0.20	mg/kg	0.43	<0.20	----	----	----	
zirconium	7440-67-7	E475A	0.040	mg/kg wwt	----	----	<0.040	----	----	
zirconium	7440-67-7	E472A	0.040	mg/kg wwt	0.079	<0.040	----	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: <b>VA22A7600</b>	Page	: 1 of 10
Client	: <b>Hatfield Consultants LLP</b>	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 08-Apr-2022 08:10
PO	: ----	Issue Date	: 02-May-2022 14:45
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

### **Workorder Comments**

Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

### **Summary of Outliers**

#### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

#### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

#### **Outliers : Analysis Holding Time Compliance (Breaches)**

- No Analysis Holding Time Outliers exist.



### ***Outliers : Frequency of Quality Control Samples***

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Biopsy)										
LDPE bag PJ2021-006 100% ELS	E512	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 0.32% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 1.0% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 10% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 3.2% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 32% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 56% ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Mercury in Biota by CVAAS (DRY units, Micro)										
LDPE bag PJ2021-006 Site Control ELS	E511	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Biopsy)										
LDPE bag PJ2021-006 100% ELS	E512A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 0.32% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 1.0% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 10% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 3.2% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 32% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 56% ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Micro)										
LDPE bag PJ2021-006 Site Control ELS	E511A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	365 days	198 days	✓





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals by CRC ICPMS (DRY units, Biopsy)										
LDPE bag PJ2021-006 100% ELS	E475	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 0.32% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 1.0% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 10% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 3.2% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 32% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 56% ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (DRY units, Micro)										
LDPE bag PJ2021-006 Site Control ELS	E472	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔
Metals : Metals in Biota by CRC ICPMS (WET units, Biopsy)										
LDPE bag PJ2021-006 100% ELS	E475A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✔





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 0.32% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 1.0% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 10% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 3.2% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 32% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 56% ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Micro)										
LDPE bag PJ2021-006 Site Control ELS	E472A	12-Oct-2021	28-Apr-2022	----	----		28-Apr-2022	730 days	198 days	✓
Physical Tests : Moisture Content by Gravimetry (Biopsy)										
LDPE bag PJ2021-006 100% ELS	E144A	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 0.32% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 1.0% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 10% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 3.2% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 32% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 56% ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	
Physical Tests : Moisture Content by Gravimetry (Micro)										
LDPE bag PJ2021-006 Site Control ELS	E144-H	12-Oct-2021	----	----	----		27-Apr-2022	----	----	

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Micro)	E511	469869	0	7	0.0	5.0	✖
Mercury in Biota by CVAAS (WET units, Micro)	E511A	469870	0	7	0.0	5.0	✖
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	469871	0	7	0.0	5.0	✖
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	469868	0	7	0.0	5.0	✖
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	469876	2	1	200.0	10.0	✔
Mercury in Biota by CVAAS (DRY units, Micro)	E511	469869	2	7	28.5	10.0	✔
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	469877	2	1	200.0	10.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	469870	2	7	28.5	10.0	✔
Metals by CRC ICPMS (DRY units, Biopsy)	E475	469879	2	1	200.0	10.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	469871	2	7	28.5	10.0	✔
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A	469878	2	1	200.0	10.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	469868	2	7	28.5	10.0	✔
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512	469876	1	1	100.0	5.0	✔
Mercury in Biota by CVAAS (DRY units, Micro)	E511	469869	1	7	14.2	5.0	✔
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	469877	1	1	100.0	5.0	✔
Mercury in Biota by CVAAS (WET units, Micro)	E511A	469870	1	7	14.2	5.0	✔
Metals by CRC ICPMS (DRY units, Biopsy)	E475	469879	1	1	100.0	5.0	✔
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472	469871	1	7	14.2	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A	469878	1	1	100.0	5.0	✔
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A	469868	1	7	14.2	5.0	✔





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry (Biopsy)	E144A  Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	This analysis is carried out gravimetrically by drying the sample at <60 deg. C for a minimum of three days.
Moisture Content by Gravimetry (Micro)	E144-H  Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/BC MOE Lab Manual	Moisture is measured gravimetrically by drying the sample at <60°C for a minimum of 3 days to constant weight. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of soil, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Micro)	E472  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> . Analysis is by Collision/Reaction Cell ICPMS.  Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (WET units, Micro)	E472A  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> . Analysis is by Collision/Reaction Cell ICPMS.  Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals by CRC ICPMS (DRY units, Biopsy)	E475  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A  Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Micro)	E511  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.





<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Mercury in Biota by CVAAS (WET units, Micro)	E511A  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (DRY units, Biopsy)	E512  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A  Vancouver - Environmental	Biota	EPA 200.3/1631E (mod)	Samples are homogenized digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Analysis is by CVAAS.
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Metals and Mercury Biota Digestion (Micro)	EP472  Vancouver - Environmental	Biota	EPA 200.3	This method, designed for small sample amounts, uses a heated strong acid digestion with HNO <sub>3</sub> , HCl, and H <sub>2</sub> O <sub>2</sub> and is intended to provide a conservative estimate of bio-available metals.
Metals and Mercury Biota Digestion (Biopsy)	EP475  Vancouver - Environmental	Biota	EPA 200.3/200.8 (mod)	Samples are digested with nitric acid, hydrochloric acid, and hydrogen peroxide. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.



## QUALITY CONTROL REPORT

**Work Order** : **VA22A7600**

**Page** : 1 of 15

**Client** : Hatfield Consultants LLP  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
 North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 8  
**No. of samples analysed** : 8

**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
 Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 08-Apr-2022 08:10  
**Date Analysis Commenced** : 27-Apr-2022  
**Issue Date** : 02-May-2022 14:45

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia



Page : 2 of 15  
Work Order : VA22A7600  
Client : Hatfield Consultants LLP  
Project : ----



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## General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percentage Difference

# = Indicates a QC result that did not meet the ALS DQO.

## Workorder Comments

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Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

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## Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 469868)</b>						
aluminum	7429-90-5	E472A	1	mg/kg ww	<4.0	----
antimony	7440-36-0	E472A	0.002	mg/kg ww	<0.0080	----
arsenic	7440-38-2	E472A	0.006	mg/kg ww	<0.0240	----
barium	7440-39-3	E472A	0.01	mg/kg ww	<0.040	----
beryllium	7440-41-7	E472A	0.002	mg/kg ww	<0.0080	----
bismuth	7440-69-9	E472A	0.002	mg/kg ww	<0.0080	----
boron	7440-42-8	E472A	0.2	mg/kg ww	<0.80	----
cadmium	7440-43-9	E472A	0.002	mg/kg ww	<0.0080	----
calcium	7440-70-2	E472A	4	mg/kg ww	<16.0	----
cesium	7440-46-2	E472A	0.001	mg/kg ww	<0.0040	----
chromium	7440-47-3	E472A	0.04	mg/kg ww	<0.160	----
cobalt	7440-48-4	E472A	0.004	mg/kg ww	<0.0160	----
copper	7440-50-8	E472A	0.04	mg/kg ww	<0.160	----
iron	7439-89-6	E472A	1	mg/kg ww	<4.0	----
lead	7439-92-1	E472A	0.01	mg/kg ww	<0.040	----
lithium	7439-93-2	E472A	0.1	mg/kg ww	<0.40	----
magnesium	7439-95-4	E472A	0.4	mg/kg ww	<1.60	----
manganese	7439-96-5	E472A	0.01	mg/kg ww	<0.040	----
molybdenum	7439-98-7	E472A	0.008	mg/kg ww	<0.0320	----
nickel	7440-02-0	E472A	0.04	mg/kg ww	<0.160	----
phosphorus	7723-14-0	E472A	2	mg/kg ww	<8.0	----
potassium	7440-09-7	E472A	4	mg/kg ww	<16.0	----
rubidium	7440-17-7	E472A	0.01	mg/kg ww	<0.040	----
selenium	7782-49-2	E472A	0.02	mg/kg ww	<0.080	----
sodium	7440-23-5	E472A	4	mg/kg ww	<16.0	----
strontium	7440-24-6	E472A	0.02	mg/kg ww	<0.080	----
tellurium	13494-80-9	E472A	0.004	mg/kg ww	<0.0160	----
thallium	7440-28-0	E472A	0.0004	mg/kg ww	<0.00160	----
tin	7440-31-5	E472A	0.02	mg/kg ww	<0.080	----
uranium	7440-61-1	E472A	0.0004	mg/kg ww	<0.00160	----
vanadium	7440-62-2	E472A	0.02	mg/kg ww	<0.080	----
zinc	7440-66-6	E472A	0.2	mg/kg ww	<0.80	----
zirconium	7440-67-7	E472A	0.04	mg/kg ww	<0.160	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 469869)</b>						
mercury	7439-97-6	E511	0.005	mg/kg	<0.0050	----
<b>Metals (QCLot: 469870)</b>						
mercury	7439-97-6	E511A	0.001	mg/kg wwt	<0.0010	----
<b>Metals (QCLot: 469871)</b>						
aluminum	7429-90-5	E472	5	mg/kg	<5.0	----
antimony	7440-36-0	E472	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E472	0.03	mg/kg	<0.030	----
barium	7440-39-3	E472	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E472	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E472	0.01	mg/kg	<0.010	----
boron	7440-42-8	E472	1	mg/kg	<1.0	----
cadmium	7440-43-9	E472	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E472	20	mg/kg	<20	----
cesium	7440-46-2	E472	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E472	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E472	0.02	mg/kg	<0.020	----
copper	7440-50-8	E472	0.2	mg/kg	<0.20	----
iron	7439-89-6	E472	5	mg/kg	<5.0	----
lead	7439-92-1	E472	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E472	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E472	2	mg/kg	<2.0	----
manganese	7439-96-5	E472	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E472	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E472	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E472	10	mg/kg	<10	----
potassium	7440-09-7	E472	20	mg/kg	<20	----
rubidium	7440-17-7	E472	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E472	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E472	20	mg/kg	<20	----
strontium	7440-24-6	E472	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E472	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E472	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E472	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E472	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E472	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E472	1	mg/kg	<1.0	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 469871) - continued</b>						
zirconium	7440-67-7	E472	0.2	mg/kg	<0.20	----
<b>Metals (QCLot: 469876)</b>						
mercury	7439-97-6	E512	0.01	mg/kg	<0.010	----
<b>Metals (QCLot: 469877)</b>						
mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----
<b>Metals (QCLot: 469878)</b>						
aluminum	7429-90-5	E475A	1	mg/kg wwt	<4.0	----
antimony	7440-36-0	E475A	0.004	mg/kg wwt	<0.0160	----
arsenic	7440-38-2	E475A	0.01	mg/kg wwt	<0.040	----
barium	7440-39-3	E475A	0.01	mg/kg wwt	<0.040	----
beryllium	7440-41-7	E475A	0.002	mg/kg wwt	<0.0080	----
bismuth	7440-69-9	E475A	0.002	mg/kg wwt	<0.0080	----
boron	7440-42-8	E475A	0.2	mg/kg wwt	<0.80	----
cadmium	7440-43-9	E475A	0.002	mg/kg wwt	<0.0080	----
calcium	7440-70-2	E475A	4	mg/kg wwt	<16.0	----
cesium	7440-46-2	E475A	0.001	mg/kg wwt	<0.0040	----
chromium	7440-47-3	E475A	0.04	mg/kg wwt	<0.160	----
cobalt	7440-48-4	E475A	0.004	mg/kg wwt	<0.0160	----
copper	7440-50-8	E475A	0.04	mg/kg wwt	<0.160	----
iron	7439-89-6	E475A	1	mg/kg wwt	<4.0	----
lead	7439-92-1	E475A	0.01	mg/kg wwt	<0.040	----
lithium	7439-93-2	E475A	0.1	mg/kg wwt	<0.40	----
magnesium	7439-95-4	E475A	0.4	mg/kg wwt	<1.60	----
manganese	7439-96-5	E475A	0.01	mg/kg wwt	<0.040	----
molybdenum	7439-98-7	E475A	0.008	mg/kg wwt	<0.0320	----
nickel	7440-02-0	E475A	0.04	mg/kg wwt	<0.160	----
phosphorus	7723-14-0	E475A	4	mg/kg wwt	<16.0	----
potassium	7440-09-7	E475A	4	mg/kg wwt	<16.0	----
rubidium	7440-17-7	E475A	0.01	mg/kg wwt	<0.040	----
selenium	7782-49-2	E475A	0.02	mg/kg wwt	<0.080	----
sodium	7440-23-5	E475A	4	mg/kg wwt	<16.0	----
strontium	7440-24-6	E475A	0.02	mg/kg wwt	<0.080	----
tellurium	13494-80-9	E475A	0.004	mg/kg wwt	<0.0160	----
thallium	7440-28-0	E475A	0.0004	mg/kg wwt	<0.00160	----
tin	7440-31-5	E475A	0.02	mg/kg wwt	<0.080	----
uranium	7440-61-1	E475A	0.0004	mg/kg wwt	<0.00160	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
<b>Metals (QCLot: 469878) - continued</b>						
vanadium	7440-62-2	E475A	0.02	mg/kg wwt	<0.080	----
zinc	7440-66-6	E475A	0.2	mg/kg wwt	<0.80	----
zirconium	7440-67-7	E475A	0.04	mg/kg wwt	<0.160	----
<b>Metals (QCLot: 469879)</b>						
aluminum	7429-90-5	E475	5	mg/kg	<5.0	----
antimony	7440-36-0	E475	0.02	mg/kg	<0.020	----
arsenic	7440-38-2	E475	0.05	mg/kg	<0.050	----
barium	7440-39-3	E475	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E475	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E475	0.01	mg/kg	<0.010	----
boron	7440-42-8	E475	1	mg/kg	<1.0	----
cadmium	7440-43-9	E475	0.01	mg/kg	<0.010	----
calcium	7440-70-2	E475	20	mg/kg	<20	----
cesium	7440-46-2	E475	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E475	0.2	mg/kg	<0.20	----
cobalt	7440-48-4	E475	0.02	mg/kg	<0.020	----
copper	7440-50-8	E475	0.2	mg/kg	<0.20	----
iron	7439-89-6	E475	5	mg/kg	<5.0	----
lead	7439-92-1	E475	0.05	mg/kg	<0.050	----
lithium	7439-93-2	E475	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E475	2	mg/kg	<2.0	----
manganese	7439-96-5	E475	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E475	0.04	mg/kg	<0.040	----
nickel	7440-02-0	E475	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E475	20	mg/kg	<20	----
potassium	7440-09-7	E475	20	mg/kg	<20	----
rubidium	7440-17-7	E475	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E475	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E475	20	mg/kg	<20	----
strontium	7440-24-6	E475	0.1	mg/kg	<0.10	----
tellurium	13494-80-9	E475	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E475	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E475	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E475	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E475	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E475	1	mg/kg	<1.0	----





Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 469879) - continued						
Zirconium	7440-67-7	E475	0.2	mg/kg	<0.20	----



A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

Sub-Matrix: Biota					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 469868)									
aluminum	7429-90-5	E472A	1	mg/kg ww	20 mg/kg ww	98.9	80.0	120	---
antimony	7440-36-0	E472A	0.002	mg/kg ww	10 mg/kg ww	96.4	80.0	120	---
arsenic	7440-38-2	E472A	0.006	mg/kg ww	10 mg/kg ww	101	80.0	120	---
barium	7440-39-3	E472A	0.01	mg/kg ww	2.5 mg/kg ww	103	80.0	120	---
beryllium	7440-41-7	E472A	0.002	mg/kg ww	1 mg/kg ww	94.6	80.0	120	---
bismuth	7440-69-9	E472A	0.002	mg/kg ww	10 mg/kg ww	92.4	80.0	120	---
boron	7440-42-8	E472A	0.2	mg/kg ww	10 mg/kg ww	90.7	80.0	120	---
cadmium	7440-43-9	E472A	0.002	mg/kg ww	1 mg/kg ww	94.7	80.0	120	---
calcium	7440-70-2	E472A	4	mg/kg ww	500 mg/kg ww	98.4	80.0	120	---
cesium	7440-46-2	E472A	0.001	mg/kg ww	0.5 mg/kg ww	98.3	80.0	120	---
chromium	7440-47-3	E472A	0.04	mg/kg ww	2.5 mg/kg ww	97.7	80.0	120	---
cobalt	7440-48-4	E472A	0.004	mg/kg ww	2.5 mg/kg ww	95.4	80.0	120	---
copper	7440-50-8	E472A	0.04	mg/kg ww	2.5 mg/kg ww	93.8	80.0	120	---
iron	7439-89-6	E472A	1	mg/kg ww	10 mg/kg ww	101	80.0	120	---
lead	7439-92-1	E472A	0.01	mg/kg ww	5 mg/kg ww	94.2	80.0	120	---
lithium	7439-93-2	E472A	0.1	mg/kg ww	2.5 mg/kg ww	94.5	80.0	120	---
magnesium	7439-95-4	E472A	0.4	mg/kg ww	500 mg/kg ww	94.7	80.0	120	---
manganese	7439-96-5	E472A	0.01	mg/kg ww	2.5 mg/kg ww	97.8	80.0	120	---
molybdenum	7439-98-7	E472A	0.008	mg/kg ww	2.5 mg/kg ww	103	80.0	120	---
nickel	7440-02-0	E472A	0.04	mg/kg ww	5 mg/kg ww	95.1	80.0	120	---
phosphorus	7723-14-0	E472A	2	mg/kg ww	100 mg/kg ww	106	80.0	120	---
potassium	7440-09-7	E472A	4	mg/kg ww	500 mg/kg ww	92.2	80.0	120	---
rubidium	7440-17-7	E472A	0.01	mg/kg ww	1 mg/kg ww	100	80.0	120	---
selenium	7782-49-2	E472A	0.02	mg/kg ww	10 mg/kg ww	93.2	80.0	120	---
sodium	7440-23-5	E472A	4	mg/kg ww	500 mg/kg ww	96.1	80.0	120	---
strontium	7440-24-6	E472A	0.02	mg/kg ww	2.5 mg/kg ww	105	80.0	120	---
tellurium	13494-80-9	E472A	0.004	mg/kg ww	1 mg/kg ww	96.2	80.0	120	---
thallium	7440-28-0	E472A	0.0004	mg/kg ww	10 mg/kg ww	92.0	80.0	120	---
tin	7440-31-5	E472A	0.02	mg/kg ww	5 mg/kg ww	96.5	80.0	120	---
uranium	7440-61-1	E472A	0.0004	mg/kg ww	0.05 mg/kg ww	94.3	80.0	120	---
vanadium	7440-62-2	E472A	0.02	mg/kg ww	5 mg/kg ww	101	80.0	120	---
zinc	7440-66-6	E472A	0.2	mg/kg ww	5 mg/kg ww	89.8	80.0	120	---
zirconium	7440-67-7	E472A	0.04	mg/kg ww	1 mg/kg ww	100	80.0	120	---
Metals (QCLot: 469869)									





Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 469869) - continued									
mercury	7439-97-6	E511	0.005	mg/kg	0.02 mg/kg	97.8	80.0	120	----
Metals (QCLot: 469870)									
mercury	7439-97-6	E511A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.8	80.0	120	----
Metals (QCLot: 469871)									
aluminum	7429-90-5	E472	5	mg/kg	20 mg/kg	98.9	80.0	120	----
antimony	7440-36-0	E472	0.01	mg/kg	10 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E472	0.03	mg/kg	10 mg/kg	101	80.0	120	----
barium	7440-39-3	E472	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E472	0.01	mg/kg	1 mg/kg	94.6	80.0	120	----
bismuth	7440-69-9	E472	0.01	mg/kg	10 mg/kg	92.4	80.0	120	----
boron	7440-42-8	E472	1	mg/kg	10 mg/kg	90.7	80.0	120	----
cadmium	7440-43-9	E472	0.01	mg/kg	1 mg/kg	94.7	80.0	120	----
calcium	7440-70-2	E472	20	mg/kg	500 mg/kg	98.4	80.0	120	----
cesium	7440-46-2	E472	0.005	mg/kg	0.5 mg/kg	98.3	80.0	120	----
chromium	7440-47-3	E472	0.2	mg/kg	2.5 mg/kg	97.7	80.0	120	----
cobalt	7440-48-4	E472	0.02	mg/kg	2.5 mg/kg	95.4	80.0	120	----
copper	7440-50-8	E472	0.2	mg/kg	2.5 mg/kg	93.8	80.0	120	----
iron	7439-89-6	E472	5	mg/kg	10 mg/kg	101	80.0	120	----
lead	7439-92-1	E472	0.05	mg/kg	5 mg/kg	94.2	80.0	120	----
lithium	7439-93-2	E472	0.5	mg/kg	2.5 mg/kg	94.5	80.0	120	----
magnesium	7439-95-4	E472	2	mg/kg	500 mg/kg	94.7	80.0	120	----
manganese	7439-96-5	E472	0.05	mg/kg	2.5 mg/kg	97.8	80.0	120	----
molybdenum	7439-98-7	E472	0.04	mg/kg	2.5 mg/kg	103	80.0	120	----
nickel	7440-02-0	E472	0.2	mg/kg	5 mg/kg	95.1	80.0	120	----
phosphorus	7723-14-0	E472	10	mg/kg	100 mg/kg	106	80.0	120	----
potassium	7440-09-7	E472	20	mg/kg	500 mg/kg	92.2	80.0	120	----
rubidium	7440-17-7	E472	0.05	mg/kg	1 mg/kg	100	80.0	120	----
selenium	7782-49-2	E472	0.1	mg/kg	10 mg/kg	93.2	80.0	120	----
sodium	7440-23-5	E472	20	mg/kg	500 mg/kg	96.1	80.0	120	----
strontium	7440-24-6	E472	0.1	mg/kg	2.5 mg/kg	105	80.0	120	----
tellurium	13494-80-9	E472	0.02	mg/kg	1 mg/kg	96.2	80.0	120	----
thallium	7440-28-0	E472	0.002	mg/kg	10 mg/kg	92.0	80.0	120	----
tin	7440-31-5	E472	0.1	mg/kg	5 mg/kg	96.5	80.0	120	----
uranium	7440-61-1	E472	0.002	mg/kg	0.05 mg/kg	94.3	80.0	120	----
vanadium	7440-62-2	E472	0.1	mg/kg	5 mg/kg	101	80.0	120	----
zinc	7440-66-6	E472	1	mg/kg	5 mg/kg	89.8	80.0	120	----
zirconium	7440-67-7	E472	0.2	mg/kg	1 mg/kg	100	80.0	120	----





Sub-Matrix: Biota

Sub-Matrix: Biota					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 469876)									
mercury	7439-97-6	E512	0.01	mg/kg	0.05 mg/kg	98.8	80.0	120	----
Metals (QCLot: 469877)									
mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	98.8	80.0	120	----
Metals (QCLot: 469878)									
aluminum	7429-90-5	E475A	1	mg/kg wwt	50 mg/kg wwt	98.9	80.0	120	----
antimony	7440-36-0	E475A	0.004	mg/kg wwt	25 mg/kg wwt	96.4	80.0	120	----
arsenic	7440-38-2	E475A	0.01	mg/kg wwt	25 mg/kg wwt	101	80.0	120	----
barium	7440-39-3	E475A	0.01	mg/kg wwt	6.25 mg/kg wwt	103	80.0	120	----
beryllium	7440-41-7	E475A	0.002	mg/kg wwt	2.5 mg/kg wwt	94.6	80.0	120	----
bismuth	7440-69-9	E475A	0.002	mg/kg wwt	25 mg/kg wwt	92.4	80.0	120	----
boron	7440-42-8	E475A	0.2	mg/kg wwt	25 mg/kg wwt	90.7	80.0	120	----
cadmium	7440-43-9	E475A	0.002	mg/kg wwt	2.5 mg/kg wwt	94.7	80.0	120	----
calcium	7440-70-2	E475A	4	mg/kg wwt	1250 mg/kg wwt	98.4	80.0	120	----
cesium	7440-46-2	E475A	0.001	mg/kg wwt	1.25 mg/kg wwt	98.3	80.0	120	----
chromium	7440-47-3	E475A	0.04	mg/kg wwt	6.25 mg/kg wwt	97.7	80.0	120	----
cobalt	7440-48-4	E475A	0.004	mg/kg wwt	6.25 mg/kg wwt	95.4	80.0	120	----
copper	7440-50-8	E475A	0.04	mg/kg wwt	6.25 mg/kg wwt	93.8	80.0	120	----
iron	7439-89-6	E475A	1	mg/kg wwt	25 mg/kg wwt	101	80.0	120	----
lead	7439-92-1	E475A	0.01	mg/kg wwt	12.5 mg/kg wwt	94.2	80.0	120	----
lithium	7439-93-2	E475A	0.1	mg/kg wwt	6.25 mg/kg wwt	94.5	80.0	120	----
magnesium	7439-95-4	E475A	0.4	mg/kg wwt	1250 mg/kg wwt	94.7	80.0	120	----
manganese	7439-96-5	E475A	0.01	mg/kg wwt	6.25 mg/kg wwt	97.8	80.0	120	----
molybdenum	7439-98-7	E475A	0.008	mg/kg wwt	6.25 mg/kg wwt	103	80.0	120	----
nickel	7440-02-0	E475A	0.04	mg/kg wwt	12.5 mg/kg wwt	95.1	80.0	120	----
phosphorus	7723-14-0	E475A	4	mg/kg wwt	250 mg/kg wwt	106	80.0	120	----
potassium	7440-09-7	E475A	4	mg/kg wwt	1250 mg/kg wwt	92.2	80.0	120	----
rubidium	7440-17-7	E475A	0.01	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
selenium	7782-49-2	E475A	0.02	mg/kg wwt	25 mg/kg wwt	93.2	80.0	120	----
sodium	7440-23-5	E475A	4	mg/kg wwt	1250 mg/kg wwt	96.1	80.0	120	----
strontium	7440-24-6	E475A	0.02	mg/kg wwt	6.25 mg/kg wwt	105	80.0	120	----
tellurium	13494-80-9	E475A	0.004	mg/kg wwt	2.5 mg/kg wwt	96.2	80.0	120	----
thallium	7440-28-0	E475A	0.0004	mg/kg wwt	25 mg/kg wwt	92.0	80.0	120	----
tin	7440-31-5	E475A	0.02	mg/kg wwt	12.5 mg/kg wwt	96.5	80.0	120	----
uranium	7440-61-1	E475A	0.0004	mg/kg wwt	0.125 mg/kg wwt	94.3	80.0	120	----
vanadium	7440-62-2	E475A	0.02	mg/kg wwt	12.5 mg/kg wwt	101	80.0	120	----
zinc	7440-66-6	E475A	0.2	mg/kg wwt	12.5 mg/kg wwt	89.8	80.0	120	----
zirconium	7440-67-7	E475A	0.04	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----





Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 469879)									
aluminum	7429-90-5	E475	5	mg/kg	50 mg/kg	98.9	80.0	120	----
antimony	7440-36-0	E475	0.02	mg/kg	25 mg/kg	96.4	80.0	120	----
arsenic	7440-38-2	E475	0.05	mg/kg	25 mg/kg	101	80.0	120	----
barium	7440-39-3	E475	0.05	mg/kg	6.25 mg/kg	103	80.0	120	----
beryllium	7440-41-7	E475	0.01	mg/kg	2.5 mg/kg	94.6	80.0	120	----
bismuth	7440-69-9	E475	0.01	mg/kg	25 mg/kg	92.4	80.0	120	----
boron	7440-42-8	E475	1	mg/kg	25 mg/kg	90.7	80.0	120	----
cadmium	7440-43-9	E475	0.01	mg/kg	2.5 mg/kg	94.7	80.0	120	----
calcium	7440-70-2	E475	20	mg/kg	1250 mg/kg	98.4	80.0	120	----
cesium	7440-46-2	E475	0.005	mg/kg	1.25 mg/kg	98.3	80.0	120	----
chromium	7440-47-3	E475	0.2	mg/kg	6.25 mg/kg	97.7	80.0	120	----
cobalt	7440-48-4	E475	0.02	mg/kg	6.25 mg/kg	95.4	80.0	120	----
copper	7440-50-8	E475	0.2	mg/kg	6.25 mg/kg	93.8	80.0	120	----
iron	7439-89-6	E475	5	mg/kg	25 mg/kg	101	80.0	120	----
lead	7439-92-1	E475	0.05	mg/kg	12.5 mg/kg	94.2	80.0	120	----
lithium	7439-93-2	E475	0.5	mg/kg	6.25 mg/kg	94.5	80.0	120	----
magnesium	7439-95-4	E475	2	mg/kg	1250 mg/kg	94.7	80.0	120	----
manganese	7439-96-5	E475	0.05	mg/kg	6.25 mg/kg	97.8	80.0	120	----
molybdenum	7439-98-7	E475	0.04	mg/kg	6.25 mg/kg	103	80.0	120	----
nickel	7440-02-0	E475	0.2	mg/kg	12.5 mg/kg	95.1	80.0	120	----
phosphorus	7723-14-0	E475	20	mg/kg	250 mg/kg	106	80.0	120	----
potassium	7440-09-7	E475	20	mg/kg	1250 mg/kg	92.2	80.0	120	----
rubidium	7440-17-7	E475	0.05	mg/kg	2.5 mg/kg	100	80.0	120	----
selenium	7782-49-2	E475	0.1	mg/kg	25 mg/kg	93.2	80.0	120	----
sodium	7440-23-5	E475	20	mg/kg	1250 mg/kg	96.1	80.0	120	----
strontium	7440-24-6	E475	0.1	mg/kg	6.25 mg/kg	105	80.0	120	----
tellurium	13494-80-9	E475	0.02	mg/kg	2.5 mg/kg	96.2	80.0	120	----
thallium	7440-28-0	E475	0.002	mg/kg	25 mg/kg	92.0	80.0	120	----
tin	7440-31-5	E475	0.1	mg/kg	12.5 mg/kg	96.5	80.0	120	----
uranium	7440-61-1	E475	0.002	mg/kg	0.125 mg/kg	94.3	80.0	120	----
vanadium	7440-62-2	E475	0.1	mg/kg	12.5 mg/kg	101	80.0	120	----
zinc	7440-66-6	E475	1	mg/kg	12.5 mg/kg	89.8	80.0	120	----
zirconium	7440-67-7	E475	0.2	mg/kg	2.5 mg/kg	100	80.0	120	----





## Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: Biota

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	Qualifier
Metals (QCLot: 469868)									
QC-469868-003	RM	aluminum	7429-90-5	E472A	11.2 mg/kg wwt	97.8	70.0	130	----
QC-469868-003	RM	arsenic	7440-38-2	E472A	34.6 mg/kg wwt	98.4	70.0	130	----
QC-469868-003	RM	bismuth	7440-69-9	E472A	0.0247 mg/kg wwt	66.0	60.0	140	----
QC-469868-003	RM	cadmium	7440-43-9	E472A	14.5 mg/kg wwt	90.9	70.0	130	----
QC-469868-003	RM	calcium	7440-70-2	E472A	550 mg/kg wwt	94.4	70.0	130	----
QC-469868-003	RM	cesium	7440-46-2	E472A	0.0712 mg/kg wwt	94.7	70.0	130	----
QC-469868-003	RM	chromium	7440-47-3	E472A	1.96 mg/kg wwt	94.4	70.0	130	----
QC-469868-003	RM	cobalt	7440-48-4	E472A	0.267 mg/kg wwt	91.1	70.0	130	----
QC-469868-003	RM	copper	7440-50-8	E472A	35 mg/kg wwt	94.4	70.0	130	----
QC-469868-003	RM	iron	7439-89-6	E472A	1070 mg/kg wwt	96.8	70.0	130	----
QC-469868-003	RM	lead	7439-92-1	E472A	0.162 mg/kg wwt	82.1	70.0	130	----
QC-469868-003	RM	magnesium	7439-95-4	E472A	940 mg/kg wwt	93.6	70.0	130	----
QC-469868-003	RM	manganese	7439-96-5	E472A	8.91 mg/kg wwt	96.1	70.0	130	----
QC-469868-003	RM	molybdenum	7439-98-7	E472A	1.41 mg/kg wwt	96.6	70.0	130	----
QC-469868-003	RM	nickel	7440-02-0	E472A	1.57 mg/kg wwt	80.5	70.0	130	----
QC-469868-003	RM	phosphorus	7723-14-0	E472A	11500 mg/kg wwt	99.3	70.0	130	----
QC-469868-003	RM	potassium	7440-09-7	E472A	14400 mg/kg wwt	93.7	70.0	130	----
QC-469868-003	RM	rubidium	7440-17-7	E472A	5.11 mg/kg wwt	95.9	70.0	130	----
QC-469868-003	RM	selenium	7782-49-2	E472A	8 mg/kg wwt	95.2	70.0	130	----
QC-469868-003	RM	sodium	7440-23-5	E472A	10673 mg/kg wwt	94.4	70.0	130	----
QC-469868-003	RM	strontium	7440-24-6	E472A	3.92 mg/kg wwt	92.6	70.0	130	----
QC-469868-003	RM	thallium	7440-28-0	E472A	0.013 mg/kg wwt	86.2	70.0	130	----
QC-469868-003	RM	uranium	7440-61-1	E472A	0.0786 mg/kg wwt	94.4	70.0	130	----
QC-469868-003	RM	vanadium	7440-62-2	E472A	0.51 mg/kg wwt	94.8	70.0	130	----
QC-469868-003	RM	zinc	7440-66-6	E472A	105.3 mg/kg wwt	92.6	70.0	130	----
Metals (QCLot: 469869)									
QC-469869-003	RM	mercury	7439-97-6	E511	0.331 mg/kg	106	70.0	130	----





Sub-Matrix: Biota

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	Qualifier
Metals (QCLot: 469870)									
QC-469870-003	RM	mercury	7439-97-6	E511A	0.331 mg/kg wwt	106	70.0	130	----
Metals (QCLot: 469871)									
QC-469871-003	RM	aluminum	7429-90-5	E472	11.2 mg/kg	97.8	70.0	130	----
QC-469871-003	RM	arsenic	7440-38-2	E472	34.6 mg/kg	98.4	70.0	130	----
QC-469871-003	RM	bismuth	7440-69-9	E472	0.0247 mg/kg	66.0	60.0	140	----
QC-469871-003	RM	cadmium	7440-43-9	E472	14.5 mg/kg	90.9	70.0	130	----
QC-469871-003	RM	calcium	7440-70-2	E472	550 mg/kg	94.4	70.0	130	----
QC-469871-003	RM	cesium	7440-46-2	E472	0.0712 mg/kg	94.7	70.0	130	----
QC-469871-003	RM	chromium	7440-47-3	E472	1.96 mg/kg	94.4	70.0	130	----
QC-469871-003	RM	cobalt	7440-48-4	E472	0.267 mg/kg	91.1	70.0	130	----
QC-469871-003	RM	copper	7440-50-8	E472	35 mg/kg	94.4	70.0	130	----
QC-469871-003	RM	iron	7439-89-6	E472	1070 mg/kg	96.8	70.0	130	----
QC-469871-003	RM	lead	7439-92-1	E472	0.162 mg/kg	82.1	70.0	130	----
QC-469871-003	RM	magnesium	7439-95-4	E472	940 mg/kg	93.6	70.0	130	----
QC-469871-003	RM	manganese	7439-96-5	E472	8.91 mg/kg	96.1	70.0	130	----
QC-469871-003	RM	molybdenum	7439-98-7	E472	1.41 mg/kg	96.6	70.0	130	----
QC-469871-003	RM	nickel	7440-02-0	E472	1.57 mg/kg	80.5	70.0	130	----
QC-469871-003	RM	phosphorus	7723-14-0	E472	11500 mg/kg	99.3	70.0	130	----
QC-469871-003	RM	potassium	7440-09-7	E472	14400 mg/kg	93.7	70.0	130	----
QC-469871-003	RM	rubidium	7440-17-7	E472	5.11 mg/kg	95.9	70.0	130	----
QC-469871-003	RM	selenium	7782-49-2	E472	8 mg/kg	95.2	70.0	130	----
QC-469871-003	RM	sodium	7440-23-5	E472	10673 mg/kg	94.4	70.0	130	----
QC-469871-003	RM	strontium	7440-24-6	E472	3.92 mg/kg	92.6	70.0	130	----
QC-469871-003	RM	thallium	7440-28-0	E472	0.013 mg/kg	86.2	70.0	130	----
QC-469871-003	RM	uranium	7440-61-1	E472	0.0786 mg/kg	94.4	70.0	130	----
QC-469871-003	RM	vanadium	7440-62-2	E472	0.51 mg/kg	94.8	70.0	130	----
QC-469871-003	RM	zinc	7440-66-6	E472	105.3 mg/kg	92.6	70.0	130	----
Metals (QCLot: 469876)									
QC-469876-003	RM	mercury	7439-97-6	E512	0.331 mg/kg	107	70.0	130	----
Metals (QCLot: 469877)									
QC-469877-003	RM	mercury	7439-97-6	E512A	0.331 mg/kg wwt	107	70.0	130	----
Metals (QCLot: 469878)									
QC-469878-003	RM	aluminum	7429-90-5	E475A	11.2 mg/kg wwt	97.8	70.0	130	----





Sub-Matrix: Biota

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	Qualifier
Metals (QCLot: 469878) - continued									
QC-469878-003	RM	arsenic	7440-38-2	E475A	34.6 mg/kg wwt	98.4	70.0	130	----
QC-469878-003	RM	bismuth	7440-69-9	E475A	0.0247 mg/kg wwt	66.0	60.0	140	----
QC-469878-003	RM	cadmium	7440-43-9	E475A	14.5 mg/kg wwt	90.9	70.0	130	----
QC-469878-003	RM	calcium	7440-70-2	E475A	550 mg/kg wwt	94.4	70.0	130	----
QC-469878-003	RM	cesium	7440-46-2	E475A	0.0712 mg/kg wwt	94.7	70.0	130	----
QC-469878-003	RM	chromium	7440-47-3	E475A	1.96 mg/kg wwt	94.4	70.0	130	----
QC-469878-003	RM	cobalt	7440-48-4	E475A	0.267 mg/kg wwt	91.1	70.0	130	----
QC-469878-003	RM	copper	7440-50-8	E475A	35 mg/kg wwt	94.4	70.0	130	----
QC-469878-003	RM	iron	7439-89-6	E475A	1070 mg/kg wwt	96.8	70.0	130	----
QC-469878-003	RM	lead	7439-92-1	E475A	0.162 mg/kg wwt	82.1	70.0	130	----
QC-469878-003	RM	magnesium	7439-95-4	E475A	940 mg/kg wwt	93.6	70.0	130	----
QC-469878-003	RM	manganese	7439-96-5	E475A	8.91 mg/kg wwt	96.1	70.0	130	----
QC-469878-003	RM	molybdenum	7439-98-7	E475A	1.41 mg/kg wwt	96.6	70.0	130	----
QC-469878-003	RM	nickel	7440-02-0	E475A	1.57 mg/kg wwt	80.5	70.0	130	----
QC-469878-003	RM	phosphorus	7723-14-0	E475A	11500 mg/kg wwt	99.3	70.0	130	----
QC-469878-003	RM	potassium	7440-09-7	E475A	14400 mg/kg wwt	93.7	70.0	130	----
QC-469878-003	RM	rubidium	7440-17-7	E475A	5.11 mg/kg wwt	95.9	70.0	130	----
QC-469878-003	RM	selenium	7782-49-2	E475A	8 mg/kg wwt	95.2	70.0	130	----
QC-469878-003	RM	sodium	7440-23-5	E475A	10673 mg/kg wwt	94.4	70.0	130	----
QC-469878-003	RM	strontium	7440-24-6	E475A	3.92 mg/kg wwt	92.6	70.0	130	----
QC-469878-003	RM	thallium	7440-28-0	E475A	0.013 mg/kg wwt	86.2	70.0	130	----
QC-469878-003	RM	uranium	7440-61-1	E475A	0.0786 mg/kg wwt	94.4	70.0	130	----
QC-469878-003	RM	vanadium	7440-62-2	E475A	0.51 mg/kg wwt	94.8	70.0	130	----
QC-469878-003	RM	zinc	7440-66-6	E475A	105.3 mg/kg wwt	92.6	70.0	130	----
Metals (QCLot: 469879)									
QC-469879-003	RM	aluminum	7429-90-5	E475	11.2 mg/kg	97.8	70.0	130	----
QC-469879-003	RM	arsenic	7440-38-2	E475	34.6 mg/kg	98.4	70.0	130	----
QC-469879-003	RM	bismuth	7440-69-9	E475	0.0247 mg/kg	66.0	60.0	140	----
QC-469879-003	RM	cadmium	7440-43-9	E475	14.5 mg/kg	90.9	70.0	130	----
QC-469879-003	RM	calcium	7440-70-2	E475	550 mg/kg	94.4	70.0	130	----
QC-469879-003	RM	cesium	7440-46-2	E475	0.0712 mg/kg	94.7	70.0	130	----





Sub-Matrix: Biota

Sub-Matrix: Biota					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	
Metals (QCLot: 469879) - continued									
QC-469879-003	RM	chromium	7440-47-3	E475	1.96 mg/kg	94.4	70.0	130	----
QC-469879-003	RM	cobalt	7440-48-4	E475	0.267 mg/kg	91.1	70.0	130	----
QC-469879-003	RM	copper	7440-50-8	E475	35 mg/kg	94.4	70.0	130	----
QC-469879-003	RM	iron	7439-89-6	E475	1070 mg/kg	96.8	70.0	130	----
QC-469879-003	RM	lead	7439-92-1	E475	0.162 mg/kg	82.1	70.0	130	----
QC-469879-003	RM	magnesium	7439-95-4	E475	940 mg/kg	93.6	70.0	130	----
QC-469879-003	RM	manganese	7439-96-5	E475	8.91 mg/kg	96.1	70.0	130	----
QC-469879-003	RM	molybdenum	7439-98-7	E475	1.41 mg/kg	96.6	70.0	130	----
QC-469879-003	RM	nickel	7440-02-0	E475	1.57 mg/kg	80.5	70.0	130	----
QC-469879-003	RM	phosphorus	7723-14-0	E475	11500 mg/kg	99.3	70.0	130	----
QC-469879-003	RM	potassium	7440-09-7	E475	14400 mg/kg	93.7	70.0	130	----
QC-469879-003	RM	rubidium	7440-17-7	E475	5.11 mg/kg	95.9	70.0	130	----
QC-469879-003	RM	selenium	7782-49-2	E475	8 mg/kg	95.2	70.0	130	----
QC-469879-003	RM	sodium	7440-23-5	E475	10673 mg/kg	94.4	70.0	130	----
QC-469879-003	RM	strontium	7440-24-6	E475	3.92 mg/kg	92.6	70.0	130	----
QC-469879-003	RM	thallium	7440-28-0	E475	0.013 mg/kg	86.2	70.0	130	----
QC-469879-003	RM	uranium	7440-61-1	E475	0.0786 mg/kg	94.4	70.0	130	----
QC-469879-003	RM	vanadium	7440-62-2	E475	0.51 mg/kg	94.8	70.0	130	----
QC-469879-003	RM	zinc	7440-66-6	E475	105.3 mg/kg	92.6	70.0	130	----





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<b>Invoice To</b>	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<b>Invoice Distribution</b>		<div style="display: flex; align-items: center; justify-content: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">NUMBER OF CONTAINERS</div> <div style="border: 1px solid black; padding: 10px; text-align: center;">             Environmental Division              Vancouver              Work Order Reference  <b>VA22A7600</b>                Telephone: +1 604 253 4188           </div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">SAMPLES ON HOLD</div> </div>		
	Copy of Invoice with Report <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			
Company:	Hatfield Consultants	Email 1 or Fax				
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<b>Project Information</b>		<b>Oil and Gas Required Fields (client use)</b>				
ALS Account # / Quote #:	VA21-HATF100-008	AFE/Cost Center:	PO#			
Job #:		Major/Minor Code:	Routing Code:			
PO / AFE:		Requisitioner:				
LSD:		Location:				
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:			
<b>ALS Sample #</b> (lab use only)	<b>Sample Identification and/or Coordinates</b> (This description will appear on the report)	<b>Date</b> (dd-mmm-yy)	<b>Time</b> (hh:mm)	<b>Sample Type</b>		
	PJ2021-006 Site Control ELS	12-Oct-21		Tissue	1 R	
	PJ2021-006 0.32% ELS				1 R	
	PJ2021-006 1.0% ELS				1 R	
	PJ2021-006 3.2% ELS				1 R	
	PJ2021-006 10% ELS				1 R	
	PJ2021-006 32% ELS				1 R	
	PJ2021-006 56% ELS				1 R	
	PJ2021-006 100% ELS				1 R	
<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)</b>		<b>SAMPLE CONDITION AS RECEIVED (lab use only)</b>		
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO		Samples were dried prior to grading -see ELS sheet for wet + dry weights		Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		
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				Cooling Initiated <input type="checkbox"/>		
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## **Appendix A2**

### **Laboratory Effects Assessment (Acute and Sublethal Toxicity): Detailed Methods and Results**

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# **Evaluation of treated oil sands process-affected water (OSPW) to aquatic organisms**

Synchrude pilot treatment plant

Draft Report

September 2, 2022

Submitted to: **Hatfield Consultants**  
North Vancouver, BC



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## SIGNATURE PAGE

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Report By:

Stephanie Schiffer, MSc  
Project Biologist

---

Reviewed By:

Leila Oosterbroek, P Biol  
Environmental Scientist

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Reviewed By:

James Elphick, RPBio  
Senior Environmental Toxicologist

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.



## 1.0 INTRODUCTION

Syncrude Canada Ltd. (Syncrude) has developed a pilot-scale treatment facility that utilizes fluidized petroleum coke to remove chemical constituents of concern from oil sands process-affected waters (OSPW) (Zubot et al. 2012). The primary objective of this treatment process is to treat OSPW to allow for its eventual safe release to the Athabasca River. To evaluate the effectiveness of this treatment process, particularly as it relates to chemical and toxicological attributes of the treated OSPW, Syncrude requested that Hatfield Consultants (Hatfield) design and implement a closed-circuit aquatic toxicity study, building on a study design previously proposed by Crude et al. (2017), and considering recommendations by the OSPW Science Team.

The study used a triad approach to assess the treated OSPW produced from the pilot-scale treatment facility to evaluate risk if released to the Athabasca River. The triad approach incorporated three components: (1) chemical characterization of untreated and treated OSPW, (2) toxicological testing of treated OSPW, and (3) assessment of responses of aquatic invertebrate and periphyton communities in a mesocosm exposure to treated OSPW.

In collaboration with Hatfield, Nautilus Environmental Company Inc. (Nautilus) assisted with implementing the toxicity testing component of the study, which was designed to test the effectiveness of the Syncrude OSPW treatment over a five-week period using laboratory and on-site toxicity testing. The on-site testing included sublethal toxicity testing with fathead minnows using a mobile toxicity testing trailer. Additional toxicity tests with three native species (walleye and two bivalve species) were also conducted during the following spring and summer of 2022.

This report describes the methods and results of toxicity tests. Copies of laboratory data sheets are provided in Appendices A to J. Interpretation of the results from this study will be provided in a separate report to which these data will be appended.



---

## 2.0 METHODS

### 2.1 Sample collection

Samples were collected on a regular basis from the pilot facility and the Athabasca River (for control and dilution) and delivered to the on-site testing facility for use in the on-site toxicity tests and mesocosms. Additional details of the sampling and delivery procedures, as well as water chemistry associated with the samples and results from the mesocosm experiments, are discussed in separate reports. An aliquot of the samples was delivered on a weekly basis to the Nautilus laboratory in Calgary, AB, in 200-L plastic drums for use in the laboratory toxicity tests. Samples were delivered to the laboratory on September 7, 13, 20, and 27, as well as on October 4, 2021. Finally, a large volume of water from Reactor 3 was collected at the end of the program and stored in 1000-L plastic cubitainers under cold conditions by Syncrude. One of the 1000-L containers was subsequently delivered to Nautilus on April 27, 2022 for use in tests with walleye and bivalves that were conducted in 2022.

### 2.2 Toxicity testing

The toxicity of treated OSPW to freshwater organisms was evaluated over a five-week period. A summary of toxicity tests performed and the frequency at which they were performed over the five-week period is presented in Table 1. Laboratory toxicity tests were conducted according to methods, including those published by Environment and Climate Change Canada (ECCC), American Society for Testing and Materials (ASTM) and United States Environmental Protection Agency (USEPA). Long-term tests with juvenile fathead minnows were conducted in both the laboratory and the on-site facility. In addition to treated OSPW from Reactor 3, which was the primary source of samples for the testing program, standard acute and sublethal toxicity tests were also performed on sample from Reactor 2 during the fourth week of testing.

The toxicity of treated OSPW to early life-stages of walleye, juvenile fingernail clams (*Sphaerium* sp.) and glochidia of *Lampsilis siliquoidea* was also evaluated in exposures that were conducted in 2022.



**Table 1. Toxicity test species, test methods and frequency of tests with treated OSPW from Reactor 3.**

Species	Test	Test Method	Frequency
Rainbow trout ( <i>O. mykiss</i> )	Acute toxicity	ECCC EPS 1/RM/13	Weekly
Water flea ( <i>D. magna</i> )	Acute toxicity	ECCC EPS 1/RM/14	Weekly
Water flea ( <i>C. dubia</i> )	Sublethal toxicity	ECCC EPS 1/RM/21	Weekly
Fathead minnow ( <i>P. promelas</i> )	Sublethal toxicity	ECCC EPS 1/RM/22	Weekly
Green alga ( <i>P. subcapitata</i> )	Sublethal toxicity	ECCC EPS 1/RM/25	Weekly
Amphipod ( <i>H. azteca</i> )	Sublethal toxicity	ECCC EPS 1/RM/33	Weekly
Fathead minnow ( <i>P. promelas</i> )	Sublethal toxicity, (0-30d)	USEPA (1996); ASTM (2013)	Once
Fathead minnow ( <i>P. promelas</i> )	Sublethal toxicity, (60-88d)	Adapted from ASTM (2013)	Once

ECCC = Environmental Canada and Climate Change, USEPA = United States Environmental Protection Agency, ASTM = American Society for Testing and Materials

### 2.2.1 On-site testing

The method for the toxicity test with juvenile fathead minnows performed on-site in the mobile toxicity testing trailer is summarized in Table 2. This test was conducted concurrently with the mesocosm study at the Bouchier Contracting site in Fort MacKay, AB.

Juvenile fish were obtained from Aquatic Research Organisms (Hampton, NH, USA) with associated health certificates as required by the import permit. The fish were delivered to the mobile toxicity testing trailer in Fort MacKay, AB on September 2, 2021. Fish were then acclimated to test conditions, before testing began on September 4, 2021.

The purpose of conducting tests in the mobile testing trailer test was to measure sublethal effects associated with long-term exposure to treated OSPW to fish without the complication or delay associated with shipping samples to the laboratory. The juvenile fathead minnow test evaluated effects on survival, length, weight, and body condition factor and was initiated with fish that were approximately 75-days post-hatch, with the duration of the test being 28 days.

### 2.2.2 Laboratory-based testing

The juvenile fathead minnow test that was conducted on-site in the mobile toxicity trailer was duplicated at the Nautilus Calgary laboratory. This test was initiated a few days following initiation of the test in the mobile-trailer, on September 10, 2021, with the same batch of fathead minnows



and also followed methods provided in Table 2. The purpose of the duplicate laboratory test was to provide a backup in the event of a problem with the test in the mobile trailer, as well as to assess whether tests conducted on-site provided a different level of sensitivity as compared to laboratory tests (for example, if toxicity were to dissipate while the samples were in transit to the laboratory). In addition to assessing the effects of treated OSPW on the survival, length, weight and condition factor of fish, fish were subsampled (n=5, where possible from each concentration) from the laboratory testing and livers were dissected and weighed to calculate a liver somatic index (LSI) value.

A 32-day fathead minnow embryo-larval test was also conducted in the laboratory using eggs that were <24-hours post-fertilization, following test methods that are summarized in Table 3. The embryo-larval stage test provides measures effects at early life-stages, with endpoints including percent of hatched eggs, post-hatch survival, growth, and incidence of deformities.

Standard tests were performed including both acute and sublethal tests that were initiated on a weekly basis. Tests were conducted at both Nautilus laboratories; rainbow trout, *D. magna*, *C. dubia* and 7-day fathead minnow tests were performed in Calgary, AB, and *P. subcapitata* and *H. azteca* tests were performed in Burnaby, BC. During week 3 of testing, the *C. dubia* and 7-day fathead minnow tests were performed in the Burnaby, BC lab. Methods for the standard acute and sublethal tests are summarized in Tables 4 to 9.

Additional tests were included in the study following some unexpected observations during testing with Reactor 3 treated OSPW, which included high pH measurements and microbial and algal growth in the sample (the sample was brownish green in appearance). The additional tests included pH adjustments to lower the pH and copper adjustments to reduce microbial effects in fathead minnow tests.

A suite of toxicity tests was performed for treated OSPW from Reactor 2, which was comprised of treated OSPW before it was released to the polishing ponds. The treated OSPW from Reactor 2 was clear and colorless and had a lower pH ( $\leq 7.5$ ) than treated OSPW from Reactor 3.

The pH of Reactor 3 treated OSPW remained consistently high ( $\geq 8.8$ ) over the five-week testing period. To determine if high pH contributed to adverse effects observed, additional screening tests were performed using the *C. dubia* and 7-day fathead minnow tests during the last week of testing (week 5). The pH in these tests was decreased using 1 N HCl to reach a pH  $\leq 8.6$ , with daily adjustment taking place prior to each test solution replenishment.



To reduce microbial growth in the 7-day fathead minnow tests, 20 µg/L of copper was added to the site control water and the 50 and 100% test concentrations of Reactor 3 sample during week 3 of testing at Nautilus in Burnaby, BC. The copper additions proved successful in reducing sporadic mortality in the fathead minnow test in the site control and 50% test concentration, and were subsequently added to the site control and all test concentrations during week 4 and 5 testing of Reactor 3 samples.

Standard acute and sublethal laboratory tests (rainbow trout, *D. magna*, *C. dubia*, 7-day fathead minnow, *H. azteca* and *P. subcapitata*) for treated OSPW collected from Reactor 2 prior to its discharge to Reactor 3 were conducted during week 4 of testing. Treated OSPW from Reactor 2 was not tested using the long-term fathead minnow tests.

### 2.2.3 Toxicity tests using native species

Additional tests were conducted to identify potential acute and sublethal effects in organisms native to the lower Athabasca River following both short and long-term exposure to treated OSPW. Native test organisms included early life-stages of walleye, juvenile fingernail clams and glochidia of freshwater mussel. Standardized test protocols have not been developed for these organisms but the methods followed are summarized in Tables 10 to 12. Due to limited availability of these organisms in the fall of 2021 when the pilot-program was conducted, these tests were delayed until the spring and summer of 2022. These tests followed the same dilution series used in the long-term fathead minnow tests, with the exception that, in the present tests, dechlorinated municipal tap water was used as dilution water rather than site water collected from the Athabasca River.

Field-collected adult fingernail clams arrived at the Nautilus laboratory in Point Edwards, ON, on April 5, 2022. These organisms were cultured in the laboratory at  $4 \pm 2^{\circ}\text{C}$  to stimulate late winter conditions. Temperature of the culture was gradually increased over the next three weeks to stimulate spring conditions. This increase in temperature resulted in production of offspring that were used in testing. The 28-d survival and growth test was initiated on May 9, 2022 using offspring produced within the prior three-week period.

Glochidia were tested for viability (ability to close valves) after 24- and 48-hour exposures to treated OSPW. Glochidia, which develop from fertilized eggs within the marsupia of adult females, were collected from gravid, *L. siliquoidea* females. The test was initiated on August 16, 2022 using viable glochidia larvae; the tests were performed by Nautilus staff at the Guelph University laboratory of Dr. Ryan Prosser.



Newly fertilized walleye eggs were collected at a spawn camp conducted by the Cold Lake Hatchery at Lac Ste. Anne, AB, on May 5, 2022 and transported to the Nautilus laboratory in Calgary, AB, the same day. Upon arrival, fertilized eggs were transferred to a MacDonald hatch jar maintained at  $8 \pm 2^{\circ}\text{C}$ . The hatch jar was set up on a recirculation system using dechlorinated municipal tap water. The 30-d embryo-larval test was initiated one day after receiving the eggs on May 6, 2022.

### 2.3 Statistical analysis

Statistical analyses were performed using CETIS (Tidepool Scientific Software, version 1.9.4.11 or 2.1.0.7). Where possible, the laboratory control was used to establish test validity and the site control (i.e., Athabasca River water) was used as the negative control for endpoint calculation. It should be noted that while test validity was met in the laboratory control for all tests, it was not met in the site control for fathead minnow survival during week 3 of testing with Reactor 3 sample and *C. dubia* reproduction during week 4 of testing with Reactor 2 sample. However, the site control was still used as the negative control for endpoint calculation for these two tests. The laboratory control was used as the negative control for endpoint calculation of toxicity tests using native species, since water from the Athabasca River was not used in these tests. Spearman-Kärber or linear interpolation was used in calculation of the lethal concentration (LC) values. For growth and/or reproduction inhibitory concentrations (IC) values, linear interpolation or non-linear regression was used based on best fit of the model.



**Table 2. Summary of test conditions: *Pimephales promelas* juvenile-adult test.**

Test organism	<i>Pimephales promelas</i>
Organism source	Aquatic Research Organisms Inc., Hampton, New Hampshire
Organism age	60 days post hatch
Test type	Static-renewal
Test duration	28 days
Test chamber	6.0-L glass aquaria
Test solution volume	4 L
Test concentrations	On-site Testing - Six concentrations (100, 32, 10, 3.2, 1.0, 0.32%), plus site water control Laboratory Testing – Seven concentrations (100, 56, 32, 10, 3.2, 1.0, 0.32%) plus laboratory and site water control
Number of replicates	4
Laboratory control water	Dechlorinated City of Calgary tap water (laboratory testing)
Site control/ dilution water	Athabasca River Water
Test solution renewal	Daily (~80%)
Test temperature	25 ± 2°C
Number of organisms	10 per replicate
Feeding	Twice daily, with frozen <i>Artemia</i> nauplii
Light intensity	100 to 600 lux
Photoperiod	16 hours light/8 hours dark
Aeration	Continuous gentle aeration
Test protocol	Adapted from ASTM (2013)
Statistical software	CETIS version 1.9.4.11 and 2.1.0.7
Test endpoints	Survival, length, wet weight, body condition factor
Test acceptability criterion for controls	≥70% survival



**Table 3. Summary of test conditions: Early-Life stage test with fathead minnow (*Pimephales promelas*).**

Test organism	<i>Pimephales promelas</i>
Organism source	Aquatox Inc., Hot Springs, Arkansas
Organism age	<24 hours post fertilization
Test type	Static-renewal
Test duration	From egg stage until 28 days post-hatch
Test chamber	2.0-L glass jars
Test solution volume	1.8 L
Test concentrations	Seven concentrations (100, 32, 56, 10, 3.2, 1.0, 0.32%), plus laboratory and site water control Copper (20 µg/L) added to site water control and seven concentrations from day 10 to 21
Number of replicates	4 per treatment
Laboratory control water	Dechlorinated City of Calgary tap water amended with 4 mg/L KCl
Site control/ Dilution water	Athabasca River Water
Test solution renewal	Daily (~80%)
Test temperature	25 ± 1°C
Number of organisms	20 per replicate
Feeding	Three times daily, with newly hatched <i>Artemia</i> nauplii
Light intensity	100 to 500 lux
Photoperiod	16 hours light/8 hours dark
Aeration	None unless required to maintain DO >50% saturation
Test protocol	USEPA (1996); ASTM (2013)
Statistical software	CETIS version 2.1.0.7
Test endpoints	Hatch, overall survival, post-hatch survival, length, dry weight, normal development
Test acceptability criterion for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Sodium chloride (NaCl)



**Table 4. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) survival test.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Fish Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10-20 L, depending on size of fish
Test solution depth	Minimum 15 cm
Test concentrations	Five concentrations (100, 50, 25, 12.5 and 6.25%), plus laboratory and site water control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Laboratory control water	Dechlorinated City of Calgary tap water
Site control/ dilution water	Athabasca River Water
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	pH, conductivity, dissolved oxygen and temperature were measured at test initiation and termination; salinity measured at test initiation; evaluated daily for survival
Test protocol	Environment Canada (2000a), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS version 1.9.4.11
Test endpoints	Survival (LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Potassium chloride (KCl)



**Table 5. Summary of test conditions: 48-h *Daphnia magna* survival test.**

Test species	<i>Daphnia magna</i>
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	385-mL plastic containers
Test volume	150 mL
Test concentrations	Five concentrations (100, 50, 25, 12.5 and 6.25%), plus laboratory and site water control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Laboratory control water	Dechlorinated City of Calgary tap water amended with 4 mg/L KCl and with B12 (2 µg/L) and Na <sub>2</sub> SeO <sub>4</sub> (2 µg Se/L)
Site control/ dilution water	Athabasca River Water
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen and temperature measured at test initiation and completion; salinity and hardness measured at test initiation in undiluted sample; evaluated daily for survival
Test protocol	Environment Canada (2000b), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4.11
Test endpoints	Survival (LC50) and immobility (EC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)



**Table 6. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.**

Test species	<i>Ceriodaphnia dubia</i>
Organism source	In-house culture
Organism age	<24-hour old neonates, produced within a 12-hour window
Test type	Static-renewal
Test duration	6-8 days
Test vessel	20-mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	Seven concentrations (100, 50, 25, 12.5, 6.3, 3.2 and 1.6%) plus laboratory control and site water control
Test replicates	10 per treatment
Number of organisms	1 per replicate
Laboratory control water	20% Perrier water and 80% deionized water supplemented with vitamin B12 (2 µg/L) and Na <sub>2</sub> SeO <sub>4</sub> (5 µg Se/L)
Site control/ dilution water	Athabasca River Water
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Calgary: Daily with <i>Pseudokirchneriella subcapitata</i> and YCT Burnaby: Daily with <i>Pseudokirchneriella subcapitata</i> and TCC <sup>1</sup> (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen and temperature measured daily; evaluated for survival and reproduction daily
Test protocol	Environment Canada (2007b), EPS 1/RM/21
Statistical software	CETIS version 1.9.4.11
Test endpoints	Survival (LC50) and reproduction (IC25)
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods, no ephippia present
Reference toxicant	Sodium chloride (NaCl)

<sup>1</sup>TCC = Trout chow and Cerophyl



**Table 7. Summary of test conditions: 7-d fathead minnow (*Pimephales promelas*) survival and growth test.**

Test species	<i>Pimephales promelas</i>
Organism source	Aquatox Inc., Hot Springs, Arkansas (Calgary) Aquatic Biosystems, Fort Collins, CO (Burnaby)
Organism age	<24 hours post-hatch
Test type	Static-renewal
Test duration	7 days
Test vessel	385-mL plastic container (Calgary); 375-mL glass container (Burnaby)
Test volume	250 mL
Test solution depth	6.5 cm
Test concentrations	Seven concentrations (100, 50, 25, 12.5, 6.3, 3.2 and 1.6%), plus laboratory and site water control Copper (20 µg/L) added to 100, 50% and site control in week 3; copper added to seven concentrations (100, 50, 25, 12.5, 6.3, 3.2 and 1.6%) and site control in week 4 and 5; copper added to 100, 50% and site control in week 3,
Test replicates	4 per treatment (Calgary); 3 per treatment (Burnaby)
Number of organisms	10 per replicate
Laboratory control water	Dechlorinated City of Calgary tap water amended with 4 mg/L KCl (Calgary); Moderately-hard reconstituted water (Burnaby)
Site control/ dilution water	Athabasca River Water
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day with approximately 1500-2250 newly hatched brine shrimp nauplii ( <i>Artemia sp.</i> ) in each test container
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None, unless dissolved oxygen falls to <40% saturation
Test measurements	pH, conductivity, dissolved oxygen and temperature were measured daily; evaluated for survival daily
Test protocol	Environment Canada (2011), EPS 1/RM/22
Statistical software	CETIS Version 1.9.4.11
Test endpoints	Survival (LC50) and biomass (IC25)
Test acceptability criteria for controls	≥80% survival; ≥250 µg mean dry weight
Reference toxicant	Sodium chloride (NaCl)



**Table 8. Summary of test conditions: 72-h *Pseudokirchneriella subcapitata* growth inhibition test.**

Test species	<i>Pseudokirchneriella subcapitata</i> , strain CPCC# 37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	Seven concentrations (100, 50, 25, 12.5, 6.3, 3.2 and 1.6%), plus laboratory control and site control
Test replicates	4 per treatment; 8 for laboratory control and site control
Number of organisms	10,000 cells/mL
Laboratory control water	Deionized water supplemented with nutrients
Site control/ dilution water	Athabasca River Water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007a), EPS 1/RM/25
Statistical software	CETIS Version 1.9.4
Test endpoints	Algal cell growth inhibition (IC <sub>25</sub> )
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as ZnSO <sub>4</sub> )



**Table 9. Summary of test conditions: 14-d *Hyalella azteca* water-only survival and growth test.**

Test species	<i>Hyalella azteca</i>
Organism source	Aquatic BioSystems, Fort Collins, CO
Organism age	7- to 9-days old
Test type	Static-renewal
Test duration	14 days
Test vessel	375-mL glass container
Test volume	275 mL
Test concentrations	Seven concentrations (100, 50, 25, 12.5, 6.3, 3.2 and 1.6%) plus laboratory control and site control
Test replicates	5 per sample
Number of organisms	10 per replicate
Control/dilution water	Reconstituted water; recipe from Borgmann (1996)
Test solution renewal	Three times a week on non-consecutive days
Test temperature	23 ± 1°C
Feeding	0.75 mL of YCT and 1.35 mg of Tetramin per replicate daily
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity of overlying water measured daily; total ammonia of overlying water measured at test initiation and termination
Test protocol	Environment Canada (2017), EPS 1/RM/33
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival (LC50) and dry weight (IC25)
Test acceptability criteria for controls	≥80% survival; ≥0.1 mg/amphipod dry weight
Reference toxicant	Sodium chloride (NaCl)



**Table 10. Summary of test conditions: Fingernail clam (*Sphaerium* sp.) survival and growth test.**

Test species	<i>Sphaerium</i> sp.
Organism source	Field-collected near Guelph, ON
Organism age	1- to 21-days old
Test type	Static-renewal
Test duration	28 days
Test vessel	500-mL glass container
Test volume	300 mL
Test concentrations	Seven concentrations (100, 32, 56, 10, 3.2, 1.0, 0.32%), plus laboratory control
Test substrate	Small layer of sand (i.e., silica sand)
Test replicates	4 per treatment
Number of organisms	5 per replicate
Control/dilution water	Dechlorinated municipal tap water
Test solution renewal	Three times per week (~ 80% renewal)
Test temperature	22 ± 1°C
Feeding	Daily: MWF (after water exchange): 2 ml Nanno + Shellfish diet and 2 ml <i>Pseudokirchneriella subcapitata</i> TTSS (in the morning): 1 ml Nanno + Shellfish diet and 1 ml <i>P. subcapitata</i>
Light intensity	~500 lux at water surface
Photoperiod	16 h light / 8 h dark
Aeration	Continuous (using spider tubing)
Test measurements	Temperature, dissolved oxygen, pH measured, conductivity, and ammonia measured during water changes
Test protocol	Adapted from Wang et al. (2007)
Statistical software	CETIS version 1.9.4.11; CETIS version 2.1.0.7
Test endpoints	Survival, shell length, and dry weight
Test acceptability criterion for controls	Mean control survival of ≥80%
Reference toxicant	None



**Table 11. Summary of test conditions: 48-h *Lampsilis siliquoidea* viability test.**

Test species	<i>Lampsilis siliquoidea</i>
Organism source	In-house culture (University of Guelph)
Organism age	<24-hour old glochidia
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beakers
Test volume	150 mL
Test concentrations	Seven concentrations (100, 32, 56, 10, 3.2, 1.0, 0.32%), plus laboratory control
Test replicates	4 per treatment (5 for control)
Number of organisms	> 500 per replicate
Control/dilution water	De-ionized water amended with 4 mg/L KCl, 96 mg/L NaHCO <sub>3</sub> , 60 mg/L CaSO <sub>4</sub> ·2H <sub>2</sub> O, 60 mg/L MgSO <sub>4</sub>
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	100 to 1000 lux
Photoperiod	16 h light / 8 h dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen, temperature, chloride, and ammonia measured at test initiation and completion; evaluated daily for viability
Test protocol	ASTM (2022)
Statistical software	CETIS version 2.1.0.7
Test endpoints	Percent viability
Test acceptability criterion for controls	Change of percent viability < 10% from initial to 48 hours
Reference toxicant	None



**Table 12. Summary of test conditions: early life-stage walleye (*Sander vitreus*) survival and growth test.**

Test species	<i>Sander vitreus</i>
Organism source	Lac Ste. Anne Spawn Camp (Cold Lake Fish Hatchery)
Organism age	24 to 48-h post-fertilization.
Test type	Static-renewal
Test duration	30 days
Test vessel	2-L glass jars
Test volume	1 L
Test concentrations	Seven concentrations (100, 32, 56, 10, 3.2, 1.0, 0.32%), plus laboratory control
Test replicates	5 per treatment
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Calgary municipal tap water
Test solution renewal	50% renewals daily
Test temperature	Test was initiated at $8 \pm 2^{\circ}\text{C}$ and increased $1\text{--}2^{\circ}\text{C}$ each week to mimic natural conditions
Feeding	Fed three times daily, with newly hatched <i>Artemia</i> nauplii approximately 8-days post-hatch
Light intensity	100 to 300 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Gentle, continuous
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily in new and old solutions; survival checked daily.
Test protocol	Adapted from USEPA (2016), ASTM (2013), Raine et al. (2017)
Test endpoint	Percent hatch, percent for $\geq 50\%$ to hatch, 21-d and 28-d post-hatch survival, 21-d and 28-d overall survival, 28-d dry weight, 28-d normality of hatched larvae
Statistical software	CETIS version 2.1.0
Test acceptability criterion for controls	$>66\%$ hatch; $\geq 70\%$ post-hatch survival



### 3.0 RESULTS

#### 3.1 Long-term survival and growth toxicity tests with fathead minnow

Results of the 28-day toxicity tests conducted with sample from Reactor 3 using juvenile fathead minnows from the on-site trailer and laboratory are provided in Tables 13 and 14, respectively. The resulting LC50 values for survival were 82.7% and 90.4% for the on-site and laboratory tests, respectively. The IC25 value for length was >100% for both tests and wet weight was 57.2% and 59.8% sample for the on-site and laboratory tests, respectively. The condition factors of fish were less than one in the full-strength sample for both the on-site trailer and laboratory tests. The LSI values calculated at the end of the 28-day laboratory test for the juvenile fathead minnow are presented in Table 13. It should be noted that only three livers sample could be dissected and weighed from fish exposed to the full-strength sample due to poor physiological health of the fish and reduced survival at termination. Although the LSI value was found to decrease in the full-strength sample, factors such as small fish size and poor physiological health may have impacted the ability to obtain intact livers during dissections. Therefore, values presented for LSI in the full-strength sample should be interpreted with caution. Survival and growth results obtained for juvenile fathead minnows from the on-site and laboratory tests were similar based on point estimate values and overlapping 95% confidence limits. This similarity in sensitivity between the two testing locations suggests that toxicants present in the samples did not appear to dissipate with transportation times.

Results from the early life stage toxicity test for fathead minnow initiated with sample from Reactor 3 are provided in Table 15. No adverse effects were observed on hatch success, dry weight, length or normal development of fathead minnows at the end of the test with resulting EC50 and IC25 values of >100%. Adverse effects were observed on post-hatch and overall survival of fathead minnows, with resulting LC50 values of 61.4 and 61.1%, respectively.

Microbial and/or bacterial growth was observed in the early life stage test with fathead minnow in the site water and all tested concentrations. This was first observed a few days after embryos hatched, and resulted in sporadic mortality in every treatment except the laboratory control. Fathead minnows are known to be susceptible to adverse effects caused by naturally-occurring fungi and/or bacteria, which has been termed sporadic mortality phenomenon (Grothe and Johnson, 1996; Kszos et al. 1997; Downey et al. 2000). This infection causes mortality, and results in high variability among replicates, nonmonotonic dose responses or anomalous patterns of survival in tests with fish as early as 4 days post-hatch. Based on previous laboratory experience with early life-stage tests, fathead minnows are less sensitive to effects of microbes once they reach 20 days post-hatch. To curtail the effects of microbes in samples, low doses of copper can



be added to prophylactically reduce microbial growth. Therefore, 20 µg/L copper was added to the site control and test concentrations starting on day 10 of the exposure to counteract effects of microbial growth. Copper additions ended on day 21, as microbial/bacterial growth was no longer expected to impact fish health. Following the copper additions, microbial growth was no longer observed and sporadic mortality in the site water control and test concentrations stabilized.



**Table 13. Results (Mean  $\pm$  SD): Juvenile fathead minnow (*Pimephales promelas*) survival and growth on-site trailer test.**

Concentration (% v/v)	Survival (%)	Length (mm)	Wet weight (g)	Condition Factor
Site Control	100.0 $\pm$ 0.0	29.2 $\pm$ 1.0	0.31 $\pm$ 0.02	1.20 $\pm$ 0.15
0.32	100.0 $\pm$ 0.0	29.7 $\pm$ 0.6	0.34 $\pm$ 0.03	1.24 $\pm$ 0.14
1.0	100.0 $\pm$ 0.0	28.6 $\pm$ 1.5	0.30 $\pm$ 0.05	1.23 $\pm$ 0.14
3.2	100.0 $\pm$ 0.0	28.8 $\pm$ 1.5	0.32 $\pm$ 0.04	1.27 $\pm$ 0.15
10	100.0 $\pm$ 0.0	29.5 $\pm$ 0.8	0.32 $\pm$ 0.02	1.19 $\pm$ 0.17
32	100.0 $\pm$ 0.0	29.6 $\pm$ 1.9	0.31 $\pm$ 0.04	1.16 $\pm$ 0.20
100	40.0 $\pm$ 0.0	25.6 $\pm$ 1.9	0.17 $\pm$ 0.04	0.95 $\pm$ 0.23
<b>Test endpoint (% v/v)</b>				
LC50 (95% CL)	82.7 (64.7 – >100)	--	--	--
IC25 (95% CL)	--	>100	57.2 (38.0 – 76.7)	--

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



**Table 14. Results (Mean  $\pm$  SD): Juvenile fathead minnow (*Pimephales promelas*) survival and growth laboratory test.**

Concentration (% v/v)	Survival (%)	Length (mm)	Wet weight (g)	Condition Factor	LSI
Laboratory Control	100.0 $\pm$ 0.0	32.6 $\pm$ 0.8	0.41 $\pm$ 0.02	1.12 $\pm$ 0.06	1.9 $\pm$ 0.6
Site Control	100.0 $\pm$ 0.0	32.0 $\pm$ 1.0	0.40 $\pm$ 0.03	1.14 $\pm$ 0.04	2.0 $\pm$ 0.4
0.32	100.0 $\pm$ 0.0	32.4 $\pm$ 0.5	0.39 $\pm$ 0.01	1.11 $\pm$ 0.03	1.9 $\pm$ 0.5
1.0	100.0 $\pm$ 0.0	31.1 $\pm$ 1.1	0.36 $\pm$ 0.04	1.14 $\pm$ 0.02	2.0 $\pm$ 0.5
3.2	100.0 $\pm$ 0.0	32.3 $\pm$ 1.6	0.40 $\pm$ 0.06	1.13 $\pm$ 0.02	2.0 $\pm$ 0.4
10	100.0 $\pm$ 0.0	32.3 $\pm$ 1.3	0.40 $\pm$ 0.06	1.14 $\pm$ 0.02	2.0 $\pm$ 0.4
32	100.0 $\pm$ 0.0	31.8 $\pm$ 1.1	0.40 $\pm$ 0.05	1.17 $\pm$ 0.06	1.9 $\pm$ 0.8
56	97.5 $\pm$ 5.0	29.6 $\pm$ 1.0	0.30 $\pm$ 0.05	1.08 $\pm$ 0.17	1.9 $\pm$ 0.6
100	40.0 $\pm$ 14.1	26.1 $\pm$ 2.9	0.16 $\pm$ 0.07	0.80 $\pm$ 0.07	1.5 $\pm$ 1.3
<b>Test endpoint (% v/v)</b>					
LC50 (95% CL)	90.4 (79.4 - >100)	--	--	--	--
IC25 (95% CL)	--	>100	59.8 (47.6 – 70.8)	--	--

SD = Standard Deviation, IC = Inhibition Concentration, LC = Lethal Concentration, CL = Confidence Limit, LSI = Liver Somatic Index.



**Table 15. Results (Mean  $\pm$  SD): fathead minnow (*Pimephales promelas*) early life stage test.**

Concentration <sup>1</sup> (% v/v)	Hatch (%)	Post Hatch Survival (%)	Overall Survival (%)	Dry Weight (mg/org)	Length (mm)	Normal Development (%)
Laboratory Control	98.8 $\pm$ 2.5	87.4 $\pm$ 6.4	86.3 $\pm$ 6.3	5.74 $\pm$ 0.65	12.8 $\pm$ 0.2	98.5 $\pm$ 2.9
Site Control	100.0 $\pm$ 0.0	78.8 $\pm$ 2.5	78.8 $\pm$ 2.5	5.99 $\pm$ 0.14	12.7 $\pm$ 0.3	100.0 $\pm$ 0.0
0.32	98.8 $\pm$ 2.5	79.9 $\pm$ 15.7	78.8 $\pm$ 14.4	6.13 $\pm$ 1.71	12.6 $\pm$ 0.9	93.8 $\pm$ 8.0
1.0	97.5 $\pm$ 2.9	62.0 $\pm$ 19.5	61.3 $\pm$ 19.7	6.22 $\pm$ 1.15	12.9 $\pm$ 0.7	97.7 $\pm$ 4.6
3.2	100.0 $\pm$ 0.0	87.5 $\pm$ 11.9	87.5 $\pm$ 11.9	4.84 $\pm$ 0.92	12.0 $\pm$ 0.5	100.0 $\pm$ 0.0
10	100.0 $\pm$ 0.0	72.5 $\pm$ 11.9	72.5 $\pm$ 11.9	6.05 $\pm$ 1.18	12.7 $\pm$ 0.9	96.9 $\pm$ 6.3
32	98.8 $\pm$ 2.5	79.7 $\pm$ 12.4	78.8 $\pm$ 13.2	5.28 $\pm$ 1.35	12.3 $\pm$ 0.8	100.0 $\pm$ 0.0
56	98.8 $\pm$ 2.5	47.0 $\pm$ 11.2	46.3 $\pm$ 10.3	5.74 $\pm$ 0.91	12.4 $\pm$ 0.5	100.0 $\pm$ 0.0
100	96.3 $\pm$ 7.5	9.0 $\pm$ 7.4	8.8 $\pm$ 7.5	5.21 $\pm$ 3.09	11.1 $\pm$ 2.5	75.0 $\pm$ 50.0
<b>Test endpoint (% v/v)</b>						
LC50 (95% CL)	--	61.4 (56.2 – 67.1)	61.1 (56.1 – 66.7)	--	--	>100
EC50	>100	--	--	--	--	--
IC25	--	--	--	>100	>100	--

SD = Standard Deviation, EC = Effect Concentration, IC = Inhibition Concentration, LC = Lethal Concentration, CL = Confidence Limit.

<sup>1</sup> 20  $\mu$ g/L of copper added to site control and all dilution treatments from day 10 to day 21 of testing to control for microbial growth.



### 3.2 Acute toxicity tests

Results from the acute toxicity tests using rainbow trout and *D. magna* are provided in Tables 16 and 17 for the Reactor 3 sample, respectively, and Table 18 for the Reactor 2 sample. There was no acute toxicity to rainbow trout or *D. magna* for samples collected from Reactor 3 over the five-week period. Similarly, there was no acute toxicity to rainbow trout or *D. magna* observed for the one sample collected from Reactor 2.



**Table 16. Reactor 3 Results: Rainbow trout survival tests.**

Concentration (% v/v)	Week 1	Week 2	Week 3	Week 4	Week 5
	Survival (%)	Survival (%)	Survival (%)	Survival (%)	Survival (%)
Laboratory Control	100	100	100	100	100
Site Control	100	100	100	100	100
6.25	100	100	100	100	100
12.5	100	100	100	100	100
25	100	100	100	100	100
50	100	100	100	100	100
100	100	100	100	100	100
<b>Test endpoint (% v/v)</b>					
Survival LC50	>100	>100	>100	>100	>100

LC = Lethal Concentration



**Table 17. Reactor 3 Results: *Daphnia magna* survival tests.**

Concentration (% v/v)	Week 1		Week 2		Week 3		Week 4		Week 5	
	Survival (%)	Immobile (%)	Survival (%)	Immobile (%)	Survival (%)	Immobile (%)	Survival (%)	Immobile (%)	Survival (%)	Immobile (%)
Laboratory Control	100	0	100	0	100	0	100	0	100	0
Site Control	100	0	100	0	100	0	100	0	100	0
6.25	100	0	100	0	100	0	100	0	100	0
12.5	100	0	100	0	100	0	100	0	100	0
25	100	0	100	0	100	0	100	0	100	0
50	100	0	100	0	100	0	100	0	100	0
100	100	0	100	0	100	0	100	0	100	0
<b>Test endpoint (% v/v)</b>										
Survival LC50	>100	--	>100	--	>100	--	>100	--	>100	--
Immobility EC50	--	>100	--	>100	--	>100	--	>100	--	>100

LC = Lethal Concentration, EC = Effect Concentration.



**Table 18. Reactor 2 Results: Rainbow trout and *Daphnia magna* survival tests<sup>1</sup>.**

Concentration (% v/v)	Rainbow trout	<i>D. magna</i>	
	Survival (%)	Survival (%)	Immobile (%)
Laboratory Control	100	100	0
Site Control	100	100	0
6.25	100	100	0
12.5	100	100	0
25	100	100	0
50	100	100	0
100	90	100	0
<b>Test endpoint (% v/v)</b>			
Survival LC50	> 100	> 100	> 100
Immobility EC50	--	> 100	> 100

LC = Lethal Concentration, EC = Effect Concentration

<sup>1</sup> Sample was tested during week 4.



### 3.3 Sublethal toxicity tests

Results from the sublethal toxicity tests conducted using *C. dubia*, fathead minnow, green algae (*P. subcapitata*) and the freshwater amphipod, *H. azteca*, for Reactor 3 and 2 samples are summarized in Tables 19 through 22. The lethal and sublethal endpoints obtained during the five-week testing period with sample from Reactor 3 are summarized in Figure 1.

#### 3.3.1 *Ceriodaphnia dubia*

Adverse effects were observed on *C. dubia* survival during the testing program with sample from Reactor 3, resulting in LC50 values of 61.6, 46.7, 46.6, 66.7 and 61.6% for weeks 1 through 5, respectively. Adverse effects were also observed on reproduction of *C. dubia* exposed to Reactor 3 with IC25 values of 20.1, 20.7, 30.8, 27.8 and 9.9%, respectively (Table 19). In the first two weeks of testing, small organisms were observed on the *C. dubia* in the 50 and 100% test concentrations; however, this was no longer observed after week 2 and it is uncertain how this may have affected *C. dubia* survival and/or reproduction at these concentrations. Lethal and sublethal effect concentrations for *C. dubia* were generally similar over the five-week testing period (Table 19; Figure 1).

The Reactor 2 sample produced an LC50 value of 66.0% for survival, which was similar to the LC50 determined for Reactor 3. The IC25 for reproduction for the Reactor 2 sample was 38.0%, which was slightly greater than that observed in Reactor 3 sample during week 4 (Table 19). The pH of full-strength sample from Reactor 2 (pH of 8.3-8.4) was lower than the full-strength sample from Reactor 3 (pH of 8.8-8.9) during the fourth week of testing.

The high pH associated with sample from Reactor 3 (pH  $\geq 8.8$ ) was identified as a potential stressor for *C. dubia*. Therefore, in week 5, full-strength sample from Reactor 3 was pH adjusted daily from a pH of  $\geq 8.6$  (8.6-9.0) to pH 8.2 and tested concurrently with the unadjusted Reactor 3 *C. dubia* test. There was no improvement in toxicity when the pH was adjusted downwards (Table 16). This suggests that elevated pH was likely not the primary cause of the adverse effects observed for *C. dubia* in this sample.

#### 3.3.2 Fathead minnow

In the 7-day fathead minnow test performed with sample from Reactor 3, adverse effects were observed on survival in weeks 1, 2 and 3 with resulting LC50 values of 57.3, 68.7 and 83.9%, respectively. A smaller adverse effect was observed in weeks 4 and 5, with 50% mortality occurring in the full-strength sample. The IC25 values for biomass for Reactor 3 were 34.5, 55.5, 55.1, 63.5



and 67.9% for week 1 through 5 of testing, respectively, which indicated a small decrease in toxicity over the five-week test period (Table 20; Figure 1). Similar to the early life-stage test with fathead minnows described in Section 3.1, microbial and/or bacterial growth was observed in the 50% and 100% concentrations in the week 1 and 2 samples. To counteract the effects of microbial growth associated with the sample, copper-amended sample (added at 20 µg/L) was tested separately in the site water control, 50% and 100% concentrations in addition to the standard test, for which copper was not added. These results are presented in Table 20 and illustrate that copper additions produced a small improvement in the site control and the 50% concentration when compared to the same test concentrations with no copper addition during week 3. As a result, 20 µg/L of copper was added to the site control and all concentrations for the final two weeks of testing, and microbial growth was no longer observed.

Adverse effects were observed on the survival and growth of fathead minnow in the Reactor 2 sample, resulting in LC50 and IC25 values of 96.4 and 42.7%, respectively. These results were similar to survival and growth results obtained for Reactor 3 in week 4 (Table 20). Copper was not added to the Reactor 2 sample to control for microbial growth. The pH of full-strength sample from Reactor 2 (pH of 8.3-8.7) was lower than in the full-strength sample from Reactor 3 (pH of 8.8-9.1) during the fourth week of testing.

Similar to *C. dubia*, the high pH of Reactor 3 was suspected to be a stressor to fathead minnows during the 7-day fathead minnow tests. In week 5, full-strength sample from Reactor 3 was pH adjusted daily from a pH of  $\geq 8.6$  (8.6-9.0) to a pH of  $\leq 8.6$  (8.2-8.6) and tested concurrently with the unadjusted Reactor 3 fathead minnow test. There was no improvement in toxicity when the pH was adjusted downwards (Table 20). This suggests that pH in this sample was also likely not the primary cause of the adverse effects observed with fathead minnows.

### 3.3.3 *Pseudokirchneriella subcapitata*

Adverse effects on the growth of the green algae, *P. subcapitata*, were observed during the five weeks of testing; however, toxicity was lower in the last week. IC25 values were 11.0, 5.6, 14.8, 8.9 and 50.7% over the five weeks of testing (Table 21; Figure 1). There was a higher IC25 value for *P. subcapitata* growth in Reactor 2, relative to Reactor 3, indicating a lower degree of toxicity in the Reactor 2 sample. The IC25 for Reactor 2 was 60.4% sample (Table 21).

It should be noted that although adverse effects were observed in the samples relative to the site water control, growth exceeded the performance of the laboratory water control in all concentrations and in all samples.



### 3.3.4 *Hyaella azteca*

No adverse effects were observed in sample from Reactor 3 on survival of *H. azteca*. The LC50 values over the five weeks of testing were all >100% sample. The IC25 values for *H. azteca* dry weight over the five-week testing period were 92.6, 70.1, 70.4, 92.3 and 95.5% (Table 22; Figure 1). Similar to the Reactor 3 sample, the Reactor 2 sample did not exhibit adverse effects to survival of *H. azteca* and had an LC50 of >100%. The dry weight IC25 of *H. azteca* in Reactor 2 sample was 71.6%, which was lower than Reactor 3 results obtained during the same week of testing (Table 22).



**Table 19. Reactor 2 and 3 Results (Mean  $\pm$  SD): *Ceriodaphnia dubia* survival and reproduction test.**

Concentration (% v/v)	Reactor 3 Week 1		Reactor 3 Week 2		Reactor 3 Week 3	
	Survival (%)	Reproduction	Survival (%)	Reproduction	Survival (%)	Reproduction
Laboratory Control	100	28.3 $\pm$ 9.1	100	27.4 $\pm$ 5.2	100	22.8 $\pm$ 2.7
Site Control	100	30.9 $\pm$ 6.5	100	28.3 $\pm$ 2.5	100	21.2 $\pm$ 4.5
1.6	100	33.1 $\pm$ 3.6	100	26.6 $\pm$ 2.8	100	22.3 $\pm$ 3.0
3.2	100	31.5 $\pm$ 3.4	100	26.0 $\pm$ 3.0	90	19.8 $\pm$ 6.2
6.25	100	31.3 $\pm$ 4.2	100	25.4 $\pm$ 3.3	100	20.7 $\pm$ 3.2
12.5	100	31.1 $\pm$ 3.7	100	24.9 $\pm$ 4.5	100	21.6 $\pm$ 3.5
25	90	20.7 $\pm$ 6.0	90	19.8 $\pm$ 7.8	100	20.8 $\pm$ 4.0
50	90	7.8 $\pm$ 4.1	50	7.4 $\pm$ 7.7	50	6.0 $\pm$ 3.4
100	0	0.0 $\pm$ 0.0	0	0.0 $\pm$ 0.0	0	0.0 $\pm$ 0.0
<b>Test Endpoint (% v/v)</b>						
Survival LC50 (95% CL)	61.6 (51.1 – 74.1)	--	46.7 (36.1 – 60.2)	--	46.6 (36.0 – 60.4)	--
Reproduction IC25 (95% CL)	--	20.1 (16.9 – 24.7)	--	20.7 (14.2 – 27.2)	--	30.8 (27.2 – 32.4)

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



**Table 19 (continued). Reactor 2 and 3 Results (Mean  $\pm$  SD): *Ceriodaphnia dubia* survival and reproduction test.**

Concentration (% v/v)	Reactor 3 Week 4		Reactor 2 Week 4		Reactor 3 Week 5	
	Survival (%)	Reproduction	Survival (%)	Reproduction	Survival (%)	Reproduction
Laboratory Control	100	27.2 $\pm$ 5.0	100	24.0 $\pm$ 5.7	100	30.6 $\pm$ 3.2
Site Control	90	21.7 $\pm$ 12.4	100	26.6 $\pm$ 7.5 <sup>2</sup>	100	29.5 $\pm$ 7.0
1.6	100	17.5 $\pm$ 7.4	100	26.0 $\pm$ 8.2	100	30.9 $\pm$ 3.5
3.2	100	23.8 $\pm$ 6.5	100	25.6 $\pm$ 6.6	100	25.8 $\pm$ 6.6
6.25	100	24.8 $\pm$ 5.1	100	27.2 $\pm$ 8.2	100	27.6 $\pm$ 5.7
12.5	100	21.3 $\pm$ 9.2	100	26.9 $\pm$ 8.0	100	20.5 $\pm$ 5.1
25	100	17.7 $\pm$ 9.5	100	28.6 $\pm$ 7.1	100	7.5 $\pm$ 2.8
50	90	9.5 $\pm$ 2.7	90	15.7 $\pm$ 7.5	80	4.1 $\pm$ 2.3
100	0	0.0 $\pm$ 0.0	0	0.0 $\pm$ 0.0	0	0.2 $\pm$ 0.6
100-pH adjusted <sup>1</sup>	NT	NT	NT	NT	0	0.0 $\pm$ 0.0
<b>Test Endpoint (% v/v)</b>						
Survival LC50 (95% CL)	66.7 (59.0 – 75.3)	--	66.0 (57.8 – 75.3)	--	61.6 (51.7 – 73.4)	--
Reproduction IC25 (95% CL)	--	27.8 (9.9 – 34.7)	--	38.0 (28.4 – 50.2)	--	9.9 (6.5 – 13.3)

SD = Standard Deviation, NT = Not Tested, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits.

<sup>1</sup> pH of 100% sample adjusted to 8.2 during testing using 1M HCl (not included in the lethal or reproduction test endpoint calculation).

<sup>2</sup> Site control did not meet the acceptability criteria for reproduction at termination (only 50% of adults had three broods of neonates instead of the required 60%).



**Table 20. Reactor 2 and 3 Results (Mean  $\pm$  SD): Fathead minnow (*Pimephales promelas*) survival and biomass test.**

Concentration (% v/v)	Reactor 3 Week 1		Reactor 3 Week 2		Reactor 3 Week 3	
	Survival (%)	Biomass (mg/org)	Survival (%)	Biomass (mg/org)	Survival (%)	Biomass (mg/org)
Laboratory Control	92.5 $\pm$ 9.6	0.35 $\pm$ 0.03	97.5 $\pm$ 5.0	0.32 $\pm$ 0.03	96.7 $\pm$ 5.8	0.57 $\pm$ 0.04
Site Control	97.5 $\pm$ 5.0	0.48 $\pm$ 0.05	97.5 $\pm$ 5.0	0.43 $\pm$ 0.03	76.7 $\pm$ 5.8 <sup>2</sup>	0.52 $\pm$ 0.03
1.6	92.5 $\pm$ 9.6	0.45 $\pm$ 0.02	97.5 $\pm$ 5.0	0.48 $\pm$ 0.08	76.7 $\pm$ 5.8	0.48 $\pm$ 0.01
3.2	95.0 $\pm$ 10.0	0.48 $\pm$ 0.04	100.0 $\pm$ 0.0	0.45 $\pm$ 0.04	80.0 $\pm$ 10.0	0.45 $\pm$ 0.05
6.25	92.5 $\pm$ 5.0	0.49 $\pm$ 0.03	100.0 $\pm$ 0.0	0.48 $\pm$ 0.03	66.7 $\pm$ 32.2	0.36 $\pm$ 0.15
12.5	100.0 $\pm$ 0.0	0.56 $\pm$ 0.06	100.0 $\pm$ 0.0	0.43 $\pm$ 0.04	70.0 $\pm$ 10.0	0.38 $\pm$ 0.05
25	90.0 $\pm$ 14.1	0.43 $\pm$ 0.07	95.0 $\pm$ 5.8	0.56 $\pm$ 0.07	76.7 $\pm$ 5.8	0.44 $\pm$ 0.01
50	57.5 $\pm$ 9.6	0.22 $\pm$ 0.08	75.0 $\pm$ 17.3	0.41 $\pm$ 0.13	86.7 $\pm$ 5.8	0.55 $\pm$ 0.05
100	17.5 $\pm$ 9.6	0.04 $\pm$ 0.02	20.0 $\pm$ 8.2	0.05 $\pm$ 0.02	26.7 $\pm$ 11.6	0.11 $\pm$ 0.10
Site Control (20 $\mu$ g/L Cu) <sup>1</sup>	NT	NT	NT	NT	96.7 $\pm$ 5.8	0.63 $\pm$ 0.03
50 (20 $\mu$ g/L Cu) <sup>1</sup>	NT	NT	NT	NT	96.7 $\pm$ 5.8	0.59 $\pm$ 0.07
100 (20 $\mu$ g/L Cu) <sup>1</sup>	NT	NT	NT	NT	16.7 $\pm$ 5.8	0.10 $\pm$ 0.08
<b>Test Endpoint (% v/v)</b>						
Survival LC50 (95% CL)	57.3 (47.4 – 69.2)	--	68.7 (55.1 – 85.7)	--	83.9 (72.5 – 97.1)	--
Growth IC25 (95% CL)	--	34.5 (26.7 – 41.0)	--	55.5 (27.4 – 64.0)	--	55.1 (46.7 – 65.3)

SD = Standard Deviation, NT = Not Tested, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits

<sup>1</sup> 20  $\mu$ g/L copper added to help control for microbial growth (not included in lethal or growth test endpoint calculation).

<sup>2</sup> Site control did not meet acceptability criteria of  $\geq 80\%$  for survival at termination.



**Table 20 (continued). Reactor 2 and 3 Results (Mean  $\pm$  SD): Fathead minnow (*Pimephales promelas*) survival and biomass test.**

Concentration (% v/v)	Reactor 3 Week 4 *		Reactor 2 Week 4		Reactor 3 Week 5*	
	Survival (%)	Biomass (mg/org)	Survival (%)	Biomass (mg/org)	Survival (%)	Biomass (mg/org)
Laboratory Control	87.5 $\pm$ 12.6	0.30 $\pm$ 0.02	85.0 $\pm$ 10.0	0.30 $\pm$ 0.04	100.0 $\pm$ 0.0	0.52 $\pm$ 0.03
Site Control	82.5 $\pm$ 9.6	0.32 $\pm$ 0.05	82.2 $\pm$ 16.9	0.29 $\pm$ 0.05	97.5 $\pm$ 5.0	0.41 $\pm$ 0.02
1.6	90.0 $\pm$ 11.6	0.36 $\pm$ 0.02	95.0 $\pm$ 5.8	0.31 $\pm$ 0.02	100.0 $\pm$ 0.0	0.50 $\pm$ 0.06
3.2	92.5 $\pm$ 5.0	0.38 $\pm$ 0.05	90.0 $\pm$ 14.1	0.27 $\pm$ 0.05	95.0 $\pm$ 10.0	0.48 $\pm$ 0.04
6.25	100.0 $\pm$ 0.0	0.42 $\pm$ 0.04	90.0 $\pm$ 8.2	0.29 $\pm$ 0.03	97.5 $\pm$ 5.0	0.51 $\pm$ 0.06
12.5	100.0 $\pm$ 0.0	0.46 $\pm$ 0.02	87.5 $\pm$ 18.9	0.28 $\pm$ 0.03	100.0 $\pm$ 0.0	0.49 $\pm$ 0.05
25	97.5 $\pm$ 5.0	0.38 $\pm$ 0.11	85.0 $\pm$ 5.8	0.25 $\pm$ 0.04	100.0 $\pm$ 0.0	0.50 $\pm$ 0.03
50	90.0 $\pm$ 8.2	0.39 $\pm$ 0.05	82.5 $\pm$ 9.6	0.22 $\pm$ 0.02	92.5 $\pm$ 5.0	0.50 $\pm$ 0.07
100	50.0 $\pm$ 8.2	0.11 $\pm$ 0.03	42.5 $\pm$ 18.9	0.12 $\pm$ 0.07	50.0 $\pm$ 8.2	0.21 $\pm$ 0.07
100-pH adjusted <sup>1</sup>	NT	NT	NT	NT	55.0 $\pm$ 17.3	0.17 $\pm$ 0.12
<b>Test Endpoint (% v/v)</b>						
Survival LC50 (95% CL)	>100	--	96.4 (76.5 – >100)	--	>100	--
Growth IC25 (95% CL)	--	63.5 (54.1 – 65.4)	--	42.7 (6.4 – 65.6)	--	67.9 (59.0 – 75.2)

SD = Standard Deviation, NT = Not Tested, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits

\* 20  $\mu$ g/L of copper was added to the site control and dilution concentrations to help control for microbial growth.

<sup>1</sup> pH of 100% sample adjusted to 8.2-8.6 during testing using 1M HCl (not included in lethal or growth test endpoint calculation).



**Table 21. Reactor 2 and 3 Results (Mean  $\pm$  SD): Algae (*Pseudokirchneriella subcapitata*) growth inhibition test.**

Concentration (% v/v)	Reactor 3 Week 1		Reactor 3 Week 2		Reactor 3 Week 3	
	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)
Laboratory Control	24.0 $\pm$ 2.8	--	27.8 $\pm$ 3.7	--	19.4 $\pm$ 1.4	--
Site Control	94.4 $\pm$ 8.7	--	99.9 $\pm$ 2.8	--	90.4 $\pm$ 9.5	--
1.5	94.8 $\pm$ 8.3	0.4	96.0 $\pm$ 11.9	--	85.0 $\pm$ 7.3	--
3.0	85.2 $\pm$ 7.9	--	83.8 $\pm$ 8.1	--	79.2 $\pm$ 3.3	--
6.0	85.0 $\pm$ 10.9	--	74.0 $\pm$ 2.2	--	70.0 $\pm$ 6.3	--
11.9	68.2 $\pm$ 9.3	--	70.8 $\pm$ 6.1	--	72.0 $\pm$ 7.1	--
23.8	53.8 $\pm$ 3.9	--	60.0 $\pm$ 2.2	--	67.0 $\pm$ 7.9	--
47.6	39.8 $\pm$ 3.5	--	29.5 $\pm$ 3.1	--	46.2 $\pm$ 6.1	--
95.2	26.2 $\pm$ 3.9	--	13.0 $\pm$ 0.8	--	34.0 $\pm$ 4.1	--
<b>Test Endpoint (% v/v)</b>						
Growth IC25 (95% CL)	11.0 (8.6 – 13.8)	--	5.6 (3.5 – 16.0)	--	14.8 (10.6 – 19.8)	--

SD = Standard Deviation, IC = Inhibition Concentration, CL = Confidence Limits



**Table 21 (continued). Reactor 2 and 3 Results (Mean  $\pm$  SD): Algae (*Pseudokirchneriella subcapitata*) growth inhibition test.**

Concentration (% v/v)	Reactor 3 Week 4		Reactor 2 Week 4		Reactor 3 Week 5	
	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)	Cell Yield ( $\times 10^3$ cells/mL)	Stimulation (%)
Laboratory Control	21.8 $\pm$ 1.8	--	18.6 $\pm$ 0.7	--	20.4 $\pm$ 1.7	--
Site Control	73.4 $\pm$ 3.5	--	67.2 $\pm$ 2.8	--	56.2 $\pm$ 5.4	--
1.5	72.0 $\pm$ 7.0	--	52.8 $\pm$ 5.7	--	53.2 $\pm$ 6.7	--
3.0	62.0 $\pm$ 9.2	--	55.2 $\pm$ 9.0	--	50.5 $\pm$ 2.9	--
6.0	61.2 $\pm$ 3.9	--	61.2 $\pm$ 7.1	--	51.8 $\pm$ 6.2	--
11.9	50.2 $\pm$ 7.8	--	62.5 $\pm$ 3.3	--	57.5 $\pm$ 4.0	2.2
23.8	45.5 $\pm$ 5.9	--	61.0 $\pm$ 12.2	--	54.0 $\pm$ 3.9	--
47.6	32.8 $\pm$ 2.2	--	59.8 $\pm$ 8.1	--	40.8 $\pm$ 2.1	--
95.2	20.8 $\pm$ 1.7	--	34.5 $\pm$ 3.7	--	23.8 $\pm$ 3.6	--
<b>Test Endpoint (% v/v)</b>						
Growth IC25 (95% CL)	8.9 (6.2 – 14.1)	--	60.4 (44.9 – 66.9)	--	50.7 (41.5 – 60.0)	--

SD = Standard Deviation, IC = Inhibition Concentration, CL = Confidence Limits



**Table 22. Reactor 2 and 3 Results (Mean  $\pm$  SD): *Hyalella azteca* water-only survival and growth test.**

Concentration (% v/v)	Reactor 3 Week 1		Reactor 3 Week 2		Reactor 3 Week 3	
	Survival (%)	Dry weight (mg/org)	Survival (%)	Dry weight (mg/org)	Survival (%)	Dry weight (mg/org)
Laboratory Control	96.0 $\pm$ 8.9	0.17 $\pm$ 0.05	100.0 $\pm$ 0.0	0.19 $\pm$ 0.01	96.0 $\pm$ 5.5	0.18 $\pm$ 0.01
Site Control	100.0 $\pm$ 0.0	0.22 $\pm$ 0.02	98.0 $\pm$ 4.5	0.21 $\pm$ 0.03	98.0 $\pm$ 4.5	0.24 $\pm$ 0.02
1.6	98.0 $\pm$ 4.5	0.25 $\pm$ 0.04	98.0 $\pm$ 4.5	0.21 $\pm$ 0.03	100.0 $\pm$ 0.0	0.27 $\pm$ 0.02
3.2	98.0 $\pm$ 4.5	0.26 $\pm$ 0.04	100.0 $\pm$ 0.0	0.22 $\pm$ 0.02	98.0 $\pm$ 4.5	0.26 $\pm$ 0.03
6.25	98.0 $\pm$ 4.5	0.25 $\pm$ 0.02	100.0 $\pm$ 0.0	0.24 $\pm$ 0.02	100.0 $\pm$ 0.0	0.28 $\pm$ 0.04
12.5	96.0 $\pm$ 5.5	0.28 $\pm$ 0.03	100.0 $\pm$ 0.0	0.23 $\pm$ 0.03	96.0 $\pm$ 8.9	0.27 $\pm$ 0.03
25	98.0 $\pm$ 4.5	0.27 $\pm$ 0.02	98.0 $\pm$ 4.5	0.21 $\pm$ 0.03	98.0 $\pm$ 4.5	0.25 $\pm$ 0.03
50	98.0 $\pm$ 4.5	0.25 $\pm$ 0.01	100.0 $\pm$ 0.0	0.18 $\pm$ 0.01	98.0 $\pm$ 4.5	0.23 $\pm$ 0.03
100	94.0 $\pm$ 8.9	0.18 $\pm$ 0.03	100.0 $\pm$ 0.0	0.14 $\pm$ 0.03	98.0 $\pm$ 4.5	0.14 $\pm$ 0.02
<b>Test Endpoint (% v/v)</b>						
Survival LC50	>100	--	>100	--	>100	--
Growth IC25 (95% CL)	--	92.6 (70.0 – NC)	--	70.1 (53.2 – 87.2)	--	70.4 (55.6 – 84.1)

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, NC = Not Calculable.



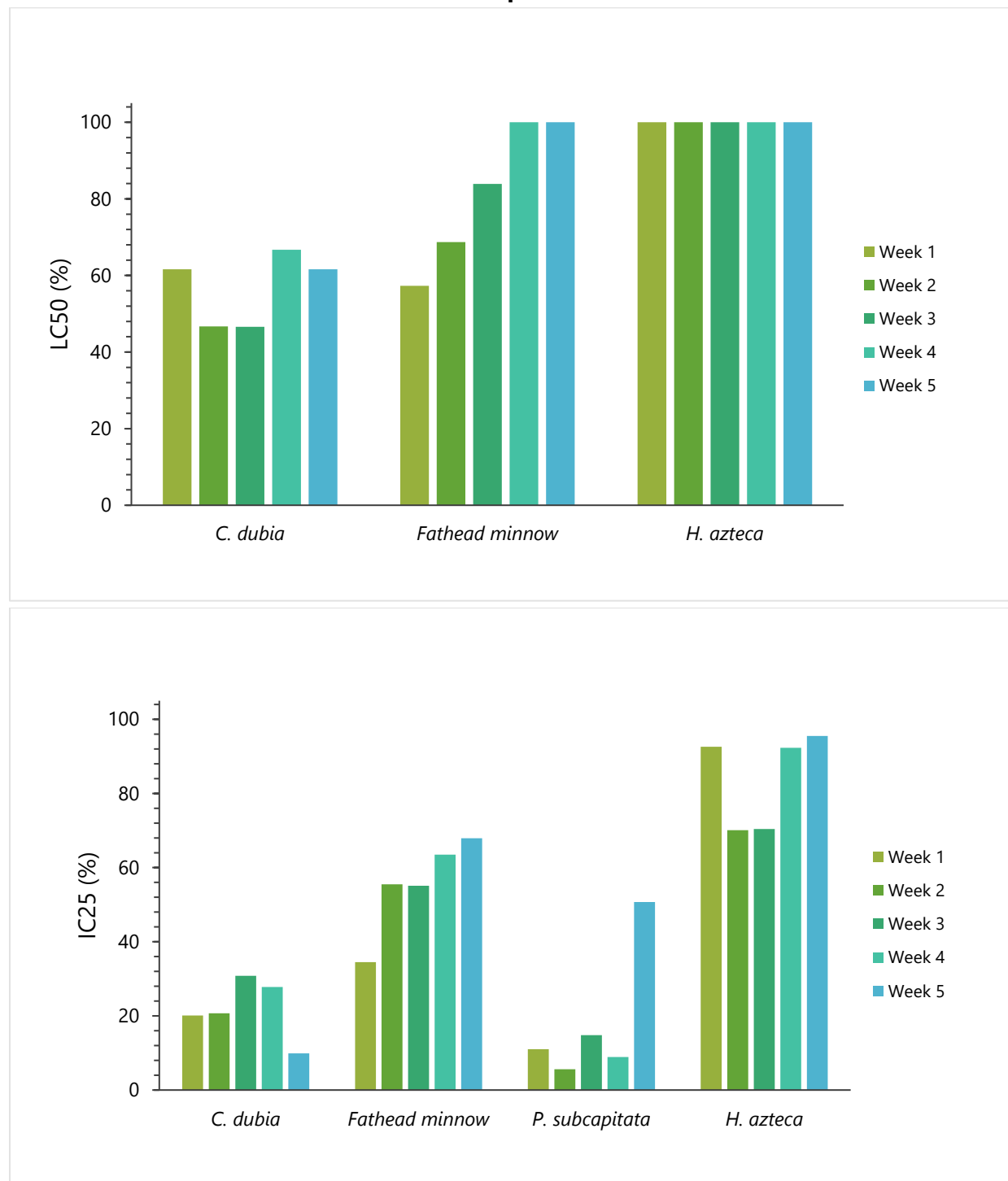
**Table 22 (continued). Reactor 2 and 3 Results (Mean  $\pm$  SD): *Hyalella azteca* water-only survival and growth test.**

Concentration (% v/v)	Reactor 3 Week 4		Reactor 2 Week 4		Reactor 3 Week 5	
	Survival (%)	Dry weight (mg/org)	Survival (%)	Dry weight (mg/org)	Survival (%)	Dry weight (mg/org)
Laboratory Control	100.0 $\pm$ 0.0	0.18 $\pm$ 0.05	100.0 $\pm$ 0.0	0.15 $\pm$ 0.05	96.0 $\pm$ 8.9	0.19 $\pm$ 0.01
Site Control	100.0 $\pm$ 0.0	0.27 $\pm$ 0.01	100.0 $\pm$ 0.0	0.22 $\pm$ 0.04	94.0 $\pm$ 8.9	0.26 $\pm$ 0.05
1.6	100.0 $\pm$ 0.0	0.27 $\pm$ 0.02	100.0 $\pm$ 0.0	0.24 $\pm$ 0.02	96.0 $\pm$ 8.9	0.25 $\pm$ 0.03
3.2	100.0 $\pm$ 0.0	0.27 $\pm$ 0.01	98.0 $\pm$ 4.5	0.24 $\pm$ 0.03	98.0 $\pm$ 4.5	0.27 $\pm$ 0.06
6.25	98.0 $\pm$ 4.5	0.28 $\pm$ 0.03	96.0 $\pm$ 8.9	0.24 $\pm$ 0.02	98.0 $\pm$ 4.5	0.28 $\pm$ 0.01
12.5	100.0 $\pm$ 0.0	0.27 $\pm$ 0.02	100.0 $\pm$ 0.0	0.23 $\pm$ 0.02	100.0 $\pm$ 0.0	0.29 $\pm$ 0.03
25	100.0 $\pm$ 0.0	0.27 $\pm$ 0.02	100.0 $\pm$ 0.0	0.21 $\pm$ 0.02	96.0 $\pm$ 5.5	0.32 $\pm$ 0.04
50	100.0 $\pm$ 0.0	0.27 $\pm$ 0.02	98.0 $\pm$ 4.5	0.21 $\pm$ 0.02	97.5 $\pm$ 5.0	0.28 $\pm$ 0.04
100	96.0 $\pm$ 5.5	0.18 $\pm$ 0.03	100.0 $\pm$ 0.0	0.13 $\pm$ 0.02	98.0 $\pm$ 4.5	0.19 $\pm$ 0.01
<b>Test Endpoint (% v/v)</b>						
Survival LC50	>100	--	>100	--	>100	--
Growth IC25 (95% CL)	--	92.3 (80.9 – >100)	--	71.6 (57.5 – 85.3)	--	95.5 (64.8 – NC)

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, NC = Not Calculable



**Figure 1. Summary of lethal and sublethal point estimates for tests performed weekly over five weeks with treated OSPW sample from Reactor 3.**





### 3.4 Toxicity tests using native species

The results of toxicity tests to evaluate toxicity of treated OSPW to native species are presented in Tables 23 to 26. In these tests, pH of the treated OSPW was approximately 8.5 in the full-strength solutions.

The results of the 28-d fingernail clam toxicity test are summarized in Table 23. Survival was adversely affected, resulting in an LC25 value of 64.8%. No adverse effects were observed on dry weight or length of surviving clams at the end of the exposure, resulting in IC25 values of >56%. There were no adverse effects on the ability to burrow as all surviving clams were observed to burrow normally at test termination.

Results of the 48-h glochidia toxicity test are summarized in Table 24. Viability of glochidia was adversely affected following 24 and 48 hours of exposure, resulting in EC25 values of 46.2% and 37.0%, respectively.

Results of the early life-stage walleye test are summarized in Tables 25 and 26. No adverse effects were observed on hatch success, resulting in an EC25 value of >100%. Adverse effects were observed on survival at day 23, resulting in LC25 values for overall and post-hatch survival of 23.2% and 24.6%, respectively (Table 25).

No adverse effects were observed on dry weight, length and normal development of larvae, resulting in IC25 and EC50 values of >100% for each endpoint; however, these results should be interpreted with caution due to poor survival in the laboratory control and test concentrations at test termination (Table 26). For all concentrations, hatch began on day 12 and was complete by day 23. At day 23, overall and post-hatch survival of hatched larvae in the laboratory control were 57 and 76%, respectively; however, the health of larvae deteriorated during the final week of exposure and by day 30 overall and post-hatch survival of the control were only 13% and 16%, respectively (Table 26).

Walleye are known to be challenging to culture under laboratory or hatchery conditions and standardized protocols have not been developed for culturing and testing. Factors such as test vessels (clear glass vessels) and control water (clear, dechlorinated tap water) may have affected swimming and feeding behaviour of larvae, as well as successful swim-bladder inflation. In the literature, attempts to rear walleye from hatch have been more successful in dark, square containers to prevent phototactic behaviour of larvae and swim-bladder inflation has been found to be more successful in turbid waters than clear waters (Clayton et al. 2009; Rieger and



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Summerfelt, 1997). Raine et al. (2017) conducted their exposure as a sediment exposure, which would have increased water turbidity and may have resulted in increased survival of hatched larvae. Based on the results presented here, further method development is required before using early life-stages of walleye in routine toxicity tests.



**Table 23. Results (Mean  $\pm$  SD): Fingernail clams (*Sphaerium* sp.) survival and growth test.**

Concentration (% v/v)	Survival (%)	Dry weight (mg/org)	Shell length (mm)
Laboratory Control	100.0 $\pm$ 0.0	5.69 $\pm$ 0.34	4.2 $\pm$ 0.2
0.32	100.0 $\pm$ 0.0	5.93 $\pm$ 0.50	4.1 $\pm$ 0.2
1.0	100.0 $\pm$ 0.0	5.59 $\pm$ 0.72	3.8 $\pm$ 0.5
3.2	100.0 $\pm$ 0.0	5.88 $\pm$ 0.36	4.1 $\pm$ 0.2
10	100.0 $\pm$ 0.0	5.37 $\pm$ 0.68	3.9 $\pm$ 0.2
32	100.0 $\pm$ 0.0	6.01 $\pm$ 0.64	4.3 $\pm$ 0.4
56	100.0 $\pm$ 0.0	5.39 $\pm$ 0.73	3.7 $\pm$ 0.6
100	0.0 $\pm$ 0.0	--	--
<b>Test endpoint (% v/v)</b>			
Survival LC50 (95% CL)	74.8 (56 – 100)	--	--
Survival LC25 (95% CL)	64.8 (56 – 100)	--	--
Growth IC25	--	>56	>56

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



**Table 24. Results (Mean  $\pm$  SD): Freshwater mussel (*Lampsilis siliquoidea*) acute viability test.**

Concentration (% v/v)	24-hour viability (%)	48-h viability (%)
Laboratory Control	97.0 $\pm$ 0.2	95.0 $\pm$ 2.4
0.32	94.9 $\pm$ 1.7	95.4 $\pm$ 1.9
1.0	95.9 $\pm$ 1.7	93.6 $\pm$ 1.6
3.2	96.7 $\pm$ 1.5	95.3 $\pm$ 1.0
10	93.4 $\pm$ 2.5	93.1 $\pm$ 1.6
32	87.9 $\pm$ 2.4	77.8 $\pm$ 9.5
56	65.0 $\pm$ 6.5	51.7 $\pm$ 13.6
100	27.8 $\pm$ 7.5	13.4 $\pm$ 4.1
<b>Test endpoint (% v/v)</b>		
Viability EC50 (95% CL)	72.7 (67.6 – 78.2)	57.0 (55.0 – 58.9)
Viability EC25 (95% CL)	46.2 (40.5 – 52.9)	37.0 (24.8 – 45.6)

SD = Standard Deviation, EC = Effect Concentration, CL = Confidence Limit



**Table 25. Results (Mean  $\pm$  SD): Walleye (*Sander vitreus*) early life stage test at 23 days.**

Concentration (%)	Hatch (%)	Average time to hatch (days)	Overall survival (%)	Post-hatch survival (%)
Laboratory control	74.7 $\pm$ 13.0	17.9 $\pm$ 0.4	57.3 $\pm$ 14.6	76.2 $\pm$ 8.1
0.32	81.3 $\pm$ 9.0	17.8 $\pm$ 0.5	68.7 $\pm$ 15.7	83.6 $\pm$ 10.7
1.0	67.3 $\pm$ 7.2	17.8 $\pm$ 0.2	51.6 $\pm$ 7.3	76.3 $\pm$ 8.5
3.2	76.7 $\pm$ 3.3	17.5 $\pm$ 0.4	62.0 $\pm$ 13.0	80.9 $\pm$ 16.6
10	78.0 $\pm$ 3.0	17.6 $\pm$ 0.2	68.0 $\pm$ 6.5	87.1 $\pm$ 6.8
32	76.7 $\pm$ 7.1	17.4 $\pm$ 0.2	42.0 $\pm$ 7.7	54.5 $\pm$ 5.7
56	76.0 $\pm$ 10.7	17.1 $\pm$ 0.1	34.7 $\pm$ 1.8	46.5 $\pm$ 8.3
100	68.7 $\pm$ 5.1	16.3 $\pm$ 0.3	28.0 $\pm$ 8.4	40.6 $\pm$ 11.2
<b>Test endpoint (% v/v)</b>				
EC50	>100	--	--	--
EC25	>100			
LC50 (95% CL)	--	--	73.8 (38.9 - >100)	>100
LC25 (95% CL)	--	--	23.2 (10.4 – 42.3)	24.6 (18.8 – 30.2)

SD = Standard Deviation, EC = Effect Concentration, LC = Lethal Concentration, CL = Confidence Limit



**Table 26. Results (Mean  $\pm$  SD): Walleye (*Sander vitreus*) early life stage test at 30 days.**

Concentration (%)	Overall survival (%)	Post-hatch survival (%)	Normality (%)	Dry weight (mg/org)	Length (mm)
Laboratory control	13.3 $\pm$ 14.9	16.1 $\pm$ 15.9	98.2 $\pm$ 4.1	0.33 $\pm$ 0.04	9.6 $\pm$ 0.4
0.32	14.7 $\pm$ 11.2	17.2 $\pm$ 11.9	81.3 $\pm$ 14.2	0.36 $\pm$ 0.03	9.5 $\pm$ 0.1
1.0	11.4 $\pm$ 9.0	16.8 $\pm$ 12.8	87.5 $\pm$ 21.7	0.32 $\pm$ 0.03	9.8 $\pm$ 0.3
3.2	11.3 $\pm$ 10.4	15.2 $\pm$ 14.3	100.0 $\pm$ 0.0	0.33 $\pm$ 0.02	9.6 $\pm$ 0.3
10	15.3 $\pm$ 12.6	19.8 $\pm$ 16.5	75.0 $\pm$ 50.0	0.36 $\pm$ 0.05	9.2 $\pm$ 0.2
32	3.3 $\pm$ 2.4	4.5 $\pm$ 3.4	100.0 $\pm$ 15.9	0.39 $\pm$ 0.03	9.1 $\pm$ 0.3
56	0.7 $\pm$ 1.5	1.1 $\pm$ 2.4	100.0	0.23	8.0
100	2.0 $\pm$ 3.0	2.9 $\pm$ 4.3	100.0 $\pm$ 15.9	0.35 $\pm$ 0.07	9.4 $\pm$ 0.5
<b>Test endpoint (% v/v)</b>					
LC50 (95% CL)	20.9 (19.2 – 22.7)	21.6 (19.7 -23.7)	>100	--	--
LC25 (95% CL)	13.2 (NC – 16.8)	14.0 (NC – 16.8)	>100	--	--
IC25	--	--	--	>100	>100

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



## 4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the test protocols. Tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests, with some exceptions which are presented below.

Sample holding times were exceeded as a result of shipping logistics for samples tested with *P. subcapitata* and *H. azteca* at the Nautilus Burnaby, BC location. These tests were initiated one day outside of the three day hold time. Additionally, Reactor 3 tests with *C. dubia* and fathead minnows (7-day test) during week 3 of testing were also conducted at the Burnaby, BC location, and were initiated one day outside of the required holding time. At the Nautilus Calgary, AB location, due to testing logistics and organism availability, the week 4 sample for Reactors 3 and 2 for the fathead minnow 7-day tests were also initiated one day outside of the specified holding time. Initiating the tests one day outside of the specified three day hold times is not expected to have impacted the results, based on the similarity of test results between the on-site and laboratory long-term fathead minnow tests. A holding time of five days is generally employed for acute toxicity tests, and all of the tests conducted here would have met that requirement, with the exception of tests that were performed in 2022 using stored sample.

Test control acceptability criteria were met in all tests conducted based on the laboratory control performance, with the exception of the early life-stage walleye test where post hatch survival at termination was <66% (ASTM, 2013; USEPA, 2016). However, the site control did not meet the acceptability criteria in two instances where the laboratory control performance was met. The first was the 7-day fathead minnow test conducted in week 3, where the site control without copper addition had survival of 77%, which was marginally below the ≥80% survival criteria. The second instance was the *C. dubia* test conducted with Reactor 2 sample in week 4. The site control in this test only had 5 organisms with three broods of neonates when it was terminated, whereas the method requires a minimum of 6 organisms with three broods of neonates over the test period. These site controls were still used, regardless, in statistical analyses of the data.

The following deviations from test methodology occurred during the test program:

- Reactor 3 (week 1): The trout test was aerated for 0.5 hours longer than required, one subsample for overlying ammonia was missed for the laboratory control at test termination for the *H. azteca* test.



- Reactor 3 (week 4): One dissolved oxygen measurement was missed at termination in the 50% sample of the *C. dubia* test.
- Reactor 3 (week 5): The number of organisms that were weighed was with the number recorded as surviving for *H. azteca*, therefore this replicate (replicate B from the 50% test concentration) was excluded from statistical analyses. The fathead minnow test was missed being fed in the afternoon on day 4.
- Reactor 2 and 3 (weeks 4 and 5): There was one less water change performed than required in the method for *H. azteca*; however, all other water chemistry parameters remained within range despite the omitted water change. Additionally, the dry weight measurements for *H. azteca* were conducted 93 hours after placing organisms in the drying oven, instead of the required 24 hours.

These deviations were relatively minor in nature and would not be expected to have an impact on the test results. Uncertainty associated with these tests is best described by the standard deviations around the means.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 27 and these tests were performed under the same conditions as those used during testing. Results for these tests fell within the acceptable range for organism performance of two standard deviations of the mean, based on historical results obtained by the laboratory with these tests, with the exception of: reproduction for one *C. dubia* test conducted on September 2, 2021, survival for one fathead minnow test conducted with the fathead minnow batch used in the early-life stage test on September 14, 2021; and survival for two concurrent tests with *H. azteca*. Both reproduction of *C. dubia* and survival of fathead minnow fell outside of two standard deviations of the historical mean. This is expected to occur in 5% of cases by chance alone. An investigation was performed and all testing and culturing procedure were followed appropriately. Reference toxicant tests for *H. azteca* in week 4 only did not meet the control validity criteria for survival; therefore, a secondary reference toxicant test using the same batch of organisms was initiated and passed successfully. These deviations did not appear to affect the test results and the tests themselves met the passing control criteria. Thus, the sensitivity of all organisms used in these tests was considered to be appropriate. No reference toxicant tests were conducted for fingernail clam (*Sphaerium* sp.), mussel glochidia (*L. siliquiodes*) or early-life stages of walleye (*S. vitreus*), as these species had been tested infrequently in the laboratory prior to this program.



**Table 27. Reference toxicant test results.**

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>C. dubia</i>	Survival (LC50): 2.1 (2.0-2.2) g/L NaCl	1.8 (1.5-2.1)	6	September 6, 2021
	Reproduction (IC50): 1.8 (1.8-1.9) g/L NaCl	1.5 (1.3-1.8)	5	
	Survival (LC50): 1.9 (1.7-2.1) g/L NaCl	1.8 (1.5-2.1)	5	October 4, 2021
	Reproduction (IC50): 1.6 (1.5-1.7) g/L NaCl	1.5 (1.3-1.9)	6	
	Survival (LC50): 2.0 (1.7-2.3) g/L NaCl	2.0 (1.8-2.2)	5	October 5, 2021
	Reproduction (IC50): 1.7 (1.3-1.9) g/L NaCl	1.8 (1.4-2.2)	12	
<i>O. mykiss</i>	Survival (LC50): 4.0 (3.7-4.4) g/L KCl	3.6 (2.8-4.6)	8	September 2, 2021
	Survival (LC50): 3.5 (3.0- 3.8) g/L KCl	3.6 (2.7-4.7)	9	September 15, 2021
	Survival (LC50): 3.3 (3.1-3.6) g/L KCl	3.5 (2.7-4.6)	9	September 22, 2021
	Survival (LC50): 3.7 (2.2-4.1)	3.5 (2.7-4.6)	9	October 8, 2021
<i>D. magna</i>	Survival (LC50): 6.7 (6.4-6.9) g/L NaCl	6.3 (5.5-7.1)	4	September 20, 2021
	Survival (LC50): 6.5 (6.0-7.0) g/L NaCl	6.3 (5.5-7.1)	4	October 1, 2021
<i>P. promelas</i>	Survival (LC50): 5.3 (4.6-6.3) g/L NaCl	6.2 (4.1-9.3)	14	September 9, 2021
	Biomass (IC25): 3.2 (2.5-4.6) g/L NaCl	3.6 (2.3-5.7)	15	
	Survival (LC50): 6.1 (5.2-7.0) g/L NaCl	6.1 (4.0-9.4)	14	September 15, 2021
	Biomass (IC25): 4.1 (3.9-4.3) g/L NaCl	3.6 (2.2-5.7)	16	
	Survival (LC50): 4.1 (3.3-4.9) g/L NaCl	5.0 (3.8-6.5)	14	September 23, 2021
	Biomass (IC50): 3.5 (2.2-4.6) g/L NaCl	4.3 (3.3-5.6)	14	
	Survival (LC50): 5.3 (4.6-6.2) g/L NaCl	6.0 (3.9-9.4)	15	October 1, 2021
	Biomass (IC25): 3.4 (2.7-3.9) g/L NaCl	3.5 (2.2-5.6)	16	
	Survival (LC50): 6.3 (5.3-7.5) g/L NaCl	6.0 (3.8-9.3)	15	October 8, 2021
	Biomass (IC25): 3.8 (2.6-5.2) g/L NaCl	3.5 (2.2-5.6)	16	
<i>P. promelas</i> (early life-stage)	Survival (LC50): 3.6 (3.0-4.2) g/L NaCl	6.1 (4.0-9.4)	14	September 14, 2021
	Biomass (IC25): 2.6 (2.3-2.7) g/L NaCl	3.6 (2.2-5.7)	16	

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



**Table 27 (continued). Reference toxicity test results**

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>P. subcapitata</i>	Growth (IC50): 32.5 (29.0-35.6) µg/L Zn	31.8 (26.4-38.4)	9	September 1, 2021
	Growth (IC50): 30.2 (26.5-34.2) µg/L Zn	31.8 (26.4-38.4)	9	September 30, 2021
<i>H. azteca</i>	Survival (LC50): 4.6 (4.1-5.3) g/L NaCl	6.4 (4.1-10.1)	23	September 10, 2021
	Survival (LC50): 4.6 (4.1-5.3) g/L NaCl	6.5 (4.1-10.1)	23	September 16, 2021
	Survival (LC50): 6.1 (4.9-7.5) g/L NaCl	6.4 (4.1-10.1)	23	September 23, 2021
	Survival (LC50): 6.6 (5.3-8.1) g/L NaCl	6.3 (4.1-9.6)	22	October 4, 2021
	Survival (LC50): 6.7 (5.0-9.1) g/L NaCl	6.2 (4.2-9.2)	20	October 7, 2021

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



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## 5.0 REFERENCES

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## **APPENDIX A - Long-term Fathead Minnow (*Pimephales promelas*) Toxicity Test Data**



## **APPENDIX A - Long-term Fathead Minnow (*Pimephales promelas*) Toxicity Test Data**



# 28-d Fathead Minnow Freshwater Toxicity Test

## Initial and Final Water Quality Measurements

Client:

Sample ID:

Work Order #:

Hatfield / Synovate  
Treated OSPW  
Tox Trailer - T101

Start Date & Time:

Stop Date & Time:

Test Species:

Sept 4/21 @ 1300h  
Oct 2/21 @ 1300h  
Pimephales promelas

Site Control Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.5	25.0	24.5	24.5	24.5	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	—	—	—	—	—	—	7.7	7.6	7.7	7.6	7.8	7.6	7.9	7.4
pH	8.5	8.3	8.3	8.2	8.5	8.1	8.4	8.1	8.5	8.2	8.5	8.4	8.4	8.3
Cond. (µS/cm)	311	—	323	307	348	311	316	—	322	—	321	—	318	—
Initials	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—

0.32% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	25.0	25.0	24.5	25.0	25.0	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	—	—	—	—	—	—	7.7	7.6	7.7	7.6	7.8	7.6	7.9	7.5
pH	8.6	8.3	8.4	8.2	8.5	8.2	8.5	8.1	8.5	8.3	8.5	8.5	8.4	8.3
Cond. (µS/cm)	320	—	335	323	327	—	326	—	329	—	330	—	326	—
Initials	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—

1.0% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	25.0	25.0	24.5	25.0	25.0	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	—	—	—	—	—	—	7.7	7.6	7.6	7.6	7.9	7.5	7.9	7.3
pH	8.6	8.3	8.4	8.2	8.5	8.2	8.5	8.1	8.5	8.3	8.5	8.4	8.4	8.3
Cond. (µS/cm)	340	—	335	—	339	—	349	—	349	—	350	—	348	—
Initials	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—

3.2% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	25.0	25.0	24.5	25.0	25.0	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	—	—	—	—	—	—	7.6	7.5	7.7	7.5	7.9	7.6	7.9	7.3
pH	8.3	8.3	8.5	8.2	8.6	8.2	8.6	8.1	8.6	8.3	8.6	8.4	8.4	8.3
Cond. (µS/cm)	402	—	396	—	402	—	404	—	413	—	419	—	417	—
Initials	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—	CMP	—

Thermometer: TC-1

DO meter/probe: TD0-1

pH meter/probe: TPH-1

Conductivity meter/probe: TC-1

	Site Control	100%		
Hardness*	128	402		
Alkalinity*	110	84		

\* mg/L as CaCO3

Analysts: CMP/SS/KSL

Reviewed by: [Signature]

Date reviewed: Nov 16, 2021

Sample Description:

Comments:



# 28-d Fathead Minnow Freshwater Toxicity Test

## Initial and Final Water Quality Measurements

Client: Hatfield / Syncrude  
 Sample ID: Treated OSRW  
 Work Order #: Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300 h  
 Stop Date & Time: Oct 2/21 @ 1300 h  
 Test Species: Pimephales promelas

10% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	-	-	-	-	-	-	7.6	7.6	7.7	7.5	7.9	7.6	7.9	7.3
pH	8.8	8.4	8.6	8.2	8.7	8.4	8.9	8.4	8.8	8.3	8.8	8.5	8.5	8.3
Cond. (µS/cm)	643	-	602	-	595	-	607	-	609	-	617	-	608	-
Initials	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-

32% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.5	26.0	25.5
DO (mg/L)	-	-	-	-	-	-	7.7	7.5	7.7	7.6	7.9	7.6	7.9	7.4
pH	9.0	8.6	8.8	8.5	8.9	8.5	9.0	8.4	8.8	8.4	8.8	8.6	8.6	8.4
Cond. (µS/cm)	1196	-	1217	-	1219	-	1192	-	1235	-	1238	-	1242	-
Initials	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-

100% Concentration	Days													
	1		2		3		4		5		6		7	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.0	25.0	25.5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.5	25.5	25.5
DO (mg/L)	-	-	-	-	-	-	7.7	7.6	7.7	7.5	7.9	7.6	8.0	7.3
pH	9.3	9.0	9.0	8.8	9.1	8.8	9.1	8.6	9.0	8.7	9.1	8.8	9.1	8.8
Cond. (µS/cm)	3190	-	3130	-	3170	-	3130	-	3170	-	3160	-	3250	-
Initials	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-	CMP	-

Concentration	Days													
	1		2		3		4		5		6		7	
	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: TC-1 DO meter/probe: DO-1 pH meter/probe: TPH-1 Conductivity meter/probe: TC-1

	Control	100%		
Hardness*	128	402		
Alkalinity*	110	84		

Analysts: CMP/SS/KSL

Reviewed by: [Signature]  
 Date reviewed: Nov 16 2021

\* mg/L as CaCO3

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# 28-d Fathead Minnow Freshwater Toxicity Test

## Initial and Final Water Quality Measurements

Client:

Hatfield / Syncrude

Sample ID:

Treated OSPW

Work Order #:

Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300h

Stop Date & Time: Oct 2/21 @ 1300h

Test Species: Pimephales promelas

Site Control Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	24.5	25.0	24.0	24.0	24.5	25.0	24.5	24.0	24.0	24.0	24.0	26.0	25.0
DO (mg/L)	7.9	8.1	8.0	8.3	8.3	8.2	7.9	8.3	8.3	8.2	8.3	8.3	8.2	7.9
pH	8.4	8.3	8.2	8.4	8.3	8.1	8.5	8.5	8.3	8.1	8.1	8.3	8.2	8.1
Cond. (µS/cm)	307		301		267		327		313		315		318	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

0.32 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	24.5	25.0	24.0	24.0	24.5	25.0	24.0	24.0	24.0	24.0	24.0	26.0	25.0
DO (mg/L)	7.9	8.1	7.9	8.2	8.3	7.9	7.7	8.3	8.2	8.1	8.3	8.3	8.3	7.8
pH	8.5	8.3	8.4	8.5	8.3	8.1	8.5	8.5	8.3	8.1	8.4	8.3	8.3	8.3
Cond. (µS/cm)	315		316		332		329		319		320		326	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

1.0 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.0	24.0	24.5	25.0	24.0	24.0	24.0	24.0	24.0	26.0	25.0
DO (mg/L)	7.9	8.0	7.9	7.9	8.2	7.7	7.7	7.9	8.1	8.2	8.3	8.3	8.4	7.8
pH	8.9	8.3	8.9	8.5	8.8	8.3	8.5	8.5	8.4	8.1	8.4	8.2	8.4	8.3
Cond. (µS/cm)	338		338		356		352		342		345		349	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

3.2 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.0	24.0	24.5	25.0	24.5	24.0	24.0	24.0	24.0	26.0	25.0
DO (mg/L)	7.9	7.8	7.9	7.9	8.2	7.9	7.8	7.8	8.1	8.1	8.2	8.3	8.5	7.9
pH	8.9	8.4	9.2	8.6	8.9	8.6	8.6	8.6	8.5	8.2	8.6	8.2	8.5	8.3
Cond. (µS/cm)	399		398		425		420		407		411		419	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

Thermometer: TC1

DO meter/probe: DO1, 1

pH meter/probe: TPH, 1

Conductivity meter/probe: TC, 1

	Control	100%		
Hardness*	128	402		
Alkalinity*	110	84		

\* mg/L as CaCO3

Analysts: CMP/SS/KSL

Reviewed by: [Signature]  
Date reviewed: Nov 16, 2021

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# **28-d Fathead Minnow Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client: Hatfield Synco  
 Sample ID: Treated OSPW  
 Work Order #: Tox Trailer - 1101

Start Date & Time: Sept 4/21 @ 1300h  
 Stop Date & Time: Oct 2/21 @ 1300h  
 Test Species: Pimephales promelas

10 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.0	24.0	24.0	25.0	24.0	24.0	24.0	24.0	24.0	26.0	24.5
DO (mg/L)	7.9	7.8	8.0	7.9	8.2	7.9	7.8	7.9	8.1	8.1	8.2	8.3	8.8	7.8
pH	9.1	8.4	9.3	8.6	8.9	8.5	8.9	8.6	8.6	8.3	8.5	8.7	8.9	8.8
Cond. (µS/cm)	591		592		644		634		630		621		630	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

32 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.0	24.0	24.0	25.0	24.0	24.0	24.0	24.0	24.0	26.0	24.5
DO (mg/L)	7.9	7.8	8.0	7.9	8.2	7.9	7.8	8.0	8.1	8.2	8.2	8.3	8.8	7.8
pH	9.2	8.6	9.4	9.1	8.9	9.4	9.2	8.7	8.8	8.4	8.9	8.4	9.0	8.5
Cond. (µS/cm)	1003		1227		1317		1332		1317		1290		1306	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

100 % Concentration	Days													
	8		9		10		11		12		13		14	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.5	25.0	25.0	24.0	25.0	24.5	24.5	24.5	24.5	24.0	24.5	24.0	26.0	25.0
DO (mg/L)	7.8	7.8	8.0	7.9	8.2	7.8	7.8	8.0	8.1	8.2	8.2	8.3	8.8	7.9
pH	9.5	8.7	9.5	9.2	9.4	9.6	9.4	9.0	9.0	8.9	9.1	8.8	9.2	8.9
Cond. (µS/cm)	3180		3170		3390		3390		3300		3330		3300	
Initials	KJL		KJL		KJL		KJL		KJL		KJL		KJL	

Concentration	Days													
	8		9		10		11		12		13		14	
	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: TC-1 DO meter/probe: TDO-1 pH meter/probe: TPH-1 Conductivity meter/probe: TC-1

	Control	100%		
Hardness*	128	402		
Alkalinity*	110	84		

\* mg/L as CaCO3

Analysts: CMP/SS/KSL

Reviewed by: [Signature]  
 Date reviewed: Nov 16, 2021

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# **28-d Fathead Minnow Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client: Hatfield / Synco  
Sample ID: Treated OSPW  
Work Order #: Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300 h  
Stop Date & Time: Oct 2/21 @ 1300 h  
Test Species: Pimephales promelas

Site Control Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	25.0	24.0	24.0	24.0	24.0	23.0	23.5	25.0	23.5	23.5	24.0	23.0	24.0	24.0
DO (mg/L)	8.1	8.2	8.1	7.9	8.2	8.1	8.1	7.5	8.0	7.9	7.9	7.8	7.9	7.5
pH	8.3	8.2	8.2	8.1	8.3	8.1	8.2	8.12	8.0	8.0	8.2	8.2	8.3	8.2
Cond. (µS/cm)	289		322		298		331		331		328		330	
Initials	KJN		SS		SS		SS		SS		SS		SS	

0.32% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.5	24.0	24.0	24.0	23.5	23.0	25.5	25.0	24.0	23.5	23.5	23.0	25.0	24.0
DO (mg/L)	8.2	8.2	8.2	7.9	8.2	7.8	7.7	7.5	8.0	7.6	7.9	8.1	7.7	7.4
pH	8.3	8.2	8.2	8.1	8.4	8.1	8.3	8.1	8.2	7.8	8.3	8.2	8.3	8.3
Cond. (µS/cm)	297		332		308		343		341		335		341	
Initials	KJN		SS		SS		SS		SS		SS		SS	

1.0% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.5	24.0	24.0	24.0	24.0	23.0	25.5	25.0	24.0	23.5	24.0	23.0	25.0	24.0
DO (mg/L)	7.9	8.2	8.2	7.9	8.1	7.9	7.6	7.5	7.9	7.4	7.8	7.8	7.7	7.5
pH	8.4	8.3	8.3	8.2	8.4	8.1	8.3	8.1	8.3	8.0	8.4	8.2	8.4	8.2
Cond. (µS/cm)	318		355		327		365		362		361		366	
Initials	KJN		SS		SS		SS		SS		SS		SS	

3.2% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.5	24.0	24.0	24.0	24.0	23.0	25.5	25.0	24.0	23.5	24.0	23.0	25.0	24.0
DO (mg/L)	7.8	8.2	8.2	7.9	8.1	7.8	7.6	7.3	7.9	7.6	7.8	7.7	7.7	7.4
pH	8.4	8.3	8.3	8.2	8.5	8.2	8.4	8.1	8.3	8.1	8.5	8.3	8.6	8.3
Cond. (µS/cm)	383		420		389		435		435		429		437	
Initials	KJN		SS		SS		SS		SS		SS		SS	

Thermometer: TC-1 DO meter/probe: TDO / 1 pH meter/probe: PH / 1 Conductivity meter/probe: TC / 1

	Control	100%
Hardness*	128	402
Alkalinity*	110	84

\* mg/L as CaCO<sub>3</sub>

Analysts: CMR/SS/KSL  
Reviewed by: [Signature]  
Date reviewed: NP 16, 2/21

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# **28-d Fathead Minnow Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client:  
Sample ID:  
Work Order #:

Hatfield/Syncrude  
Treated OSPW  
Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300h  
Stop Date & Time: Oct 2/21 @ 1300h  
Test Species: Pimephales promelas

10% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	23.0	25.5	25.0	24.0	23.5	24.0	23.0	25.0	24.0
DO (mg/L)	8.0	8.2	8.2	7.9	8.1	8.0	7.6	7.4	7.9	7.7	7.8	7.7	7.7	7.4
pH	8.6	8.3	8.5	8.5	8.6	8.3	8.4	8.1	8.5	8.2	8.7	8.3	8.8	8.4
Cond. (µS/cm)	563		621		574		634		636		635		642	
Initials	KL		SS		SS		SS		SS		SS		SS	

32% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.0	24.0	24.0	24.0	24.0	23.0	25.5	25.0	24.0	23.5	24.0	23.0	25.0	24.0
DO (mg/L)	8.0	8.1	8.2	7.9	8.1	7.8	7.5	7.3	7.9	7.6	7.8	7.7	7.7	7.4
pH	8.9	8.4	8.7	8.8	8.8	8.4	8.7	8.2	8.6	8.3	8.9	8.5	8.9	8.5
Cond. (µS/cm)	1172		1279		1160		1278		1283		1280		1299	
Initials	KL		SS		SS		SS		SS		SS		SS	

100% Concentration	Days													
	15		16		17		18		19		20		21	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	24.0	24.0	24.0	24.0	25.0	23.0	26.0	25.0	25.0	23.5	24.0	23.0	25.0	24.0
DO (mg/L)	8.1	8.1	8.2	7.9	7.8	7.9	7.5	7.3	7.7	7.5	6.9	7.7	7.7	7.1
pH	9.1	8.7	8.9	8.7	9.0	8.7	8.9	8.5	8.9	8.5	9.0	8.7	9.1	8.9
Cond. (µS/cm)	2960		3300		2980		3290		3280		3230		3310	
Initials	KL		SS		SS		SS		SS		SS		SS	

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: TC-1 DO meter/probe: DO-1 pH meter/probe: TPH-1 Conductivity meter/probe: TC-1

Site: TDO  
Control: 100%  
128  
110

Analysts: CMP/SS/KSL  
Reviewed by: [Signature]  
Date reviewed: Nov. 16, 2021

\* mg/L as CaCO<sub>3</sub>

Sample Description:

Comments: \* day 20 DO - 100% OSPW not aerating well overnight



# **28-d Fathead Minnow Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client: Hatfield/Syncrude  
 Sample ID: Treated OSPW  
 Work Order #: TOX Trailer - T101

Start Date & Time: Sept 4/21 @ 1300  
 Stop Date & Time: Oct 2/21 @ 1300  
 Test Species: Pimephales promelas

Site Control Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	22.0	23.0	24.5	24.0	25.0	24.5	25.0	24.5	24.5	25.0	25.0	25.0	/	25.0
DO (mg/L)	8.0	8.0	7.7	7.8	7.8	7.7	7.7	7.6	7.8	7.7	7.8	7.7	/	7.7
pH	8.3	8.2	8.3	8.1	8.4	8.2	8.3	8.1	8.4	8.2	8.3	8.1	/	8.2
Cond. (µS/cm)	334		337		321		324		344		339		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

0.32% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	22.5	23.5	24.5	24.0	25.0	24.5	25.0	24.5	25.0	24.5	25.0	25.0	/	25.0
DO (mg/L)	7.8	7.8	7.6	7.7	7.8	7.7	7.7	7.7	7.8	7.6	7.8	7.6	/	7.6
pH	8.3	8.2	8.3	8.1	8.5	8.2	8.4	8.2	8.4	8.2	8.4	8.1	/	8.2
Cond. (µS/cm)	343		341		334		337		347		344		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

1.0% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	22.5	23.5	24.5	24.0	25.0	24.5	25.0	24.5	25.0	24.5	25.0	25.0	/	25.0
DO (mg/L)	7.8	7.8	7.6	7.7	7.8	7.7	7.7	7.6	7.7	7.5	7.8	7.7	/	7.7
pH	8.4	8.2	8.3	8.2	8.5	8.3	8.5	8.3	8.5	8.2	8.5	8.2	/	8.3
Cond. (µS/cm)	366		371		356		361		369		371		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

3.2% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	22.0	23.0	24.5	24.0	25.0	24.5	25.0	24.5	25.0	25.0	25.0	25.0	/	25.0
DO (mg/L)	7.8	7.8	7.7	7.8	7.8	7.8	7.7	7.7	7.7	7.6	7.8	7.8	/	7.7
pH	8.6	8.3	8.5	8.3	8.5	8.3	8.5	8.3	8.5	8.3	8.5	8.2	/	8.3
Cond. (µS/cm)	431		411		407		409		440		427		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

Thermometer: TC-1 DO meter/probe: TDO-1 pH meter/probe: TPH-1 Conductivity meter/probe: TC-1

	Control	100%		
Hardness*	136	408		
Alkalinity*	110	84		

\* mg/L as CaCO<sub>3</sub>

Analysts: CML/SS/KSL

Reviewed by: [Signature]  
 Date reviewed: Nov 16, 2021

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# 28-d Fathead Minnow Freshwater Toxicity Test

## Initial and Final Water Quality Measurements

Client: Hatfield/Syncrude  
 Sample ID: Treated OSPW  
 Work Order #: Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300h  
 Stop Date & Time: Oct 2/21 @ 1300h  
 Test Species: Pimephales promelas

100% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	23.0	23.0	24.5	24.0	25.0	24.5	25.0	24.5	25.0	24.5	25.0	25.0	/	25.0
DO (mg/L)	8.8	7.8	7.7	7.8	7.8	7.7	7.7	7.6	7.8	7.6	7.8	7.8	/	7.7
pH	8.7	8.4	8.8	8.5	9.0	8.6	8.9	8.6	8.6	8.6	8.7	8.4	/	8.5
Cond. (µS/cm)	640		641		631		637		650		647		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

32% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	23.0	23.0	24.5	24.0	25.0	24.5	25.0	24.5	25.0	24.5	25.0	25.0	/	25.0
DO (mg/L)	8.8	7.8	7.7	7.7	7.8	7.8	7.8	7.7	7.8	7.6	7.7	7.7	/	7.7
pH	8.9	8.5	8.9	8.6	9.1	8.7	9.0	8.7	8.8	8.6	8.8	8.5	/	8.6
Cond. (µS/cm)	1291		1275		1267		1288		1300		1295		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

100% Concentration	Days													
	22		23		24		25		26		27		28	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	23.0	23.0	24.5	24.0	25.0	24.5	25.0	24.5	25.0	24.5	25.0	25.0	/	25.0
DO (mg/L)	8.8	7.8	7.7	7.8	7.8	7.7	7.9	7.7	7.9	7.7	7.9	7.8	/	7.7
pH	9.1	8.9	9.1	8.9	9.3	8.9	9.2	9.0	9.0	8.8	9.1	8.8	/	8.9
Cond. (µS/cm)	3310		3290		3270		3220		3280		3290		-	
Initials	SS		CML		CML		CML		CML		CML		CML	

Concentration	Days													
	22		23		24		25		26		27		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: TC-1 DO meter/probe: TDO-1 pH meter/probe: TPH-1 Conductivity meter/probe: TC-1

	Control	100%		
Hardness*	136	408		
Alkalinity*	110	84		

\* mg/L as CaCO<sub>3</sub>

Analysts: CML/SS/KSL

Reviewed by: [Signature]  
 Date reviewed: Nov 16, 2021

Sample Description: \_\_\_\_\_

Comments: \_\_\_\_\_



# 28-d Fathead Minnow Toxicity Test Daily Survival

Client:

Sample ID:

Work Order #:

Hatfield/Syncrude

Treated OSPW

Tox-trailer - T101

Start Date & Time:

Stop Date & Time:

Test Species:

Sept 4/21 @ 1300h

Sept Oct 2/21 @ 1300h

Pimephales promelas

Concentration (%V/V)	Rep	Day of Test - No. of Survivors							Comments
		1	2	3	4	5	6	7	
Site Control	A	10	10	10	10	10	10	10	
	B								
	C								
	D								
0.32	A								
	B								
	C								
	D								
1.0	A								
	B								
	C								
	D								
3.2	A								
	B								
	C								
	D								
10	A								
	B								
	C								
	D								
32	A								
	B								
	C								
	D								
100	A								
	B								
	C								
	D								
	A								
	B								
	C								
	D								
Tech Initials		CMP	CMP	CMP	CMP	CMP	CMP	CMP	

Comments:

Reviewed by:

Date reviewed:

Nov 16, 2021



# 28-d Fathead Minnow Toxicity Test Daily Survival

Client:

Sample ID:

Work Order #:

Hatfield <sup>Synchrade</sup> ~~Golder~~  
Treated DSPW  
Tox Trailer - T101

Start Date & Time:

Stop Date & Time:

Test Species:

Sept 4/21 @ 1300h  
Oct 2/21 @ 1300h  
Pimephales promelas

Concentration (%v/v)	Rep	Day of Test - No. of Survivors							Comments
		18	19	20	21	22	23	24	
Site Control	A	10	10	10	10	10	10	10	
	B								
	C								
	D								
0.32	A								
	B								
	C								
	D								
1.0	A								
	B								
	C								
	D								
3.2	A								
	B								
	C								
	D								
10	A								
	B								
	C								
	D								
32	A								
	B								
	C								
	D								
100	A	1	1	1	10	10	10	1	
	B	9	8	8	8	8	7	7	
	C	10	10	10	10	10	10	10	
	D	10	10	9	8	8	8	7	
	A								
	B								
	C								
	D								
Tech Initials		CMF	KJU	KZ	KZ	KZ	KZ	KZ	

Comments:

① 1 fish looks moribund

Reviewed by:

Date reviewed:

NN-16,2021



# **28-d Fathead Minnow Toxicity Test Daily Survival**

Client:  
Sample ID:  
Work Order #:

Hatfield/Syncrude  
Treated OSW  
TOX Trailer - T101

Start Date & Time:

Sept 4/21 @ Booth

Stop Date & Time:

Oct 2/21 @ Booth

Test Species:

Pimephales promelas

Concentration (%OV/V)	Rep	Day of Test - No. of Survivors							Comments
		1/5	2/6	3/7	4/8	5/9	6/20	7/21	
Site Control	A	10	10	10	10	10	10	10	
	B								
	C								
	D								
0.32	A								
	B								
	C								
	D								
1.0	A								
	B								
	C								
	D								
3.2	A								
	B								
	C								
	D								
10	A								
	B								
	C								
	D								
32	A								
	B								
	C								
	D								
100	A	9	9	8(1)	7	7	6	3	
	B	7	7	7	7(1)	6	6	6	
	C	10	10	9	9	9	9(1)	7	
	D	7	7(1)	6	6	6	6(1)	4	
	A								
	B								
	C								
	D								
Tech Initials		SS	SS	SS	SS	SS	SS	SS	

Comments:

Reviewed by:



Date reviewed:

Nov 16, 2021



# **28-d Fathead Minnow Toxicity Test Daily Survival**

Client:  
Sample ID:  
Work Order #:

Hatfield/Syncrude  
Treated OSPW  
Tox Trailer - T101

Start Date & Time: Sept 4/21 @ 1300h  
Stop Date & Time: Oct 2/21 @ 1300h  
Test Species: Pimephales promelas

Concentration (% V/V)	Rep	Day of Test - No. of Survivors							Comments
		1/22	2/23	3/24	4/25	5/26	6/27	7/28	
Site Control	A	10	10	10	10	10	10	10	
	B								
	C								
	D								
0.32	A								
	B								
	C								
	D								
1.0	A								
	B								
	C								
	D								
3.2	A								
	B								
	C								
	D								
10	A								
	B								
	C								
	D								
32	A								
	B								
	C								
	D	↓	↓	↓	↓	↓	↓	↓	
100	A	5	4	4	4	4	4	4	
	B	6	6	6	5	5	5	5	
	C	7	7	7	5	5	4	4	
	D	4	3	3	3	3	3	3	
	A								
	B								
	C								
	D								
Tech Initials		SS	CMP	CMP	CMP	CMP	CMP	CMP	

Comments:

Reviewed by:

[Signature]

Date reviewed:

Nov. 16, 2021



Client: Hattfield / Synchrude  
 Sample ID: Treated OSPW  
 Work order: Tox Trailer - T101

Start Date: Sept 4/21 @ 1300  
 Stop Date: Oct 2/21 @ 130  
 Test Species: Pimephales promelas

Replicate	Fish no.	Site Control		0.32%		1.00%		3.20%	
		Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
A	1	24	0.14	31	0.35	33	0.46	20	0.12
	2	32	0.36	25	0.18	28	0.24	26	0.24
	3	30	0.30	34	0.46	27	0.20	25	0.20
	4	30	0.34	27	0.31	29	0.28	32	0.41
	5	28	0.23	26	0.19	27	0.19	26	0.26
	6	28	0.25	28	0.26	24	0.17	26	0.24
	7	27	0.24	30	0.32	23	0.16	25	0.17
	8	25	0.18	35	0.50	30	0.36	28	0.32
	9	29	0.33	26	0.20	22	0.14	26	0.25
	10	33	0.50	26	0.26	26	0.22	33	0.39
B	1 *	34	0.56	34	0.60	29	0.30	28 33	0.48
	2	30	0.35	32	0.39	33	0.47	20	0.12
	3	27	0.26	29	0.29	31	0.41	33	0.43
	4	24	0.17	32	0.42	27	0.24	23	0.19
	5	23	0.15	32	0.38	29	0.30	23	0.15
	6	24	0.19	33	0.48	27	0.23	33	0.35
	7	23	0.19	27	0.22	29	0.20	32	0.33
	8	31	0.32	32	0.44	31	0.35	27	0.23
	9 *	33	0.45	29	0.35	27	0.28	38	0.70
	10	32	0.42	22	0.13	28	0.32	32	0.41
C	1	28	0.23	28	0.31	26	0.22	31	0.39
	2	28	0.28	29	0.32	30	0.32	30	0.39
	3	29	0.24	33	0.46	30	0.28	29	0.33
	4 *	36	0.49	28	0.27	28	0.27	28	0.24
	5	27	0.24	31	0.35	27	0.29	32	0.42
	6	32	0.36	30	0.34	29	0.36	30	0.34
	7 *	35	0.49	31	0.36	29	0.28	23	0.15
	8	27	0.22	29	0.29	28	0.30	31	0.31
	9	30	0.27	31	0.29	24	0.15	32	0.43
	10	27	0.17	30	0.23	29	0.33	25	0.18
D	1	32	0.33	29	0.29	32	0.39	30	0.29
	2	31	0.40	26	0.18	36	0.55	28	0.26
	3	29	0.29	33	0.50	25	0.20	28	0.23
	4	28	0.28	25	0.20	31	0.32	38	0.64
	5	31	0.37	30	0.37	34	0.56	30	0.35
	6	31	0.36	26	0.23	28	0.23	27	0.24
	7	28	0.35	31	0.41	34	0.50	31	0.45
	8	32	0.34	38	0.72	32	0.43	26	0.23
	9	29	0.29	36	0.53	32	0.39	31	0.36
	10	31	0.37	24	0.18	21	0.12	32	0.44

Used for Histo (1) Redness around gills

NN 17/21



Client: Hatfield / Synovate  
 Sample ID: Treated OSPW  
 Work Order: Tox Trailer - T101

Start Date: Sept 11/21 @ 1500  
 Stop Date: Oct 2/21 @ 1300  
 Test Species: Pimephales promelas

Replicate	Fish no.	10%		32%		100%	
		Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
A	1	26	0.24	37	0.58	27	0.26
	2	32	0.43	33	0.42	28	0.26
	3	36	0.52	30	0.30	20	0.09
	4	25	0.22	27	0.27	18	0.07
	5	24	0.14	25	0.16		
	6	34	0.52	29	0.28		
	7	28	0.28	31	0.32		
	8	25	0.19	32	0.35		
	9	26	0.17	28	0.24		
	10	27	0.20	28	0.27		
B	1	33	0.62	31	0.32	32	0.36
	2	26	0.19	33	0.46	24	0.08
	3	33	0.40	34	0.38	26	0.16
	4	25	0.16	34	0.44	28	0.22
	5	30	0.35	29	0.30	24	0.09
	6	28	0.25	30	0.35		
	7	33	0.44	24	0.14		
	8	33	0.45	34	0.53		
	9	28	0.23	35	0.49		
	10	30	0.30	27	0.20		
C	1	36	0.62	28	0.32	23	0.09
	2	24	0.24	33	0.51	28	0.17
	3	26	0.20	28	0.28	23	0.09
	4	28	0.23	21	0.12	26	0.12
	5	32	0.39	23	0.16		
	6	26	0.23	30	0.36		
	7	34	0.41	25	0.20		
	8	34	0.51	25	0.18		
	9	32	0.37	26	0.24		
	10	27	0.19	29	0.32		
D	1	30	0.35	35	0.67	30	0.31
	2	39	0.67	27	0.21	25	0.15
	3	34	0.46	27	0.27	27	0.21
	4	29	0.28	32	0.32		
	5	26	0.21	32	0.39		
	6	27	0.23	27	0.21		
	7	30	0.27	28	0.25		
	8	25	0.16	32	0.32		
	9	34	0.45	24	0.15		
	10	26	0.17	30	0.28		

11/17/21



# CETIS Summary Report

28-d

Report Date: 17 Nov-21 15:12 (p 1 of 3)  
Test Code/ID: OSPW ELS / 08-7354-5378

## Fathead Minnow Survival and Growth Test

Nautilus Environmental

Batch ID: 05-6997-9355	Test Type: Survival-Development-Growth	Analyst:
Start Date: 04 Sep-21 13:00	Protocol: ASTM E1241-05 (2013)	Diluent: River Water
Ending Date: 02 Oct-21 13:00	Species: Pimephales promelas	Brine:
Test Length: 28d 0h	Taxon: Actinopterygii	Source: Aquatic Research Organisms Age: ~60
Sample ID: 07-5550-1764	Code: OSPW ELS	Project: Special Studies
Sample Date: 04 Sep-21 13:00	Material: Effluent Treatment	Source: Hatfield
Receipt Date: 04 Sep-21 13:00	CAS (PC):	Station: Treated OSPW
Sample Age: n/a	Client: Hatfield	

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
15-8379-7896	Length-mm	Linear Interpolation (ICPIN)	IC5	46.6	6.222	65.48	2.146	1
			IC10	74.79	33.49	n/a	1.337	
			IC15	>100	n/a	n/a	<1	
			IC20	>100	n/a	n/a	<1	
			IC25	>100	n/a	n/a	<1	
			IC40	>100	n/a	n/a	<1	
			IC50	>100	n/a	n/a	<1	
18-6727-0511	Mean <del>Dry</del> <sup>CP</sup> Biomass-mg <del>Wet</del>	Linear Interpolation (ICPIN)	IC5	32.99	n/a	35.31	3.031	1
			IC10	35.59	3.601	37.95	2.81	
			IC15	38.39	28.65	40.83	2.605	
			IC20	41.4	31.66	44.05	2.415	
			IC25	44.64	34.97	47.73	2.24	
			IC40	55.94	46.53	60.51	1.788	
			IC50	64.98	55.93	71.09	1.539	
12-1553-8752	Mean <del>Dry</del> <sup>CP</sup> Weight-mg <del>Wet</del>	Linear Interpolation (ICPIN)	IC5	33.75	n/a	37.86	2.963	1
			IC10	38.52	4.836	44.86	2.596	
			IC15	43.96	27.67	53.42	2.275	
			IC20	50.14	32.79	64.06	1.994	
			IC25	57.17	38.05	76.71	1.749	
			IC40	84.61	56.36	n/a	1.182	
			IC50	>100	n/a	n/a	<1	
05-4432-1518	Survival Rate	Trimmed Spearman-Kärber	EC50	82.7	64.72	105.7 <del>105.7</del> 100 mbs	1.209	1



## CETIS Summary Report

Report Date:

17 Nov-21 15:12 (p 2 of 3)

Test Code/ID:

OSPW ELS / 08-7354-5378

## Fathead Minnow Survival and Growth Test

Nautilus Environmental

## Length-mm Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	4	29.2	27.59	30.81	28.1	30.2	0.505	1.01	3.46%	0.00%
0.32		4	29.7	28.71	30.69	28.8	30.2	0.3109	0.6218	2.09%	-1.71%
1		4	28.62	26.18	31.07	26.9	30.5	0.7696	1.539	5.38%	1.97%
3.2		4	28.83	26.47	31.18	26.7	30.1	0.7387	1.477	5.13%	1.28%
10		4	29.52	28.22	30.83	28.3	30	0.409	0.818	2.77%	-1.11%
32		4	29.57	26.54	32.61	26.8	31.1	0.9525	1.905	6.44%	-1.28%
100		4	25.6	22.64	28.55	23.25	27.33	0.9277	1.855	7.25%	12.34%

## Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	4	307.5	272.8	342.2	287	338	10.9	21.79	7.09%	0.00%
0.32		4	339	288.4	389.6	303	370	15.89	31.78	9.37%	-10.24%
1		4	300.2	214.9	385.6	242	369	26.81	53.62	17.86%	2.36%
3.2		4	316.5	253.1	379.9	260	349	19.91	39.82	12.58%	-2.93%
10		4	323.5	287.5	359.5	291	339	11.32	22.65	7.00%	-5.20%
32		4	314	253.7	374.3	269	361	18.95	37.89	12.07%	-2.11%
100		4	68.25	39.63	96.87	47	91	8.994	17.99	26.36%	77.80%

## Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	4	307.5	272.8	342.2	287	338	10.9	21.79	7.09%	0.00%
0.32		4	339	288.4	389.6	303	370	15.89	31.78	9.37%	-10.24%
1		4	300.2	214.9	385.6	242	369	26.81	53.62	17.86%	2.36%
3.2		4	316.5	253.1	379.9	260	349	19.91	39.82	12.58%	-2.93%
10		4	323.5	287.5	359.5	291	339	11.32	22.65	7.00%	-5.20%
32		4	314	253.7	374.3	269	361	18.95	37.89	12.07%	-2.11%
100		4	173.2	103.8	242.6	117.5	223.3	21.8	43.6	25.17%	43.67%

## Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0.32		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.2		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
10		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
32		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

CME

Dec 16/21



# CETIS Summary Report

Report Date: 17 Nov-21 15:12 (p 3 of 3)  
Test Code/ID: OSPW ELS / 08-7354-5378

Fathead Minnow Survival and Growth Test

Nautilus Environmental

## Length-mm Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	28.6	28.1	29.9	30.2 ✓
0.32		28.8	30.2	30	29.8
1		26.9	29.1	28	30.5
3.2		26.7	29.4	29.1	30.1
10		28.3	29.9	29.9	30
32		30	31.1	26.8	30.4
100		23.25	26.8	25	27.33

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	287	306	299	338 ✓
0.32		303	370	322	361
1		242	310	280	369
3.2		260	339	318	349
10		291	339	339	325
32		319	361	269	307
100		68	91	47	67

## Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	287	306	299	338 ✓
0.32		303	370	322	361
1		242	310	280	369
3.2		260	339	318	349
10		291	339	339	325
32		319	361	269	307
100		170	182	117.5	223.3

## Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
100					

## Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	10/10	10/10	10/10	10/10 ✓
0.32		10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
10		10/10	10/10	10/10	10/10
32		10/10	10/10	10/10	10/10
100		4/10	5/10	4/10	3/10



# CETIS Analytical Report

Report Date: 15 Dec-21 11:39 (p 1 of 2)  
Test Code/ID: OSPW ELS / 08-7354-5378

## Fathead Minnow 28-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 05-4432-1518	Endpoint: Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 08 Nov-21 10:05	Analysis: Trimmed Spearman-Kärber	Status Level: 1
Batch ID: 05-6997-9355	Test Type: Survival-Development-Growth	Analyst:
Start Date: 04 Sep-21 13:00	Protocol: ASTM E1241-05 (2013)	Diluent: River Water
Ending Date: 02 Oct-21 13:00	Species: Pimephales promelas	Brine:
Test Length: 28d 0h	Taxon: Actinopterygii	Source: Aquatic Research Organisms Age: ~60
Sample ID: 07-5550-1764	Code: OSPW ELS	Project: Special Studies
Sample Date: 04 Sep-21 13:00	Material: Effluent Treatment	Source: Hatfield
Receipt Date: 04 Sep-21 13:00	CAS (PC):	Station: Treated OSPW
Sample Age: n/a	Client: Hatfield	

### Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	0	40.00%	1.918	0.05324	82.7	64.72	105.7

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.713	2.876	3.2E-04	Outlier Detected

### Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
1		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
3.2		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
10		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
100		4	0.4000	0.3000	0.5000	0.0817	20.41%	60.0%	16/40	0.4	60.0%

### Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
100		0.4000	0.5000	0.4000	0.3000

### Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	10/10	10/10	10/10	10/10
0.32		10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
10		10/10	10/10	10/10	10/10
32		10/10	10/10	10/10	10/10
100		4/10	5/10	4/10	3/10



# CETIS Analytical Report

Report Date: 15 Dec-21 11:39 (p 2 of 2)  
Test Code/ID: OSPW ELS / 08-7354-5378

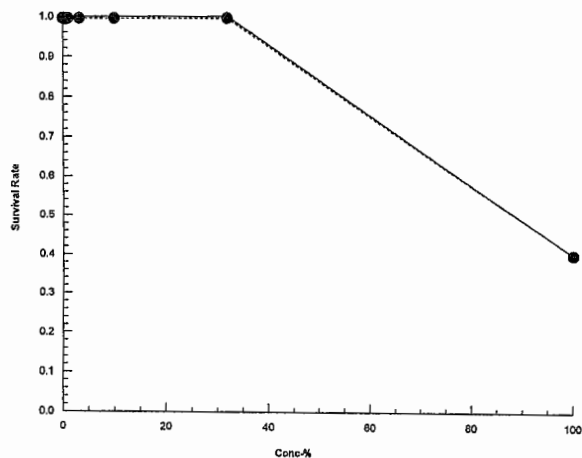
## Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 05-4432-1518      Endpoint: Survival Rate  
Analyzed: 08 Nov-21 10:05      Analysis: Trimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# CETIS Analytical Report

28-8

Report Date: 17 Nov-21 15:12 (p 1 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

## Fathead Minnow Survival and Growth Test

Nautilus Environmental

Analysis ID: 15-8379-7896	Endpoint: Length-mm	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 15:12	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 05-6997-9355	Test Type: Survival-Development-Growth	Analyst:
Start Date: 04 Sep-21 13:00	Protocol: ASTM E1241-05 (2013)	Diluent: River Water
Ending Date: 02 Oct-21 13:00	Species: Pimephales promelas	Brine:
Test Length: 28d 0h	Taxon: Actinopterygii	Source: Aquatic Research Organisms Age: ~60
Sample ID: 07-5550-1764	Code: OSPW ELS	Project: Special Studies
Sample Date: 04 Sep-21 13:00	Material: Effluent Treatment	Source: Hatfield
Receipt Date: 04 Sep-21 13:00	CAS (PC):	Station: Treated OSPW
Sample Age: n/a	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	478159	200	Yes	Two-Point Interpolation

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha$ :5%)
Control Trend	Mann-Kendall Trend Test			0.3043	Non-Significant Trend in Controls

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	46.6	6.222	65.48	2.146	1.527	16.07
IC10	74.79	33.49	n/a	1.337	n/a	2.986
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

### Length-mm Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	4	29.2	28.1	30.2	1.01	3.46%	0.0%	29.45	0.0%
0.32		4	29.7	28.8	30.2	0.6218	2.09%	-1.71%	29.45	0.0%
1		4	28.62	26.9	30.5	1.539	5.38%	1.97%	29.14	1.06%
3.2		4	28.83	26.7	30.1	1.477	5.13%	1.28%	29.14	1.06%
10		4	29.52	28.3	30	0.818	2.77%	-1.11%	29.14	1.06%
32		4	29.57	26.8	31.1	1.905	6.44%	-1.28%	29.14	1.06%
100		4	25.6	23.25	27.33	1.855	7.25%	12.34%	25.6	13.09%

### Length-mm Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	28.6	28.1	29.9	30.2
0.32		28.8	30.2	30	29.8
1		26.9	29.1	28	30.5
3.2		26.7	29.4	29.1	30.1
10		28.3	29.9	29.9	30
32		30	31.1	26.8	30.4
100		23.25	26.8	25	27.33



# CETIS Analytical Report

28-d

Report Date: 17 Nov-21 15:12 (p 2 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

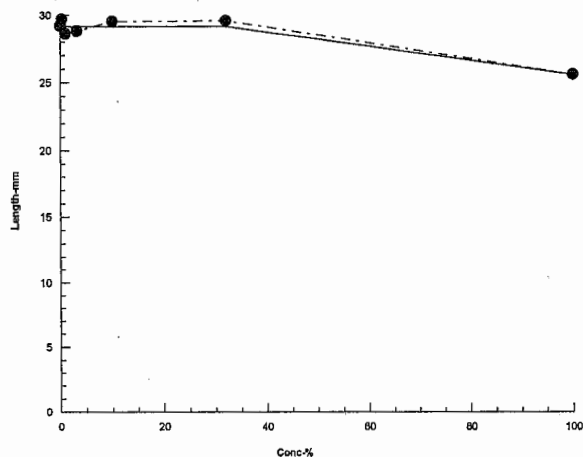
Fathead Minnow Survival and Growth Test

Nautilus Environmental

Analysis ID: 15-8379-7896 Endpoint: Length-mm  
Analyzed: 17 Nov-21 15:12 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# CETIS Analytical Report

Report Date: 17 Nov-21 15:12 (p 3 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

Fathead Minnow ~~32-d~~ Survival and Growth Test

Nautilus Environmental

Analysis ID: 18-6727-0511	Endpoint: Mean <del>Dry</del> Biomass-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 15:12	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 05-6997-9355	Test Type: Survival-Development-Growth	Analyst:
Start Date: 04 Sep-21 13:00	Protocol: ASTM E1241-05 (2013)	Diluent: River Water
Ending Date: 02 Oct-21 13:00	Species: Pimephales promelas	Brine:
Test Length: 28d 0h	Taxon: Actinopterygii	Source: Aquatic Research Organisms Age: ~60
Sample ID: 07-5550-1764	Code: OSPW ELS	Project: Special Studies
Sample Date: 04 Sep-21 13:00	Material: Effluent Treatment	Source: Hatfield
Receipt Date: 04 Sep-21 13:00	CAS (PC):	Station: Treated OSPW
Sample Age: n/a	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	385584	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha$ :5%)
Control Trend	Mann-Kendall Trend Test			0.3043	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	32.99	n/a	35.31	3.031	2.832	n/a
IC10	35.59	3.601	37.95	2.81	2.635	27.77
IC15	38.39	28.65	40.83	2.605	2.449	3.49
IC20	41.4	31.66	44.05	2.415	2.27	3.159
IC25	44.64	34.97	47.73	2.24	2.095	2.86
IC40	55.94	46.53	60.51	1.788	1.653	2.149
IC50	64.98	55.93	71.09	1.539	1.407	1.788

## Mean ~~Dry~~ Biomass-mg Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	4	307.5	287	338	21.79	7.09%	0.0%	323.2	0.0%
0.32		4	339	303	370	31.78	9.38%	-10.24%	323.2	0.0%
1		4	300.2	242	369	53.62	17.86%	2.36%	313.6	3.0%
3.2		4	316.5	260	349	39.82	12.58%	-2.93%	313.6	3.0%
10		4	323.5	291	339	22.65	7.00%	-5.2%	313.6	3.0%
32		4	314	269	361	37.89	12.07%	-2.11%	313.6	3.0%
100		4	68.25	47	91	17.99	26.36%	77.8%	68.25	78.89%

## Mean ~~Dry~~ Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	287	306	299	338
0.32		303	370	322	361
1		242	310	280	369
3.2		260	339	318	349
10		291	339	339	325
32		319	361	269	307
100		68	91	47	67



# CETIS Analytical Report

Report Date: 17 Nov-21 15:12 (p 4 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

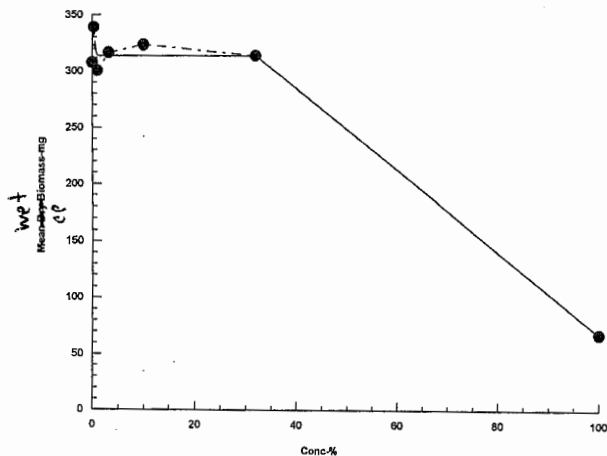
Fathead Minnow ~~32-d~~ Survival and Growth Test

Nautilus Environmental

Analysis ID: 18-6727-0511      Endpoint: Mean <sup>wet</sup> ~~Dry~~ Biomass-mg  
Analyzed: 17 Nov-21 15:12      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# CETIS Analytical Report

Report Date: 17 Nov-21 15:12 (p 5 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

Fathead Minnow ~~32-d~~ Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-1553-8752	Endpoint: Mean <del>Dry</del> Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 15:12	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 05-6997-9355	Test Type: Survival-Development-Growth	Analyst:
Start Date: 04 Sep-21 13:00	Protocol: ASTM E1241-05 (2013)	Diluent: River Water
Ending Date: 02 Oct-21 13:00	Species: Pimephales promelas	Brine:
Test Length: 28d 0h	Taxon: Actinopterygii	Source: Aquatic Research Organism Age: ~60
Sample ID: 07-5550-1764	Code: OSPW ELS	Project: Special Studies
Sample Date: 04 Sep-21 13:00	Material: Effluent Treatment	Source: Hatfield
Receipt Date: 04 Sep-21 13:00	CAS (PC):	Station: Treated OSPW
Sample Age: n/a	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1682383	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha$ :5%)
Control Trend	Mann-Kendall Trend Test			0.3043	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	33.75	n/a	37.86	2.963	2.642	n/a
IC10	38.52	4.836	44.86	2.596	2.229	20.68
IC15	43.96	27.67	53.42	2.275	1.872	3.614
IC20	50.14	32.79	64.06	1.994	1.561	3.049
IC25	57.17	38.05	76.71	1.749	1.304	2.628
IC40	84.61	56.36	n/a	1.182	n/a	1.774
IC50	>100	n/a	n/a	<1	n/a	n/a

## Mean ~~Dry~~ Weight-mg Summary

Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Calculated Variate		Isotonic Variate	
									Mean	%Effect	Mean	%Effect
0	XC	4	307.5	287	338	21.79	7.09%	0.0%	323.2	0.0%	323.2	0.0%
0.32		4	339	303	370	31.78	9.38%	-10.24%	323.2	0.0%	323.2	0.0%
1		4	300.2	242	369	53.62	17.86%	2.36%	313.6	3.0%	313.6	3.0%
3.2		4	316.5	260	349	39.82	12.58%	-2.93%	313.6	3.0%	313.6	3.0%
10		4	323.5	291	339	22.65	7.00%	-5.2%	313.6	3.0%	313.6	3.0%
32		4	314	269	361	37.89	12.07%	-2.11%	313.6	3.0%	313.6	3.0%
100		4	173.2	117.5	223.3	43.6	25.17%	43.67%	173.2	46.42%	173.2	46.42%

## Mean ~~Dry~~ Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	287	306	299	338
0.32		303	370	322	361
1		242	310	280	369
3.2		260	339	318	349
10		291	339	339	325
32		319	361	269	307
100		170	182	117.5	223.3



# CETIS Analytical Report

Report Date: 17 Nov-21 15:12 (p 6 of 6)  
Test Code/ID: OSPW ELS / 08-7354-5378

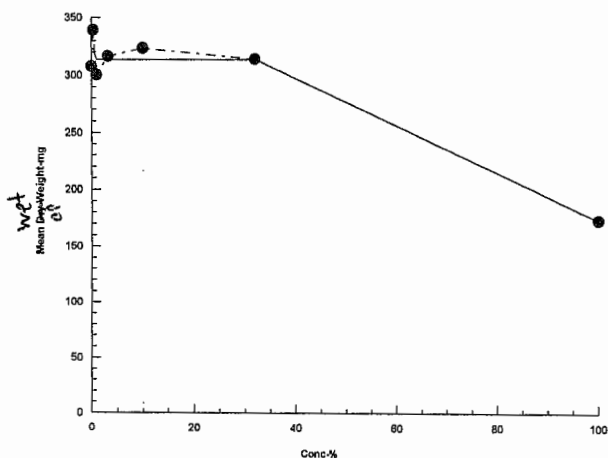
Fathead Minnow <sup>78.3</sup> 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-1553-8752      Endpoint: Mean Dry Weight-mg  
Analyzed: 17 Nov-21 15:12      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# Initial and Final Water Quality Measurements

at:   
 al:   
 Work Order #:

SYN/HAT  
PJ2021-006

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct. 8, 2021 @ 1200  
Test Species: *Promelas* *Pimephales* *Pimephales*

Sample Lab Control	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.5	7.3	6.6	7.3	6.8	7.3	6.9	7.3	6.6	7.3	7.3	7.9	6.5
pH	8.1	7.8	8.0	8.0	8.0	8.0	8.0	8.0	8.3	7.9	8.0	7.8	7.3	7.9
Cond. (µS/cm)	386	437	376	418	380	410	380	414	377	413	390	414	379	430
Initials	SS/LCC	SS/SC		SS/IEV		SS/IEV		SS/LCC		SS/IAW		EV		SS/IAW

x6.5

Sample Site Control	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.3	6.7	7.3	6.8	7.3	6.8	7.3	6.5	7.3	6.5	7.3	6.5
pH	8.2	7.7	8.1	8.0	8.1	7.9	8.2	7.9	8.4	7.8	8.2	7.4	8.1	7.9
Cond. (µS/cm)	295	335	298	318	299	319	299	328	299	320	298	326	291	317
Initials	SS/LCC	SS/SC		SS/IEV		SS/IEV		SS/LCC		SS/IAW		EV		SS/IAW

Sample 0.32%	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.3	6.4	7.3	6.7	7.3	6.8	7.3	6.5	7.3	6.5	7.3	6.6
pH	8.3	7.7	8.2	7.7	8.2	7.7	8.2	7.7	8.3	7.9	8.3	7.8	8.1	8.0
Cond. (µS/cm)	299	333	310	328	304	323	300	325	293	321	303	328	296	322
Initials	SS/LCC	SS/SC		SS/IEV		SS/IEV		SS/LCC		SS/IAW		EV		SS/IAW

Sample 1.0%	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.3	6.5	7.3	6.6	7.3	6.6	7.3	6.5	7.3	6.5	7.3	6.7
pH	8.3	7.6	8.2	7.9	8.2	7.9	8.2	7.9	8.4	7.9	8.3	7.8	8.2	7.9
Cond. (µS/cm)	327	360	328	359	310	343	303	336	308	333	301	336	308	336
Initials	SS/LCC	SS/SC		SS/IEV		SS/IEV		SS/LCC		SS/IAW		EV		SS/IAW

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: SS/LCC/IEV/IAW/SC

Reviewed by: EV  
Date reviewed: 2022/01/12

Comments:

Ammonia:

09/10 > control = 0.01 mg/L ; 100% = 0.04 mg/L

09/17 > control = 1.44 mg/L ; 100% = 0.75 mg/L



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 10:00  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
3.2%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.4	6.3	7.3	6.7	7.3	6.8	7.3	6.9	7.3	6.5	7.3	5.6	7.3	6.7
pH	8.5	7.9	8.3	7.9	8.3	7.9	8.4	8.1	8.5	7.9	8.3	7.6	8.3	7.9
Cond. (µS/cm)	384	423	376	412	395	418	420	425	471	470	374	413	373	402
Initials	SS/ICC	SS/SC		SS/IEV		SS/IEV		SS/ICC		SS/IAW		EV		SS/IDW

Sample	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
10.0%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.4	6.6	7.3	6.6	7.3	6.8	7.3	6.9	7.3	6.5	7.3	5.5	7.3	6.8
pH	8.6	7.9	8.5	7.9	8.5	8.0	8.5	8.0	8.5	8.0	8.6	7.9	8.5	8.0
Cond. (µS/cm)	542	581	571	606	601	642	556	620	585	621	603	616	578	638
Initials	SS/ICC	SS/SC		SS/IEV		SS/IEV		SS/ICC		SS/IAW		EV		SS/IDW

Sample	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
32.0%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.1	6.4	7.3	6.8	7.3	6.7	7.3	6.4	7.3	5.6	7.3	6.8
pH	8.9	7.9	8.8	8.1	8.8	8.1	8.8	8.2	8.8	8.3	8.8	8.1	8.8	8.1
Cond. (µS/cm)	1154	1190	1154	1221	1142	1219	1176	1233	1142	1241	1152	1221	1183	1263
Initials	SS/ICC	SS/SC		SS/IEV		SS/IEV		SS/ICC		SS/IAW		EV		SS/IDW

Sample	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
56.0%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	6.8	6.4	6.7	6.6	6.9	6.6	6.9	6.7	6.9	6.6	6.5	5.5	7.3	6.8
pH	9.1	8.1	8.9	8.4	8.9	8.4	8.9	8.4	8.9	8.4	8.9	8.1	9.0	8.4
Cond. (µS/cm)	1761	1818	1801	1878	1758	1873	1787	1872	1783	1886	1804	1871	1797	1927
Initials	SS/ICC	SS/SC		SS/IEV		SS/IEV		SS/ICC		SS/IAW		EV		SS/IDW

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: SS/ICC/SC/IEV/IAW/IDW

Reviewed by: EV  
Date reviewed: 2022/01/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time:   
 Test Species: *Rana futeiventris*  
*P. promelas*

Sample 100.0%	Days													
	0	1		2		3		4		5		6		7
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	5.2	5.3	6.4	6.5	6.1	6.2	6.5	6.8	6.1	6.6	5.0	5.4	7.3	7.0
pH	9.2	8.2	9.0	8.3	9.0	8.3	9.0	8.6	8.9	8.6	9.0	8.5	9.1	8.6
Cond. (µS/cm)	2960	3050	3100	3130	3040	3000	3050	3200	3080	3170	3040	3150	3050	3170
Initials	SSJCC	SSISC		SSIEV		SSIEV		SSJCC		SSIMW		EV		SSIOW

\*6.6

Sample	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														

SS

Sample	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														

Sample	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														

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: SSJCC/SC/IEV/IMW/IDW

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:



## Initial and Final Water Quality Measurements

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time: Oct 8, 2021 @ 0700  
 Test Species: *Promelas dimorphales promelas*

Sample	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Lab Control														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	22
DO (mg/L)	7.3	6.5	7.3	6.3	7.3	6.9	7.3	6.9	7.3	6.4	7.3	6.7	7.3	6.4
pH	8.0	7.9	8.3	8.1	8.3	8.0	8.0	8.0	8.3	8.0	7.9	7.9	8.4	7.9
Cond. (µS/cm)	361	417	391	418	390	412	389	445	372	401	369	414	363	401
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Site Control														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	22
DO (mg/L)	7.3	5.8	7.3	6.2	7.3	7.0	7.3	6.7	7.3	6.5	7.3	6.7	7.3	8.4
pH	8.0	7.7	8.2	7.8	8.1	7.7	7.6	7.9	8.2	7.8	8.2	7.7	8.2	7.7
Cond. (µS/cm)	284	310	288	319	264	306	280	318	298	313	297	325	314	331
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
0.32%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	22
DO (mg/L)	7.3	6.6	7.3	6.1	7.3	6.7	7.3	6.5	7.3	6.4	7.3	6.5	7.3	6.7
pH	8.1	7.9	8.2	8.0	8.2	7.9	7.9	8.0	8.2	7.9	8.2	7.9	8.2	7.9
Cond. (µS/cm)	284	312	292	315	292	309	300	318	303	317	300	319	324	331
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
1.0%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	21
DO (mg/L)	7.3	6.9	7.3	6.1	7.3	6.9	7.3	6.7	8.3	6.4	7.3	6.9	8.2	6.7
pH	8.2	8.0	8.2	8.1	8.3	7.9	8.0	8.0	8.2	8.0	8.2	7.8	8.2	7.9
Cond. (µS/cm)	299	328	308	325	306	320	305	324	312	327	311	326	352	358
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: SS, DW, SC, EV, AW

Reviewed by: EV  
 Date reviewed: 2022/01/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample 3.2%	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.0	7.3	5.5	7.3	6.8	7.3	6.5	7.3	6.6	7.3	6.4	7.3	6.7
pH	8.3	7.8	8.3	7.8	8.4	7.9	8.0	7.9	8.3	7.9	8.3	7.8	8.3	7.9
Cond. (µS/cm)	404	388	373	376	354	368	343	376	370	377	394	400	399	432
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample 10.0%	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.1	8.5	7.3	6.9	7.3	6.5	7.3	6.7	7.3	6.5	7.3	6.7
pH	8.5	8.0	8.5	8.0	8.6	7.9	8.3	8.0	8.4	8.0	8.5	7.8	8.5	7.9
Cond. (µS/cm)	574	681	575	636	554	598	554	605	581	598	590	596	601	612
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample 32.0%	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.4	7.8	5.3	7.3	6.8	7.3	6.5	7.3	6.6	7.3	6.5	7.3	6.6
pH	8.8	8.2	8.8	8.2	8.9	8.1	8.6	8.1	8.7	8.2	8.7	8.0	8.8	8.1
Cond. (µS/cm)	1182	1176	1176	1292	1163	1200	1172	1214	1176	1191	1204	1229	1194	1265
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

Sample 56.0%	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	6.7	6.9	5.0	7.3	6.5	6.8	6.5	7.0	6.5	6.9	6.5	7.0	6.5
pH	8.9	8.5	9.0	8.3	9.0	8.2	8.9	8.4	8.8	8.4	8.9	8.2	8.9	8.4
Cond. (µS/cm)	1796	1910	1825	1879	1717	1887	1854	1906	1837	1912	1819	1884	1817	1937
Initials	SS/DW	DW/SC		EV/AW		EV		EV		EV		EV		DW

DO meter: CC21CC3      pH meter: CC21CC3      Conductivity meter: CC21CC3  
\*6.1

Analysts: SS, DW, SC, EV, DW

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct. 8, 2021 @ 0000  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample 100.0%	Days													
	7	8		9		10		11		12		13		14
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	21
DO (mg/L)	6.3	8.5	7.3	4.8	6.0	6.3	6.3	6.3	7.0	6.1	6.0	6.0	6.0	6.6
pH	9.0	8.6	8.4	8.6	9.1	8.5	8.9	8.6	9.0	8.6	8.9	8.6	9.0	8.6
Cond. (µS/cm)	3070	8200	8530	3180	2910	3110	3120	3170	3160	3150	3140	3190	3110	3210
Initials	SS/DW	BWS		EV/AW		EV		EV		EV		EV		DW

Sample	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														

Sample	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														

Sample	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														

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: SS, DW, EV, AW

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:



## Initial and Final Water Quality Measurements

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time: Oct. 8, 2021 @ 0700  
 Test Species: *Promelas promelas*

Sample	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Lab Control														
Temperature (°C)	21	21	21	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.7	6.1	7.1	6.6	7.3	7.6	7.3	6.4	7.3	6.3	7.3	6.7	7.5	7.2
pH	8.4	7.9	8.3	7.8	8.2	7.7	8.1	7.8	8.1	7.9	8.1	7.8	8.2	8.0
Cond. (µS/cm)	374	403	398	407	422	414	419	430	420	416	423	448	399	443
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

Sample	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Site Control														
Temperature (°C)	22	21	21	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	8.0	6.5	8.1	6.1	7.4	5.6	7.3	4.8	7.3	5.4	7.3	6.6	8.1	6.8
pH	8.2	7.8	8.3	7.7	8.1	7.6	8.0	7.7	8.1	7.7	8.1	7.9	8.2	8.0
Cond. (µS/cm)	322	342	315	346	315	345	319	349	311	347	315	350	368	348
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

Sample	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
0.32%														
Temperature (°C)	22	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	8.0	5.5	7.5	8.0	8.1	6.1	7.3	6.4	7.3	6.2	7.3	6.7	7.8	6.8
pH	8.2	7.9	8.2	7.8	8.2	7.7	8.1	7.7	8.1	7.7	8.1	8.0	8.2	7.9
Cond. (µS/cm)	321	344	328	340	342	343	327	343	328	340	325	351	337	350
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

Sample	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
1.0%														
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	8.1	6.4	7.9	7.1	7.4	6.1	7.3	6.6	7.3	6.3	7.3	6.7	7.9	7.9
pH	8.3	8.1	8.4	8.0	8.2	7.9	8.1	7.9	8.1	7.9	8.2	7.9	8.3	8.6
Cond. (µS/cm)	334	357	334	352	342	353	346	342	342	357	345	361	355	379
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: DW, JCC, EV, AW, SS

Reviewed by: EV  
 Date reviewed: 2022/01/12/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 00:00  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample 3.2%	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	8.2	6.5	8.0	6.9	7.9	6.5	7.3	6.3	7.3	6.2	7.3	6.5	7.93	6.6
pH	8.3	8.1	8.5	7.9	8.3	7.9	8.2	7.6	8.2	7.8	8.1	7.8	8.4	7.9
Cond. (µS/cm)	391	421	409	439	428	438	418	428	389	417	392	448	434	444
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

\*439 ev

Sample 10.0%	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	8.1	6.4	8.0	6.4	7.9	6.5	7.3	5.8	7.3	6.1	7.3	6.1	7.93	6.6
pH	8.5	8.1	8.6	8.0	8.4	7.9	8.3	7.7	8.4	7.8	8.4	7.9	8.5	8.1
Cond. (µS/cm)	607	643	613	643	620	650	595	631	585	608	621	630	607	645
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

Sample 32.0%	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.8	6.3	7.8	6.4	7.9	6.4	7.3	5.8	7.3	6.1	7.3	6.2	7.3	6.7
pH	8.7	8.3	8.9	8.1	8.6	8.0	8.6	7.9	8.6	7.9	8.6	7.8	8.8	8.2
Cond. (µS/cm)	1180	1246	1192	1250	1204	1245	1229	1246	1205	1210	1220	1271	1239	1280
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

Sample 56.0%	Days													
	14	15		16		17		18		19		20		21
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.1	6.2	7.3	6.3	7.4	6.4	7.3	5.7	7.3	6.0	7.3	6.2	7.3	6.7
pH	8.9	8.3	9.1	8.3	8.8	8.2	8.8	8.1	8.8	8.2	8.8	8.2	8.9	8.4
Cond. (µS/cm)	1839	1961	1857	1921	1890	1960	1866	1956	1894	1899	1921	1941	1877	1959
Initials	DW	DW		JCC		EV		EV		AW		SS		SS

DO meter: CC21CC3 pH meter: CC21CC3 Conductivity meter: CC21CC3

Analysts: DW/JCC/EV/mw/JS

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:

Day 21(0) Initial Ammonia (mg/L) old  
Lab chl = 0.28  
Site chl = 0.13  
WTL = 0.480  
SG% = 0.17



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample	Days													
	14		15		16		17		18		19		20	
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	23	21	23	22	22	24	24	24	24	24	24	24	24	24
DO (mg/L)	6.2	6.2	6.7	6.2	6.8	5.9	6.9	5.3	7.3	5.7	7.1	6.1	9.2	6.9
pH	9.0	8.7	9.2	8.6	8.9	8.5	8.9	8.5	9.0	8.9	9.0	8.7	9.0	8.6
Cond. (µS/cm)	3110	3210	3380	3150	3210	3170	3130	3230	3190	3130	3210	3320	3200	3340
Initials	DW	AW		JCC		EV		EV		AW		SS		SS

46.8

Sample	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														

Sample	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														

Sample	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														

DO meter: CC21003 pH meter: CC21003 Conductivity meter: CC21003

Analysts: DW/JCC/EV/INW/ISS

Reviewed by: EV  
Date reviewed: 2022/01/12

Comments:

Ammonia (Day 14)

Control (old) = 0.25

100% (old) = 0.77



## Initial and Final Water Quality Measurements

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time: Oct 8, 2021 @ 0100  
 Test Species: *Promelas pimephales* 5'  
*P. promelas*

Sample	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Lab Control														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.9	6.3	7.3	6.5	7.3	6.9	7.3	6.7	7.3	6.5	7.3	7.3 6.5
pH	8.3	8.4	8.1	8.1	8.3	7.9	8.3	8.1	8.2	8.1	8.3	8.1	8.4	8.0
Cond. (µS/cm)	398	401	447	450	406	448	402	421	415	448	395	417	388	381
Initials	SS	KL		SS		SS		SS		SS		SS		SS

Sample	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Site Control														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.8	6.9	7.3	6.5	7.3	6.9	7.3	6.9	7.3	6.4	7.3	7.4 6.4
pH	8.2	8.3	8.0	8.0	8.3	7.9	8.2	8.0	8.2	8.2	8.3	8.1	8.4	7.9
Cond. (µS/cm)	325	322	351	370	331	357	325	350	321	352	329	354	349	346
Initials	SS	KL		SS		SS		SS		SS		SS		SS

Sample	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
0.32%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.7	5.5	7.3	6.2	7.3	6.8	7.3	6.9	7.3	6.3	7.3	6.4
pH	8.2	8.3	8.0	7.9	8.2	7.9	8.2	8.0	8.2	8.2	8.3	8.1	8.4	7.8
Cond. (µS/cm)	339	327	353	389	335	355	331	359	329	354	334	357	355	355
Initials	SS	KL		SS		SS		SS		SS		SS		SS

Sample	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
1.0%														
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.7	5.6	7.3	6.2	7.3	6.8	7.3	6.8	7.3	6.3	7.3	6.5
pH	8.2	8.3	8.0	7.8	8.3	7.8	8.2	8.0	8.2	8.2	8.3	8.1	8.4	8.2
Cond. (µS/cm)	342	349	360	377	392	372	352	373	350	378	354	379	374	372
Initials	SS	KL		SS		SS		SS		SS		SS		SS

DO meter: CC2 pH meter: CC2 Conductivity meter: CC2

Analysts: SS/ICK

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time: Oct 9, 2021 @ 0700  
 Test Species: *Rana tuteiventris*  
*P. promelas*

Sample 3.2%	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.3	5.6	7.3	5.6	7.3	6.7	7.3	6.8	7.3	6.3	7.3	6.9
pH	8.3	8.3	7.7	7.8	8.3	7.8	8.3	7.9	8.3	8.2	8.3	8.2	8.5	8.32
Cond. (µS/cm)	308	395	424	417	399	421	419	437	431	459	439	461	453	452
Initials	SS	KL		SS		SS		SS		SS		SS		SS

418

Sample 10.0%	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.2	5.8	7.3	5.6	7.3	6.7	7.3	6.8	7.3	6.2	7.3	6.7
pH	8.25	8.7	8.0	7.9	8.5	8.0	8.5	8.0	8.5	8.3	8.5	8.2	8.6	8.1
Cond. (µS/cm)	325	1204	1025	650	1020	660	1028	664	615	673	644	672	620	618
Initials	SS	KL		SS		SS		SS		SS		SS		SS

636 672

Sample 32.0%	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.3	5.6	7.3	5.9	7.3	6.0	7.3	6.8	7.3	6.2	7.3	6.3
pH	8.2	8.7	8.1	8.1	8.7	8.0	8.7	8.0	8.8	8.4	8.8	8.4	8.8	8.1
Cond. (µS/cm)	339	1204	1297	1322	1240	1299	1219	1303	1252	1330	1243	1330	1233	1235
Initials	SS	KL		SS		SS		SS		SS		SS		SS

1247

Sample 56.0%	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.3	7.3	6.3	5.6	7.3	5.9	7.2	6.0	7.0	6.8	7.3	6.2	7.3	6.4
pH	8.29	1984	8.4	8.4	8.9	8.4	8.9	8.3	8.9	8.6	8.9	8.6	8.9	8.5
Cond. (µS/cm)	342	98	1987	2170	1931	1997	1890	2110	1887	2110	1888	2060	1874	1872
Initials	SS	KL		SS		SS		SS		SS		SS		SS

1892

DO meter: CC2 pH meter: CC2 Conductivity meter: CC2

Analysts: SS/KL

Reviewed by: EV

Date reviewed: 2022/01/12

Comments:



# Initial and Final Water Quality Measurements

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: -

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Rana luteiventris*  
*P. promelas*

Sample 100.0%	Days													
	21	22		23		24		25		26		27		28
	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old
Temperature (°C)	24	24	24	24	24	24	24	24	24	24	24	24	24	24
DO (mg/L)	7.1	7.3	6.5	6.2	7.1	6.0	7.0	6.1	6.8	6.8	6.8	6.4	7.0	6.7
pH	9.1	9.1	8.6	9.0	9.0	8.7	9.0	8.5	9.0	8.8	8.9	8.8	9.0	8.7
Cond. (µS/cm)	3240	3180	2720	3230	3220	3290	3210	3360	3260	3380	3240	3360	3160	3120
Initials	SS	YL		SS		SS		SS		SS		SS		SS

Sample	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														

Sample	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														

Sample	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														

DO meter: CE2 pH meter: CE2 Conductivity meter: CE2

Analysts: SS/KK

Reviewed by: EV

Date reviewed: 2022/01/12

Comments: Total ammonia (mg/L) d28 Lab CH - 0.06

Site CH - 0.00

0.32 ~ 0.06

10 ~ 0.26

100 ~ 0.03



**Fish Test  
Daily Hatch**

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #:

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 8:00  
Test Species: *Promelas pimephales* S  
P. promelas

ID	Day of test - No. alive							Comments
	1	2	3	4	5	6	7	
Lab Control A	10	10	10	10	10	10	10	
Lab Control B	10	10	10	10	10	10	10	
Lab Control C	10	10	10	10	10	10	10	
Lab Control D	10	10	10	10	10	10	10	
Site Control A	10	10	10	10	10	10	10	
Site Control B	10	10	10	10	10	10	10	
Site Control C	10	10	10	10	10	10	10	
Site Control D	10	10	10	10	10	10	10	
0.32% A	10	10	10	10	10	10	10	
0.32% B	10	10	10	10	10	10	10	
0.32% C	10	10	10	10	10	10	10	
0.32% D	10	10	10	10	10	10	10	
1.0% A	10	10	10	10	10	10	10	
1.0% B	10	10	10	10	10	10	10	
1.0% C	10	10	10	10	10	10	10	
1.0% D	10	10	10	10	10	10	10	
3.2% A	10	10	10	10	10	10	10	
3.2% B	10	10	10	10	10	10	10	
3.2% C	10	10	10	10	10	10	10	
3.2% D	10	10	10	10	10	10	10	
10.0% A	10	10	10	10	10	10	10	
10.0% B	10	10	10	10	10	10	10	
10.0% C	10	10	10	10	10	10	10	
10.0% D	10	10	10	10	10	10	10	
32.0% A	10	10	10	10	10	10	10	
32.0% B	10	10	10	10	10	10	10	
32.0% C	10	10	10	10	10	10	10	
32.0% D	10	10	10	10	10	10	10	
56.0% A	10	10	10	10	10	10	10	
56.0% B	10	10	10	10	10	10	10	
56.0% C	10	10	10	10	10	10	10	
56.0% D	10	10	10	10	10	10	10	

Comments:

EV 2022/01/12



## Fish Test Daily Hatch

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: \_\_\_\_\_

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Promelas pinnephates*  
*P. promelas*

[illegible]**Comments:**

EV 2022/01/12



**Fish Test  
Daily Hatch**

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #:

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct. 8, 2021 @ 0700  
Test Species: *Promelas-pimephales*  
P. promela

ID	Day of test - No. alive							Comments
	8	9	10	11	12	13	14	
Lab Control A	10	10	10	10	10	10	10	
Lab Control B	10	10	10	10				
Lab Control C	10	10	10	10				
Lab Control D	10	10	10	10				
Site Control A	10	10	10	10				
Site Control B	10	10	10	10				
Site Control C	10	10	10	10				
Site Control D	10	10	10	10				
0.32% A	10	10	10	10				
0.32% B	10	10	10	10				
0.32% C	10	10	10	10				
0.32% D	10	10	10	10				
1.0% A	10	10	10	10				
1.0% B	10	10	10	10				
1.0% C	10	10	10	10				
1.0% D	10	10	10	10				
3.2% A	10	10	10	10				
3.2% B	10	10	10	10				
3.2% C	10	10	10	10				
3.2% D	10	10	10	10				
10.0% A	10	10	10	10				
10.0% B	10	10	10	10				
10.0% C	10	10	10	10				
10.0% D	10	10	10	10				
32.0% A	10	10	10	10				
32.0% B	10	10	10	10				
32.0% C	10	10	10	10				
32.0% D	10	10	10	10				
56.0% A	10	10	10	10				
56.0% B	10	10	10	10				
56.0% C	10	10	10	10				
56.0% D	10	10	10	10	✓	✓	✓	

Comments:

EV 2022/04/12



## Fish Test Daily Hatch

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: \_\_\_\_\_

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct 8, 2021 @ 0700  
Test Species: *Promelas pinnophales*<sup>u</sup>  
*P. pinnelae*

[illegible]

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

EV 2022/01/12



**Fish Test  
Daily Hatch**

Client: SYN/HAT  
 Sample ID: PJ2021-006  
 Work Order #: \_\_\_\_\_

Start Date & Time: September 10, 2021 @ 1200  
 Stop Date & Time: Oct 8, 2021 @ 0100  
 Test Species: *Promelas-pinnophales*  
*P. promelas*


ID	Day of test - No. alive							Comments
	15	16	17	18	19	20	21	
Lab Control A	10	10	10	10	10	10	10	
Lab Control B	10	10						
Lab Control C	10	10						
Lab Control D	10	10						
Site Control A	10	10						
Site Control B	10	10						
Site Control C	10	10						
Site Control D	10	10						
0.32% A	10	10						
0.32% B	10	10						
0.32% C	10	10						
0.32% D	10	10						
1.0% A	10	10						
1.0% B	10	10						
1.0% C	10	10						
1.0% D	10	10						
3.2% A	10	10						
3.2% B	10	10						
3.2% C	10	10						
3.2% D	10	10						
10.0% A	10	10						
10.0% B	10	10						
10.0% C	10	10						
10.0% D	10	10						
32.0% A	10	10						
32.0% B	10	10						
32.0% C	10	10						
32.0% D	10	10						
56.0% A	10	10						
56.0% B	10	10						
56.0% C	10	10	✓	✓	✓	✓	✓	
56.0% D	10	10						

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

EV 2022/01/12



## Fish Test Daily Hatch

Client: SYN/HAT  
Sample ID: PJ2021-006  
Work Order #: 

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct. 8, 2021 @ 0700  
Test Species: *Promelas pinnophyllus*  
*P. promelas*

[illegible]

Comments: \_\_\_\_\_

AV 2022/01/12



## Fish Test Daily Hatch

Client:  
Sample ID:  
Work Order #:

SYN/HAT  
PJ2021-006

**Start Date & Time:** September 10, 2021 @ 1200

Stop Date & Time: Oct 8, 2021 @ 0700

**Test Species:** Promelas pimephales →

P. promelas

ID	Day of test - No. alive							Comments
	22	23	24	25	26	27	28	
Lab Control A	10	10	10	10	10	10	10	
Lab Control B	↓	↓	↓	↓	↓	↓	10	
Lab Control C	↓	↓	↓	↓	↓	↓	10	
Lab Control D	↓	↓	↓	↓	↓	↓	10	
Site Control A	↓	↓	↓	↓	↓	↓	10	
Site Control B	↓	↓	↓	↓	↓	↓	10	
Site Control C	↓	↓	↓	↓	↓	↓	10	
Site Control D	↓	↓	↓	↓	↓	↓	10	
0.32% A	↓	↓	↓	↓	↓	↓	10	
0.32% B	↓	↓	↓	↓	↓	↓	10	
0.32% C	↓	↓	↓	↓	↓	↓	10	
0.32% D	↓	↓	↓	↓	↓	↓	10	
1.0% A	↓	↓	↓	↓	↓	↓	10	
1.0% B	↓	↓	↓	↓	↓	↓	10	
1.0% C	↓	↓	↓	↓	↓	↓	10	
1.0% D	↓	↓	↓	↓	↓	↓	10	
3.2% A	↓	↓	↓	↓	↓	↓	10	
3.2% B	↓	↓	↓	↓	↓	↓	10	
3.2% C	↓	↓	↓	↓	↓	↓	10	
3.2% D	↓	↓	↓	↓	↓	↓	10	
10.0% A	↓	↓	↓	↓	↓	↓	10	
10.0% B	↓	↓	↓	↓	↓	↓	10	
10.0% C	↓	↓	↓	↓	↓	↓	10	
10.0% D	↓	↓	↓	↓	↓	↓	10	
32.0% A	↓	↓	↓	↓	↓	↓	10	
32.0% B	↓	↓	↓	↓	↓	↓	10	
32.0% C	↓	↓	↓	↓	↓	↓	10	
32.0% D	↓	↓	↓	↓	↓	↓	10	
56.0% A	↓	↓	↓	↓	↓	↓	9	
56.0% B	↓	↓	↓	↓	↓	↓	10	
56.0% C	↓	↓	↓	↓	↓	↓	10	
56.0% D	↓	↓	↓	↓	↓	↓	10	

**Comments:**

EV 2022/01/12



## Fish Test Daily Hatch

**Client:**  
**Sample ID:**  
**Work Order #:**

SYN/HAT  
PJ2021-006

Start Date & Time: September 10, 2021 @ 1200  
Stop Date & Time: Oct. 8, 2021 @ 0700  
Test Species: *Promelas pinnophales*  
*P. promelas*

[illegible]**Comments:**

EV 2022/01/12



# Fish Development Data Sheet

Client:  
Work Order No.:

Sinilo  
PJ2021-006

Assessment Date: 2021/10/08  
Tech Initials: SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
Lab Control	1	3.6	3.1	0.68			Total wet wt. = 4.03g
A	2	3.4	2.8	0.40			
	3	3.4	2.8	0.41			
	4	3.2	2.86	0.33			
	5	3.65	3.15	0.53			
	6	2.4	2.0	0.17			
	7	3.1	2.6	0.33			
	8	3.0	2.5	0.26			
	9	3.4	2.9	0.48			
	10	2.8	2.4	0.26			
Lab Control	1	3.4	2.8	0.45			Total wet weight = 3.99g
B	2	3.5	2.9	0.51			
	3	2.2	1.9	0.18			
	4	3.3	2.7	0.38			
	5	3.6	3.0	0.56			female?
	6	3.6	3.0	0.52			
	7	3.9	2.84	0.26			
	8	3.4	2.7	0.39			
	9	3.5	3.0	0.59			
	10	2.6	2.0	0.16			
Lab Control	1	3.3	2.6	0.36			total w.w. = 4.28
C	2	3.3	2.6	0.35			
	3	3.3	2.7	0.36			
	4	3.6	3.0	0.55	10.76		
	5	3.9	3.1	0.65	10.49		
	6	3.3	2.7	0.39			
	7	4.1	3.3	0.68			
	8	3.1	2.6	0.32	8.77		uncies present
	9	2.6	2.1	0.17			
	10	3.1	2.6	0.32			
Lab Control	1	4.1	3.4	0.74	15.46		total w.w. = 4.34
D	2	3.7	3.1	0.59	9.30		
	3	3.7	3.0	0.59			
	4	3.3	2.7	0.36			
	5	2.8	2.3	0.29			
	6	2.8	2.3	0.21			
	7	2.9	2.3	0.27			
	8	2.9	2.4	0.27			
	9	3.2	2.6	0.33			
	10	3.6	3.0	0.59			

Reviewed by: EV

Date Reviewed: 2022/01/12



## Fish Development Data Sheet

Client:  
Work Order No.:

SUNW  
P17021-036

Assessment Date: 2021/10/06  
Tech Initials: SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
Site Control	1	3.7	3.2	0.13			Total wet weight = 3.9g
A	2	4.1	3.4	0.67			
	3	3.2	2.6	0.323			
	4	3.3	2.7	0.37			
	5	3.0	2.5	0.32			
	6	3.2	2.6	0.36			
	7	3.4	2.8	0.40			
	8	2.9	2.4	0.27			
	9	2.9	2.4	0.26			
	10	2.6	2.0	0.17			
Site Control	1	3.7	3.0	0.66			total wet weight = 4.12g
B	2	3.5	3.0	0.60			
	3	3.2	2.7	0.39			
	4	3.4	2.9	0.54			
	5	2.6	2.2	0.19			
	6	3.1	2.6	0.29			
	7	3.4	2.9	0.48			
	8	2.9	2.9	0.26			
	9	2.9	2.5	0.29			
	10	2.4	2.0	0.16			
Site Control	1	3.6	3.0	0.62			total w.w. = 3.8g
C	2	3.1	2.6	0.38			
	3	3.5	2.9	0.52	12.51		
	4	3.1	2.6	0.35			
	5	2.8	2.2	0.24			
	6	3.2	2.6	0.34			
	7	2.6	2.1	0.20			
	8	3.1	2.5	0.29			
	9	3.3	2.6	0.42	7.12		
	10	3.1	2.5	0.34			
Site Control	1	3.4	2.8	0.46			total w.w. = 4.49
D	2	4.0	3.2	0.79	11.70		
	3	4.1	3.4	0.74	16.33		
	4	3.8	2.9	0.52			
	5	3.2	2.6	0.34			
	6	3.6	2.9	0.53	10.32		
	7	2.9	2.3	0.27			
	8	2.7	2.2	0.23			
	9	2.9	2.2	0.24			
	10	2.7	2.1	0.22			

Reviewed by: EV

Date Reviewed: 2022/01/12



# Fish Development Data Sheet

Client:

Work Order No :

SHAW

P12021-006

Assessment Date:

2021/10/05

Tech Initials:

SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
0.32%	1	3.5	3.0	0.58	9		Total w.w. = 4.43g
A	2	3.4	2.8	0.44	3.72g		
	3	3.1	2.6	0.34	4.30g		
	4	3.5	2.9	0.47			
	5	3.4	2.7	0.49			
	6	3.4	2.8	0.48			
	7	2.9	2.4	0.23			
	8	3.0	2.5	0.28			
	9	3.1	2.5	0.30			
	10	3.7	2.2	0.20			
0.32%	1	3.9	3.2	0.65	10.60g		Total w.w. = 4.27g
B	2	3.4	2.7	0.36			
	3	3.8	2.7	0.32			
	4	3.5	2.9	0.50			
	5	3.0	2.5	0.31			
	6	3.0	2.5	0.29			
	7	3.3	2.7	0.34	1.05g		
	8	3.3	2.8	0.39			
	9	2.9	2.4	0.27			
	10	3.4	2.8	0.42			
0.32%	1	3.5	2.9	0.47	10.49		total w.w. = 4.10
C	2	3.2	2.6	0.33			
	3	3.2	2.6	0.36			
	4	2.8	2.3	0.22			
	5	3.8	2.8	0.57	6.71		
	6	3.6	2.9	0.42			
	7	3.6	2.9	0.51	8.55		
	8	3.2	2.8	0.39			
	9	3.1	2.6	0.31			
	10	3.3	2.8	0.36			
0.32%	1	3.3	2.7	0.42			total w.w. = 4.12
D	2	3.5	2.9	0.45	9.10	0.38	
	3	3.7	3.0	0.59	13.34		
	4	3.2	2.6	0.37			
	5	3.1	2.5	0.26			
	6	3.4	2.8	0.49			
	7	2.7	2.2	0.26			
	8	3.4	2.8	0.45			
	9	3.2	2.7	0.34			
	10	2.7	2.1	0.25			

Reviewed by:

EV

Date Reviewed:

2022/01/12



## Fish Development Data Sheet

Client: SUNCO  
Work Order No.: PJ 2011-036

Assessment Date: 2011/10/08  
Tech Initials: SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
1.00%	1	3.5	2.9	0.50	9.65	9.65	total w.w. = 3.59
A	2	3.1	2.5	0.32			
	3	3.3	2.7	0.46	4.73		
	4	3.0	2.6	0.35			
	5	3.1	2.6	0.35			
	6	3.1	2.6	0.36			
	7	3.2	2.7	0.37			
	8	2.8	2.3	0.24			
	9	2.6	2.2	0.19			
	10	2.5	2.0	0.18			
1.00%	1	3.29	3.2	0.76	11.76		total w.w. = 3.46g *foliote eggs (female)
B	2	2.5	2.1	0.15			
	3	3.4	2.9	0.45			
	4	3.3	2.7	0.36			
	5	2.5	2.2	0.21			
	6	2.8	2.4	0.26			
	7	2.8	2.3	0.24			
	8	3.4	2.9	0.41			
	9	2.7	2.3	0.24			
	10	2.7	2.3	0.21			
1.00%	1	3.5	2.9	0.43			total w.w. = 3.97
C	2	3.2	2.6	0.40			
	3	2.7	2.2	0.21			
	4	2.5	2.1	0.16			
	5	2.9	2.3	0.28	11.99		
	6	3.6	2.9	0.51	14.99		granules present
	7	3.5	2.9	0.55	10.92		
	8	2.6	2.2	0.22			
	9	3.6	2.9	0.58			
	10	3.6	2.9	0.53			
1.00%	1	2.5	2.0	0.16			total w.w. = 4.21
D	2	3.0	2.4	0.35			
	3	3.3	2.8	0.38			
	4	3.9	3.3	0.71	12.93		
	5	3.8	2.9	0.41			
	6	3.4	2.8	0.49	8.10		granules present
	7	3.4	2.8	0.41			
	8	3.3	2.7	0.47			
	9	3.4	2.8	0.42			
	10	2.8	2.4	0.24			

Reviewed by: EV

Date Reviewed: 2012/01/12



# Fish Development Data Sheet

Client:  
Work Order No.:

SUNW100  
PS2021-0006

Assessment Date: 2021/10/08  
Tech Initials: SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
3.2%	1	3.7	3.0	0.51	9.40		total w.w. = 3.43g
A	2	3.3	2.7	0.42			
	3	3.5	3.0	0.50			
	4	2.8	2.2	0.17			
	5	2.7	2.3	0.20			
	6	2.7	2.3	0.20			
	7	3.0	2.4	0.36			
	8	3.0	2.6	0.30			
	9	2.9	2.4	0.27			
	10	3.0	2.5	0.32			
3.2%	1	3.0	2.5	0.30			total w.w. = 4.52g
B	2	3.4	2.8	0.42			
	3	3.8	3.0	0.51			
	4	3.4	2.8	0.40			
	5	4.0	3.3	0.74			
	6	3.1	2.5	0.32			
	7	2.6	2.3	0.21			
	8	2.9	2.5	0.36			
	9	3.7	3.0	0.54			
	10	3.5	2.9	0.46			
3.2%	1	3.3	2.6	0.44			total w.w. = 3.72
C	2	3.5	2.9	0.58	8.17		
	3	3.4	2.7	0.38			
	4	2.8	2.3	0.23			
	5	3.3	2.7	0.41	9.06		
	6	3.7	3.0	0.63			
	7	2.9	2.4	0.28			
	8	3.0	2.4	0.30			
	9	3.1	2.5	0.30			
	10	2.5	2.1	0.17			
3.2%	1	3.1	2.5	0.32			total w.w. = 4.59
D	2	4.0	3.2	0.63	12.74		
	3	3.4	2.8	0.46			
	4	3.4	2.8	0.47			
	5	3.2	2.6	0.34			
	6	3.6	2.8	0.51	12.94		
	7	3.4	2.8	0.53			
	8	3.6	2.9	0.46			
	9	3.4	2.8	0.54			
	10	3.0	2.4	0.28			

Reviewed by:

EV

Date Reviewed

2022/01/12



# Fish Development Data Sheet

Client:  
Work Order No.:

Summit  
PS2021-0026

Assessment Date: 2021/10/08  
Tech Initials: 85

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Live weight (g)	Gutted fish wt (g)	Comments
10% A	1	3.2	2.8	0.38			total w.w. = 4.12
	2	3.6	2.9	0.59			
	3	3.3	2.7	0.43			
	4	3.4	2.9	0.46			
	5	3.8	3.1	0.63			
	6	3.1	2.5	0.29			
	7	3.43	2.6	0.36			
	8	3.43	2.6	0.36	3.64		
	9	2.5	2.1	0.20			
	10	2.0	1.7	0.10			
10% B	1	3.2	2.6	0.38			total w.w. = 4.83
	2	3.8	3.0	0.58	10.13		
	3	3.0	2.5	0.35			
	4	3.6	2.3	0.45			
	5	2.7	2.2	0.18			
	6	3.7	3.0	0.62			
	7	4.0	3.4	0.87			
	8	3.6	3.0	0.52	4.06		
	9	2.5	2.1	0.22			
	10	3.6	3.0	0.54			
10% C	1	3.3	2.7	0.39			total w.w. = 3.46
	2	3.4	2.9	0.42	7.70		
	3	3.4	2.8	0.40			
	4	3.3	2.7	0.38			
	5	3.5	2.9	0.51	13.11		
	6	3.0	2.6	0.40			
	7	2.4	1.9	0.14			
	8	3.1	2.6	0.32			
	9	2.6	2.1	0.21			
	10	2.9	2.3	0.23			
10% D	1	3.6	3.0	0.61	9.31		total w.w. = 4.25
	2	3.1	2.6	0.34			
	3	3.2	2.7	0.34			
	4	3.4	2.7	0.36			
	5	3.8	3.1	0.69	13.44		
	6	3.3	2.6	0.43			
	7	3.4	2.7	0.41			
	8	2.5	2.1	0.19			
	9	3.5	2.9	0.46			
	10	3.3	2.7	0.37			

Reviewed by:

EV

Date Reviewed:

2022/01/12



## Fish Development Data Sheet

Client:

Work Order No.:

S.M.W.

PS2021-006

Assessment Date:

Tech Initials:

2021/10/08

SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
32	1	3.4	2.7	0.32			total w.w. = 4.04
A	2	3.0	2.5	0.32			
	3	2.8	2.3	0.23			
	4	3.4	2.8	0.40			eggs present
	5	3.8	3.0	0.65			
	6	2.9	2.5	0.30			
	7	3.6	3.0	0.65			
	8	3.1	2.6	0.31			
	9	3.0	2.5	0.30			
	10	2.5	2.1	0.19			
32	1	3.4	2.7	0.40	3.80		total w.w. = 3.71
B	2	2.6	2.2	0.22	8.78		
	3	3.3	2.7	0.43			
	4	3.2	2.7	0.49			
	5	3.0	2.5	0.31			
	6	3.7	3.0	0.59			
	7	2.7	2.3	0.24			
	8	2.9	2.4	0.32			
	9	3.0	2.34	0.24			
	10	2.8	2.3	0.24			
32	1	2.8	2.3	0.21			total w.w. = 4.10
C	2	2.4	2.0	0.15			
	3	3.5	2.8	0.48			
	4	3.5	2.8	0.48			
	5	4.0	3.3	0.81	17.27		
	6	3.6	3.0	0.53			
	7	3.3	2.7	0.43	15.32	13.99	
	8	3.1	2.5	0.31			
	9	2.6	2.3	0.28	30		
	10	3.1	2.6	0.32			
32	1	3.5	2.9	0.45	8.90		total w.w. = 4.57
D	2	4.1	3.4	0.82	302.68		
	3	3.7	3.1	0.61			
	4	3.1	2.4	0.27			
	5	3.6	2.9	0.49	6.79		
	6	3.2	2.7	0.36			
	7	3.7	3.1	0.63			
	8	3.4	2.9	0.50			
	9	2.5	2.1	0.19			
	10	2.4	1.9	0.13			

Reviewed by:

EV

Date Reviewed:

2022/01/12



# Fish Development Data Sheet

Client:

Work Order No.:

Summit  
PS2021-006

Assessment Date:

Tech Initials:

202110108  
SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
Sb1. A	1	2.9	2.4	0.22			total w.w. = 3.57
	2	3.1	2.5	0.36			
	3	3.6	2.9	0.65			Gut eggs present
	4	3.4	2.7	0.42			
	5	3.5	2.9	0.52			
	6	2.1	2.9	0.24			
	7	2.76	2.2	0.25			
	8	2.6	2.1	0.19			
	9	3.4	2.8	0.43			
	10	-	-	-	-	-	
Sb1. B	1	2.2	1.9	0.07			total w.w. = 3.08
	2	3.5	2.9	0.65	12.07		
	3	3.5	2.8	0.49			ovaries present
	4	2.5	2.0	0.13			
	5	3.1	2.5	0.27			
	6	3.2	2.6	0.36			ovaries present
	7	3.4	2.8	0.42			
	8	2.6	2.2	0.20			
	9	2.8	2.3	0.25			
	10	2.4	2.0	0.16			
Sb1. C	1	3.5	2.5	0.30	5.50		total w.w. = 2.75
	2	3.5	2.9	0.49	5.80		
	3	2.6	2.2	0.21	5.80		liver wt = 14.85 7.67
	4	3.1	2.6	0.30			
	5	3.1	2.6	0.25			
	6	2.6	2.1	0.15			
	7	3.7	2.2	0.22			
	8	2.4	1.9	0.14			
	9	2.8	2.3	0.24			
	10	3.2	2.6	0.38	4.86		
Sb1. D	1	2.6	2.2	0.20			total w.w. = 2.68
	2	3.2	2.6	0.35			
	3	3.2	2.6	0.41	6.25		
	4	2.9	2.3	0.20			
	5	3.4	2.7	0.47	12.92	5.50	
	6	2.7	2.2	0.20			
	7	2.4	1.9	0.10			
	8	2.2	1.9	0.07			
	9	2.9	2.4	0.26			
	10	2.8	2.2	0.22	5.19		

Reviewed by:

EV

Date Reviewed:

2022/01/12



# Fish Development Data Sheet

Client:  
Work Order No :

-1<sup>st</sup> SUMMO  
PJ2021-0010

Assessment Date:  
Tech Initials:

2021/10/08  
SS

Sample ID and replicate	Fish	Total Length	Fork Length	Weight (g)	Liver weight (g)	Gutted fish wt (g)	Comments
100	1	3.4	2.6	0.36			total w.w. = 0.87
A	2	3.0 <sup>55</sup>	2.5	0.24			
	3	2.7	2.2	0.16			
	4						
	5						
	6						
	7						
	8						
	9						
	10						
100	1	3.3	2.7	0.29			total w.w. = 0.65 redness around gills
B	2	2.1	1.9	0.10	1.88		
	3	2.8	2.2	0.11			
	4	2.2	2.2				
	5	2.3	1.9	0.09			
	6						
	7						
	8						
	9						
	10						
100	1	2.7	2.2	0.16			total w.w. = 0.40
C	2	2.7	2.2	0.17	0.11		
	3	2.1	1.8	0.06			
	4						
	5						
	6						
	7						
	8						
	9						
	10						
100	1	2.7	2.2	0.15			total w.w. = 0.58
D	2	2.3	1.9	0.13	3.34		
	3	2.4	2.0	0.08			
	4	2.3	1.9	0.08			
	5	2.0	1.6	0.06			
	6	2.1	1.8	0.07			
	7						
	8						
	9						
	10						

Reviewed by:

EV

Date Reviewed:

2022/01/12



# CETIS Analytical Report

Report Date: 30 Dec-21 22:52 (p 1 of 2)  
Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (Pimephales promelas) juvenile survival and growth test					Nautilus Environmental Calgary	
Analysis ID:	15-5252-3898	Endpoint:	Survival Rate	CETIS Version:	CETISv1.9.4	
Analyzed:	30 Dec-21 22:52	Analysis:	Trimmed Spearman-Kärber	Status Level:	1	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water	
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:		
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR	Age:
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:		
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW	
Sample Age:	48h	Client:	Syncrude Canada Ltd			

Trimmed Spearman-Kärber Estimates							
Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	40.00%	1.956	0.02809	90.41	79.44	102.9

Residual Analysis						
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)	
Extreme Value	Grubbs Extreme Value Test	3.945	2.938	1.1E-04	Outlier Detected	
Control Trend	Mann-Kendall Trend Test	3.945		1.0000	Non-Significant Trend in Controls	

Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
1		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
3.2		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
10		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
56		4	0.9750	0.9000	1.0000	0.0500	5.13%	2.5%	39/40	0.975	2.5%
100		4	0.4000	0.3000	0.6000	0.1414	35.36%	60.0%	16/40	0.4	60.0%

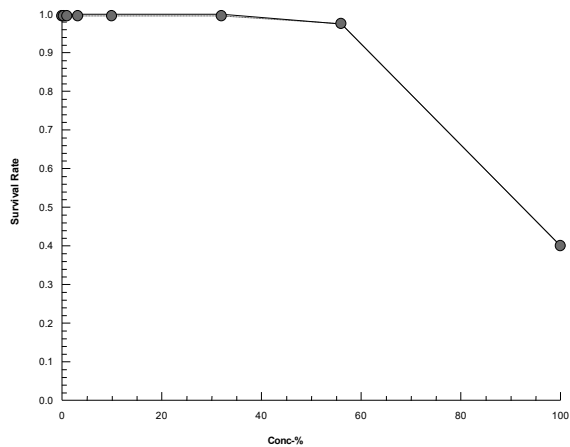
Survival Rate Detail					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
56		0.9000	1.0000	1.0000	1.0000
100		0.3000	0.4000	0.3000	0.6000

Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	10/10	10/10	10/10	10/10
0.32		10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
10		10/10	10/10	10/10	10/10
32		10/10	10/10	10/10	10/10
56		9/10	10/10	10/10	10/10
100		3/10	4/10	3/10	6/10



Fathead minnow (Pimephales promelas) juvenile survival and growth test				Nautilus Environmental Calgary
Analysis ID:	15-5252-3898	Endpoint:	Survival Rate	CETIS Version: CETISv1.9.4
Analyzed:	30 Dec-21 22:52	Analysis:	Trimmed Spearman-Kärber	Status Level: 1

Graphics





## CETIS Analytical Report

Report Date: 30 Dec-21 22:52 (p 1 of 2)  
 Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow ( <i>Pimephales promelas</i> ) juvenile survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	03-8341-2825	Endpoint:	Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	30 Dec-21 22:51	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	583029	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.945	2.938	1.1E-04	Outlier Detected
Control Trend	Mann-Kendall Trend Test	3.945		1.0000	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	57.44	55.14	60.25	1.741	1.66	1.814
LC10	60.42	57.45	63.85	1.655	1.566	1.741
LC15	63.55	59.86	67.66	1.574	1.478	1.671
LC20	66.84	62.37	72.22	1.496	1.385	1.603
LC25	70.3	64.97	77.62	1.422	1.288	1.539
LC40	81.78	74.65	96.98	1.223	1.031	1.34
LC50	90.44	80.54	n/a	1.106	n/a	1.242

## Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
0.32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
1		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
3.2		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
10		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	40/40	1	0.0%
56		4	0.9750	0.9000	1.0000	0.0500	5.13%	2.5%	39/40	0.975	2.5%
100		4	0.4000	0.3000	0.6000	0.1414	35.36%	60.0%	16/40	0.4	60.0%

## Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
56		0.9000	1.0000	1.0000	1.0000
100		0.3000	0.4000	0.3000	0.6000



# CETIS Analytical Report

Report Date: 30 Dec-21 22:52 (p 2 of 2)  
Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (*Pimephales promelas*) juvenile survival and growth test

Nautilus Environmental Calgary

Analysis ID: 03-8341-2825  
Analyzed: 30 Dec-21 22:51

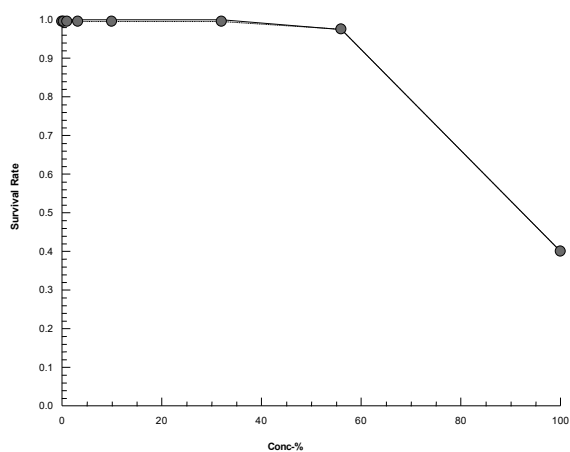
Endpoint: Survival Rate  
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	10/10	10/10	10/10	10/10
0.32		10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
10		10/10	10/10	10/10	10/10
32		10/10	10/10	10/10	10/10
56		9/10	10/10	10/10	10/10
100		3/10	4/10	3/10	6/10

## Graphics





## CETIS Analytical Report

Report Date: 06 Sep-22 15:16 (p 1 of 2)  
 Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow ( <i>Pimephales promelas</i> ) juvenile survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	19-1322-7342	Endpoint:	Length	CETIS Version:	CETISv2.1.0
Analyzed:	06 Sep-22 15:15	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	25 Jan-22 12:48	MD5 Hash:	26783D71D9400D54ACE262EF9F0D2428	Editor ID:	003-581-756-9
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1562278	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	57.72	41.43	88.85	1.732	1.126	2.414
IC15	75.71	57.85	---	1.321	---	1.728
IC20	99.22	65.84	---	1.008	---	1.519
IC25	>100	---	---	<1	---	---
IC40	>100	---	---	<1	---	---
IC50	>100	---	---	<1	---	---

Length Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	LC	4	32.64	32.5	31.95	33.6	2.46%	0.00%	32.64	0.00%
0.32		4	32.43	32.3	32	33.1	1.48%	0.65%	32.43	0.65%
1		4	31.1	30.95	30.1	32.4	3.65%	4.71%	31.9	2.26%
3.2		4	32.3	32.35	30.5	34	5.04%	1.03%	31.9	2.26%
10		4	32.3	32.3	30.9	33.7	4.08%	1.03%	31.9	2.26%
32		4	31.8	31.7	30.6	33.2	3.40%	2.57%	31.8	2.57%
56		4	29.56	29.71	28.3	30.5	3.41%	9.44%	29.56	9.44%
100		4	26.06	25.63	23	30	11.31%	20.15%	26.06	20.15%

## Length Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	31.95	32	33.6	33
0.32		32	32.4	33.1	32.2
1		30.2	30.1	31.7	32.4
3.2		30.5	33.3	31.4	34
10		31.5	33.7	30.9	33.1
32		31.5	30.6	31.9	33.2
56		30.22	29.2	30.5	28.3
100		30	26.25	25	23

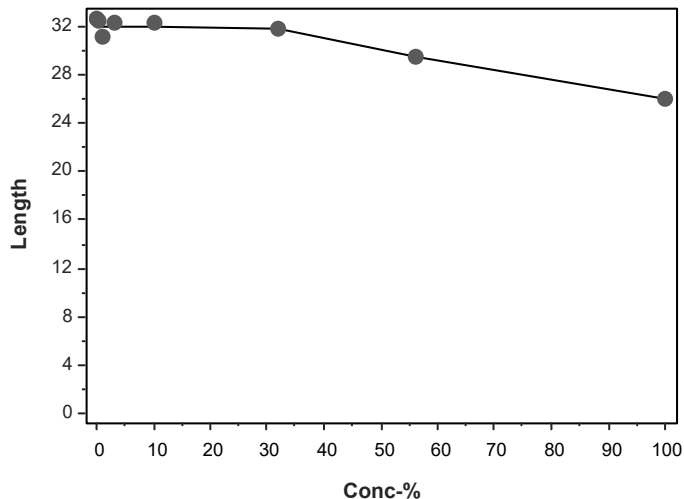


# CETIS Analytical Report

Report Date: 06 Sep-22 15:16 (p 2 of 2)  
Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (Pimephales promelas) juvenile survival and growth test				Nautilus Environmental Calgary
Analysis ID:	19-1322-7342	Endpoint:	Length	CETIS Version: CETISv2.1.0
Analyzed:	06 Sep-22 15:15	Analysis:	Linear Interpolation (ICPIN)	Status Level: 1
Edit Date:	25 Jan-22 12:48	MD5 Hash:	26783D71D9400D54ACE262EF9F0D2428	Editor ID: 003-581-756-9

## Graphics





# CETIS Summary Report

Report Date: 06 Sep-22 15:17 (p 1 of 1)  
 Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow ( <i>Pimephales promelas</i> ) juvenile survival and growth test				Nautilus Environmental Calgary	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
19-1322-7342	Length	Linear Interpolation (ICPIN)		IC10	57.72	41.43	88.85	1.732	1
				IC15	75.71	57.85	---	1.321	
				IC20	99.22	65.84	---	1.008	
				IC25	>100	---	---	<1	
				IC40	>100	---	---	<1	
				IC50	>100	---	---	<1	

Length Summary											
Conc.-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	4	32.64	31.36	33.92	31.95	33.6	0.4017	0.8035	2.46%	0.00%
0	XC	4	32.02	30.45	33.6	31.1	33.3	0.4956	0.9912	3.10%	1.88%
0.32		4	32.43	31.66	33.19	32	33.1	0.2394	0.4787	1.48%	0.65%
1		4	31.1	29.3	32.9	30.1	32.4	0.5672	1.134	3.65%	4.71%
3.2		4	32.3	29.71	34.89	30.5	34	0.8134	1.627	5.04%	1.03%
10		4	32.3	30.21	34.39	30.9	33.7	0.6583	1.317	4.08%	1.03%
32		4	31.8	30.08	33.52	30.6	33.2	0.5401	1.08	3.40%	2.57%
56		4	29.56	27.95	31.16	28.3	30.5	0.5033	1.007	3.41%	9.44%
100		4	26.06	21.37	30.75	23	30	1.473	2.947	11.31%	20.15%

Length Detail						MD5: 8FE9FE17C275D7B347F6D0D762C48C20					
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4						
0	LC	31.95	32	33.6	33						
0	XC	32.3	31.1	31.4	33.3						
0.32		32	32.4	33.1	32.2						
1		30.2	30.1	31.7	32.4						
3.2		30.5	33.3	31.4	34						
10		31.5	33.7	30.9	33.1						
32		31.5	30.6	31.9	33.2						
56		30.22	29.2	30.5	28.3						
100		30	26.25	25	23						



## CETIS Analytical Report

Report Date: 06 Sep-22 15:21 (p 1 of 3)

Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (Pimephales promelas) juvenile survival and growth test					Nautilus Environmental Calgary	
Analysis ID:	15-2579-6399	Endpoint:	Mean wet Weight-mg	CETIS Version:	CETISv2.1.0	
Analyzed:	06 Sep-22 15:20	Analysis:	Nonlinear Regression (NLR)	Status Level:	1	
Edit Date:	25 Jan-22 12:48	MD5 Hash:	DAEA93CB785DAF5A97AFBB75CE7B039F	Editor ID:	003-581-756-9	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water	
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:		
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR	Age:
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:		
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW	
Sample Age:	48h	Client:	Syncrude Canada Ltd			

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu = \alpha / [1 + (x/\delta)^\gamma]$	Normal [ $\omega = 1$ ]	Off [ $\mu^* = \mu$ ]	None	None

## Regression Summary

Iters	LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision( $\alpha:5\%$ )
10	99.61	-192.4	-188.8	0.7488	5.24%	0.3925	Yes	0.6688	0.6509	Non-Significant Lack-of-Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC15	48.53	32.51	59.86	2.06	1.671	3.076
IC20	54.42	40.68	65.63	1.838	1.524	2.458
IC25	59.81	47.56	70.8	1.672	1.413	2.103
IC40	75.11	64.82	85.96	1.331	1.163	1.543
IC50	85.81	74.67	98.6	1.165	1.014	1.339

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.3925	0.01006	0.3719	0.4131	39	<1.0E-05	Significant Parameter
$\gamma$	3.044	0.6879	1.637	4.451	4.425	0.0001	Significant Parameter
$\delta$	85.81	6.02	73.49	98.12	14.25	<1.0E-05	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	4.111	1.37	3	648.1	<1.0E-05	Significant Effect
Lack of Fit	0.007498	0.0015	5	0.6688	0.6509	Non-Significant Lack-of-Fit
Pure Error	0.05382	0.002242	24			
Residual	0.06132	0.002114	29			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Variance	Bartlett Equality of Variance Test	11.52	14.07	0.1173	Equal Variances
	Mod Levene Equality of Variance Test	1.267	2.423	0.3079	Equal Variances
Distribution	Anderson-Darling A2 Test	0.5924	2.492	0.1258	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9501	0.9338	0.1454	Normal Distribution



# CETIS Analytical Report

Report Date: 06 Sep-22 15:21 (p 2 of 3)  
 Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (*Pimephales promelas*) juvenile survival and growth test Nautilus Environmental Calgary

Analysis ID: 15-2579-6399	Endpoint: Mean Wet Weight-mg	CETIS Version: CETISv2.1.0	
Analyzed: 06 Sep-22 15:20	Analysis: Nonlinear Regression (NLR)	Status Level: 1	
Edit Date: 25 Jan-22 12:48	MD5 Hash: DAEA93CB785DAF5A97AFBB75CE7B039F	Editor ID: 003-581-756-9	

Mean Wet Weight-mg			Calculated Variate							
Summary Conc-%	Count	Mean	Median	Min	Max	Std Err	Std Dev	CV%	%Effect	
Code XC	4	0.3995	0.397	0.37	0.434	0.01389	0.02778	6.95%	0.00%	
0.32	4	0.387	0.3865	0.381	0.394	0.002739	0.005477	1.42%	3.13%	
1	4	0.363	0.3595	0.329	0.404	0.01909	0.03818	10.52%	9.14%	
3.2	4	0.395	0.399	0.328	0.454	0.02808	0.05615	14.22%	1.13%	
10	4	0.4028	0.4	0.34	0.471	0.028	0.05601	13.91%	-0.81%	
32	4	0.3985	0.4005	0.348	0.445	0.02279	0.04558	11.44%	0.25%	
56	4	0.2951	0.284	0.248	0.3644	0.02547	0.05094	17.26%	26.13%	
100	4	0.156	0.1387	0.09333	0.2533	0.03434	0.06868	44.01%	60.94%	

Mean Wet Weight-mg					
Detail Conc-%	Rep 1	Rep 2	Rep 3	Rep 4	
Code XC	0.408	0.386	0.37	0.434	
0.32	0.381	0.385	0.394	0.388	
1	0.332	0.329	0.387	0.404	
3.2	0.328	0.426	0.372	0.454	
10	0.38	0.471	0.34	0.42	
32	0.373	0.348	0.428	0.445	
56	0.3644	0.3	0.268	0.248	
100	0.2533	0.1475	0.13	0.09333	



Fathead minnow (*Pimephales promelas*) juvenile survival and growth test

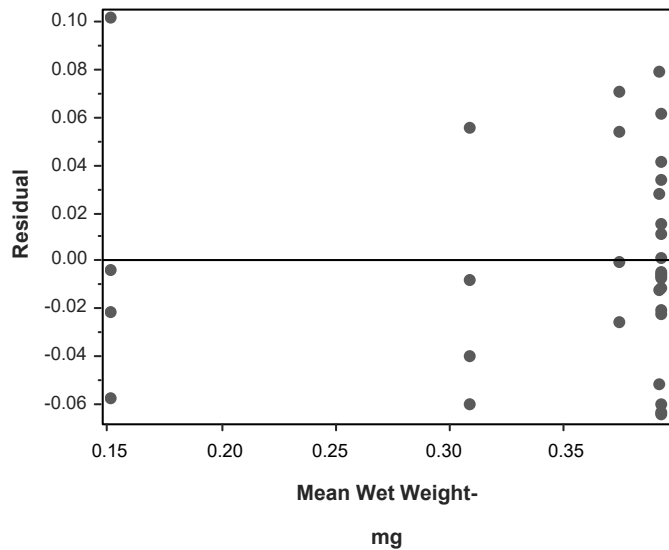
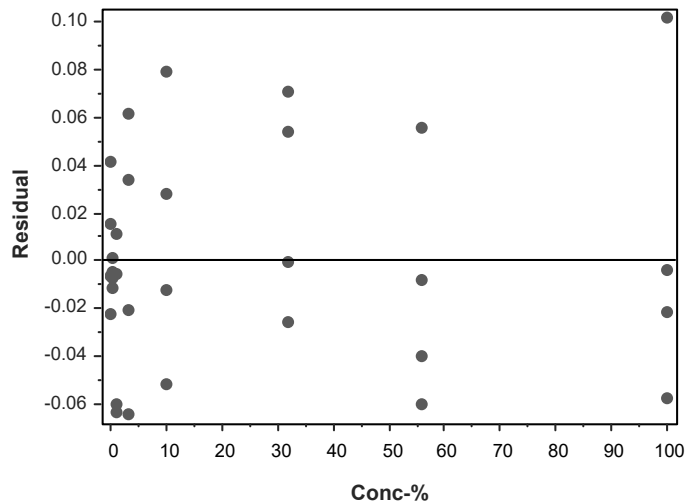
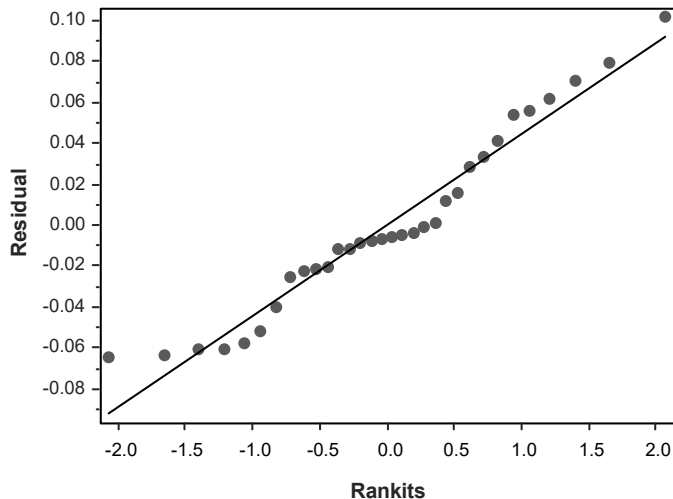
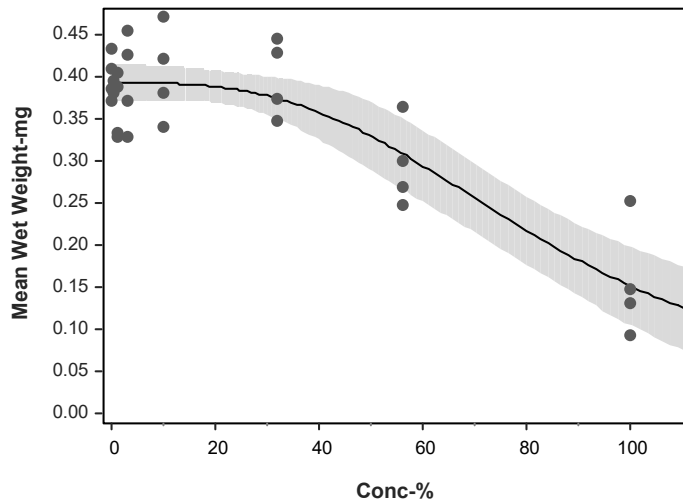
Nautilus Environmental Calgary

Analysis ID: 15-2579-6399  
Analyzed: 06 Sep-22 15:20  
Edit Date: 25 Jan-22 12:48

Endpoint: Mean Wet Weight-mg  
Analysis: Nonlinear Regression (NLR)  
MD5 Hash: DAEA93CB785DAF5A97AFBB75CE7B039F

CETIS Version: CETISv2.1.0  
Status Level: 1  
Editor ID: 003-581-756-9

## Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [ $\omega=1$ ]



# CETIS Summary Report

Report Date: 06 Sep-22 15:22 (p 1 of 1)  
Test Code/ID: PJ2021-006 Juv / 13-1418-5866

Fathead minnow (Pimephales promelas) juvenile survival and growth test					Nautilus Environmental Calgary	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water	
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:		
Test Length:	29d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR	Age:
Sample ID:	04-4029-6014	Code:	PJ2021-006 Juv	Project:		
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW	
Sample Age:	48h	Client:	Syncrude Canada Ltd			

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
15-2579-6399	Mean Wet Weight-mg	NLR: 3P Log-Logistic		IC15	48.53	32.51	59.86	2.06	1
				IC20	54.42	40.68	65.63	1.838	
				IC25	59.81	47.56	70.8	1.672	
				IC40	75.11	64.82	85.96	1.331	
				IC50	85.81	74.67	98.6	1.165	

Mean Wet Weight-mg											
Summary Conc-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect	
Code	LC	4	0.4067	0.3799	0.4336	0.385	0.424	0.00843	0.01686	4.14%	0.00%
0	XC	4	0.3995	0.3553	0.4437	0.37	0.434	0.01389	0.02778	6.95%	1.78%
0.32		4	0.387	0.3783	0.3957	0.381	0.394	0.002738	0.005477	1.42%	4.86%
1		4	0.363	0.3022	0.4238	0.329	0.404	0.01909	0.03818	10.52%	10.76%
3.2		4	0.395	0.3056	0.4844	0.328	0.454	0.02808	0.05615	14.22%	2.89%
10		4	0.4027	0.3136	0.4919	0.34	0.471	0.028	0.05601	13.91%	0.98%
32		4	0.3985	0.326	0.471	0.348	0.445	0.02279	0.04558	11.44%	2.03%
56		4	0.2951	0.214	0.3762	0.248	0.3644	0.02547	0.05094	17.26%	27.45%
100		4	0.156	0.04676	0.2653	0.09333	0.2533	0.03434	0.06868	44.01%	61.64%

Mean Wet Weight-mg					MD5: 90490BA4E44AB87C2403A0D970627F54
Detail Conc-%		Rep 1	Rep 2	Rep 3	Rep 4
Code	LC	0.385	0.403	0.415	0.424
0	XC	0.408	0.386	0.37	0.434
0.32		0.381	0.385	0.394	0.388
1		0.332	0.329	0.387	0.404
3.2		0.328	0.426	0.372	0.454
10		0.38	0.471	0.34	0.42
32		0.373	0.348	0.428	0.445
56		0.3644	0.3	0.268	0.248
100		0.2533	0.1475	0.13	0.09333



**Fathead Minnow Bench Sheet**

Method FMD 32 Day ELS Client HAT/SYN Sample: PJ2021-006

**Organism Information**

Source: AQUAGUY Batch: 20210910FM Egg Stage: 11 somites  
-ELS

Organisms Received in Good Condition: Yes or No

**Test Log**

Date	Day	Time	Technicians	Chem Cart Used	Fed			Sample Pre-Aeration Time	Bench Sheet Review
					AM	Mid-day	PM		
2021/09/10	0	1400	SS/ST	2	-	-	-	45 min	MAF
2021/09/11	1	1200	ST/SC	2	-	-	-	30 min	MAF
2021/09/12	2	1130	AW	2	-	-	-	-	KL
2021/09/13	3	1115	AW	2	-	-	-	-	EV
2021/09/14	4	1610	AW	2	-	-	-	-	SS
2021/09/15	5	1100	ST	2	✓	✓	✓	-	EV
2021/09/16	6	1045	ME	2	✓	✓	✓	-	DW
2021/09/17	7	1100	SC	2	✓	✓	✓	-	DW
2021/09/18	8	1445	ST	2	✓	✓	✓	-	MAF
2021/09/19	9	1030	AW	2	✓	✓	✓	-	KL
2021/09/20	10	1110	AW	2	✓	✓	✓	-	KL
2021/09/21	11	1130	SC	2	✓	✓	✓	-	KL
2021/09/22	12	1030	SC	2	✓	✓	✓	-	AW
2021/09/23	13	1100	SC	2	✓	✓	✓	-	KL
2021/09/24	14	1200	SC	2	✓	✓	✓	-	MAF
2021/09/25	15	1445	ST/SC	2	✓	✓	✓	-	DW
2021/09/26	16	1100	KL	2	✓	✓	✓	-	-
2021/09/27	17	1100	AW	2	✓	✓	✓	-	EV
2021/09/28	18	0930	ST	2	✓	✓	✓	-	MAF
2021/09/29	19	0955	ST	2	✓	✓	✓	-	AW
2021/09/30	20	1020	SC	2	✓	✓	✓	-	DW
2021/10/01	21	1230	SS	2	✓	✓	✓	-	-
2021/10/02	22	1100	KL	2	✓	✓	✓	-	-
2021/10/03	23	1200	SS	2	✓	✓	✓	-	-
2021/10/04	24	0830	SS	2	✓	✓	✓	-	-
2021/10/05	25	1430	SS	2	✓	✓	✓	-	-
2021/10/06	26	0905	SS	2	✓	✓	✓	-	-
2021/10/07	27	1300	SS	2	✓	✓	✓	-	-
2021/10/08	28	0900	SS	2	✓	✓	✓	45 min	-
2021/10/09	29	0830	EV	2	✓	✓	✓	45 min	-
2021/10/10	30	1000	DW	2	✓	✓	✓	45 min	-
2021/10/11	31	1400	SS	2	✓	✓	✓	45 min	-
2021/10/12	32	1400	SS	2	-	-	-	-	-

Reviewed By: SS Date Reviewed: 2021/11/15



Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006

 Control hatching success must be >66% ( $\geq 10$  per replicate). Post hatch survival must be >70%.

**Number of Alive Embryos and Hatched Organisms**

replicate	Lab Ctl		SITE CTL		0.3%		1%		3%		10%		32%	
	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	20	0	18	2	18	2	20	0	19	1	18	2	19	1
b	18	2	19	1	18	2	19	0	19	1	20	0	20	0
c	20	0	17	3	20	0	18	2	19	1	20	0	20	0
d	20	0	17	3	19	1	20	0	20	0	20	0	20	0
e	50	0	49	1	49	1	48	2	47	3	48	2	47	3

Comments/Observations:

**Number of Alive Embryos and Hatched Organisms**

replicate	CTL			SITE CTL			0.3%			1%		
	Day 2			Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 20	Alive Embryos	Dead Embryos	Cull to 20	Alive Embryos	Dead Embryos	Cull to 20	Alive Embryos	Dead Embryos	Cull to 20
a	20	0	20	17	0	20	18	2	20	20	0	20
b	18	0	20	18	1	20	18	0	20	18	1	20
c	20	0	20	17	0	20	19	1	20	18	0	20
d	20	0	20	18	0	20	19	0	20	20	0	20
e	50	1		49	0		47	0		46	1	

replicate	3%			10%			32%		
	Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 20	Alive Embryos	Dead Embryos	Cull to 20	Alive Embryos	Dead Embryos	Cull to 20
a	19	0	20	18	0	20	19	0	20
b	18	1	20	20	0	20	18	2	20
c	18	1	20	20	0	20	20	0	20
d	19	1	20	20	0	20	18	2	20
e	47	0		48	0		47	0	

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:

 Reviewed By: SS

 Date Reviewed: 2021/11/15



# Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client HAT/SYN

Sample: PJ2021-006

Control hatching success must be >66% ( $\geq 10$  per replicate). Post hatch survival must be >70%.

**Lab Ctl**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	16	0	4	0
b	12	0	8	0
c	14	0	6	0
d	18	0	2	0

**SITE CTL**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	11	0	9	0
b	14	0	6	0
c	14	0	6	0
d	14	0	6	0

**0.3%**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	16	0	4	0
b	6	0	14	0
c	14	0	6	0
d	10	0	10	0

**1%**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	12	0	8	0
b	15	0	5	0
c	11	0	9	0
d	11	0	9	0

**3%**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	11	0	9	6
b	10	0	10	0
c	16	0	4	0
d	9	0	10	1

**10%**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	10	0	10	0
b	15	0	5	0
c	9	0	11	0
d	7	0	13	0

**32.0%**  
Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	19	1	0	0
b	20	0	0	0
c	17	0	3	0
d	17	0	3	0

**Lab Ctl**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	3	0	17	0
b	2	0	18	0
c	0	1	19	0
d	5	0	15	0

**SITE CTL**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	1	0	19	0
c	1	0	19	0
d	7	0	13	0

**0.3%**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	20	0
c	1	0	19	0
d	2	0	18	0

**1.0%**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	1	0	19	0
b	1	0	19	0
c	1	1	18	0
d	2	1	17	0

**3%**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	1	0	19	0
c	0	0	20	0
d	2	0	17	0

**10%**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	1	0	19	0
c	1	0	19	0
d	0	0	20	0

**32%**  
Day 4

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	19	0
b	0	0	20	0
c	0	0	20	0
d	0	0	20	0

Comments/Observations

Reviewed by: SS

Date Reviewed: 2021/11/15



Method: FMU 32 Day ELS Client: HAI/STN

Sample: PJ2021-006

Control hatching success must be >66% ( $\geq 10$  per replicate). Post hatch survival must be >70%.

**Lab Ctl**

Day 3

	Embryos	Embryos	Alive Hatched	Hatched
a	0	0	20	0
b	0	0	20	0
c	0	0	19 (1A)	0
d	0	0	19	1

**1%**

Day 3

	Embryos	Embryos	Alive Hatched	Hatched
a	0	0	20	0
b	1	0	18	1
c	1	0	19	0
d	1	1	16	2

**32%**

Day 3

	Embryos	Embryos	Alive Hatched	Hatched
a	0	0	17	2
b	0	0	20	0
c	0	0	19	0
d	0	0	19	0

**0.3%**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	19	0
c	0	0	20	0
d	0	0	19	0

**10%**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	19	1
b	1	0	15 (1)	0
c	0	0	20	0
d	0	0	20	0

**SITE CTL**

Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	20	0
c	0	0	19	1
d	0	0	18	2

**3%**

Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	20	0
c	0	0	20	0
d	0	0	20	0

**Lab Ctl**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	19	0
b	0	0	20	0
c	0	0	18	0
d	0	0	19	0

**1%**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	18	2
b	0	0	17 (1)	1
c	0	0	19	1
d	0	0	14	13

**32%**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	14	10
b	0	0	20	0
c	0	0	19	0
d	0	0	20	0

**0.3%**

Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	20	0
c	0	0	20	0
d	0	0	19	0

**10%**

Day 3

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	1	0	15	3
c	0	0	20	0
d	0	0	20	0

**SITE CTL**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	20	0
b	0	0	20	0
c	0	0	19	0
d	0	0	18	0

**3%**

Day 6

	Alive Embryos	Dead Embryos	Alive Hatched	Dead Hatched
a	0	0	19	0
b	0	0	20	0
c	0	0	19	0
d	0	0	20	0

Comments/Observations

Reviewed By: SS

Date Reviewed: 2021/11/15



# Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client HAT/SYN

Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	19*	19	19*	20(11)	18	17	17
b	20	18*	16*	17	20	14	20
c	18	18*	18	15*	19	20	19
d	19 18*	17	19	15	20	20	20
Comments/Observations:							

Comments/Observations: \* microbial

replicate	Lab Ctl Day 8	SITE CTL Day 8	0.3% Day 8	1% Day 8	3% Day 8	10% Day 8	32% Day 8
a	Alive Hatched 17	Alive Hatched 17**	Alive Hatched 15**	Alive Hatched 20	Alive Hatched 18*	Alive Hatched 14	Alive Hatched 17
b	20*	17**	15*	13**	20*	14*	20
c	18	17*	18	12**	19	19	19
d	19	17*	19	11	19	20(11)	20

Comments/Observations: \* Microbial \*\* Microbial on one dead fish (SITE CTLA) Δ microbial on dead fish  
1A-1AS and in jar

replicate	Lab Ctl Day 9	SITE CTL Day 9	0.3% Day 9	1% Day 9	3% Day 9	10% Day 9	32% Day 9
a	Alive Hatched 19	Alive Hatched 16*	Alive Hatched 14	Alive Hatched 19	Alive Hatched 17*	Alive Hatched 14	Alive Hatched 17
b	19*	16*	15	12*	19*	12*	20
c	18	17	18	9*	19	17*	19
d	19	17	19	11	19	18*	20

Comments/Observations: \* microbial

replicate	Lab Ctl Day 10	SITE CTL Day 10	0.3% Day 10	1% Day 10	3% Day 10	10% Day 10	32% Day 10
a	Alive Hatched 19	Alive Hatched 16	Alive Hatched 14	Alive Hatched 19	Alive Hatched 16*	Alive Hatched 14	Alive Hatched 17
b	19	15	15	12	19	12	20
c	18	17	18	9	19	17	19
d	19	16	19	11	19	18	20

Comments/Observations: \* microbial  
Started adding 20 µg/L Cu to site CTL + 94 dilution and 15

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	18	16	14	19	16	14	17
b	19	15	15	12 *	19	12 *	20
c	18	17	18	9	19	17	18
d	19	16	19	11	19	18	20

 Comments/Observations: \*microbial

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	18	16	14	19	16	14	16
b	19	15	15	12*	19	12*	20
c	18	17	18	9	19	17	18
d	19	16	19	11	19	18	20

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	18	16	14	19	15	14	15
b	19	15	15	12	19	12	20
c	18	17	18	9	19	17	18
d	19	16	19	11	19	17	20

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	18	16	14	19	15	14	15
b	19*	15	15	12	19	12	20
c	18	17	18	9	19	17	18
d	19	16	19	11	19	17	20

 Comments/Observations: \*microbial

 Reviewed By: SS

 Date Reviewed: 2021/11/15



# Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client HAT/SYN

Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	17	16	14	19	15	14	15
b	19(1)	15	15	12	19	12	20
c	17	16	18	9	19	17	18
d	19	16	18	11	19	17	20

Comments/Observations: \* Microbial

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	17(1)	16	14	19(1)	15(1)	14	15
b	19(1)	15	15	12	19	12	19
c	17	16	18	9	19	17	17
d	19	16	19	11	19	17	20

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	17(1)	16	14(1)	19(1)	14	14	15
b	19(1)	15	15	11	19	12	19
c	17	16	18	9	19	16	17
d	19	16	19	11	19	17	20

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	14(1)	19(1)	14	14	15
b	19(1)	15	15	11	19	12	19
c	17	16	18	9	19	16	17
d	19	16	18	11	19	17	20

Comments/Observations:

1A-1AS

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	19(1)	14	14	15
b	19(1)	15	15	11	19	12	19
c	17	16	18	9	19	16	17
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	14	12	19(1)	14	14	15
b	19	15	15	11	19	12	19
c	17	16	18	9	19	16	17
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	18	12	19(1)	14	14	15
b	18	15	15	11	19	12	19
c	17	16	18	9	19	16	14
d	19	16	18	11	19	17	19

 Comments/Observations: last day of adding 20ug/L Cu to the site Ctl + each dilution treatment

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	19(1)	14	14	14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	16	14
d	19	16	18	11	19	17	19

Comments/Observations:

 Reviewed By: SS

 Date Reviewed: 2021/11/15



# Fathead Minnow Bench Sheet

 Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	19(1)	14	14	14 <sup>13</sup> 14
b	18	15	15	11	19	12	19
c	17	16 <sup>15</sup>	18	9	18	16	14
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	19(1)	14	14	14 <sup>13</sup> 14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	16	14
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	19(1)	14	13	14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	16	14
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	18	14	13	14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	16	13
d	19	16	18	11	19	17	19

Comments/Observations:

 Reviewed By: SS

 Date Reviewed: 2021/11/15



Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006
**Number of Alive Embryos and Hatched Organisms**

	Lab Ctl Day 27	SITE CTL Day 27	0.3% Day 27	1% Day 27	3% Day 27	10% Day 27	32% Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	16	16	12	18	13/14	13	14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	15/16	13
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl Day 28	SITE CTL Day 28	0.3% Day 28	1% Day 28	3% Day 28	10% Day 28	32% Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	16	16	12	18	14	13	14
b	18	15	15	11	19	12	19
c	17	16	18	9	18	16	13
d	19	16	18	11	19	17	19

Comments/Observations:

lab Ctl D = 17.5

	Lab Ctl Day 29	SITE CTL Day 29	0.3% Day 29	1% Day 29	3% Day 29	10% Day 29	32% Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	16	16	12	18	14	13	14
b	18(1)	15	15	11	19	12	18
c	17	16	18	9	18	16	13
d	19	16	18	11	19	17	19

Comments/Observations:

	Lab Ctl Day 30	SITE CTL Day 30	0.3% Day 30	1% Day 30	3% Day 30	10% Day 30	32% Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	16	16	12	18	14	13	14
b	18(1)	15	15	11	19	12	18
c	17	16	18	9	18	16	13
d	19	16	18	11	19	17	18

Comments/Observations:

 Reviewed By: SS

 Date Reviewed: 2021/11/15



# Fathead Minnow Bench Sheet

 Method FMD 32 Day ELS Client HAT/SYN

 Sample: PJ2021-006

Number of Alive Embryos and Hatched Organisms							
replicate	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	16	16	12	18	14	13	14
b	18	15	15	11	19	12	18
c	17	16	18	4	18	16	13
d	19	16	18	11	19	17	18

Comments/Observations:

	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
	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	16	16	12	18	14	13	14
b	17	15	15	11	19	12	18
c	17	16	18	9	18	16	13
d	19	16	18	11	19	17	18

Comments/Observations:

 Reviewed By: SS

 Date Reviewed: 2021/11/15



Method FMD 32 Day ELS

Client HAT/SYN

Sample PJ2021-006

New Solutions						
Conc (%)	Lab Ctl	SITE CTL	0.3%	1%	3%	10%
Day						

pH (units)						
0	7.9	8.2	8.3	8.3	8.4	8.6
1	8.1	8.2	8.2	8.2	8.3	8.5
2	8.1	8.2	8.2	8.2	8.3	8.5
3	8.1	8.2	8.2	8.2	8.3	8.5
4	8.1	8.2	8.2	8.2	8.3	8.5
5	8.1	8.2	8.2	8.2	8.3	8.5
6	8.1	8.2	8.2	8.2	8.3	8.5
7	8.1	8.2	8.2	8.2	8.3	8.5
8	8.1	8.2	8.2	8.2	8.3	8.5

Conductance (µS/cm)						
0	377	299	298	317	371	500
1	355	296	295	326	383	557
2	386	294	305	320	400	561
3	373	298	304	337	440	580
4	372	297	302	333	357	563
5	358	294	297	334	384	565
6	319	300	304	334	398	583
7	311	317	298	342	396	596
8	324	300	295	328	362	545

Dissolved Oxygen (mg/L) (60-100% saturation)						
0	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
2	7.3	7.3	7.3	7.3	7.3	7.3
3	7.3	7.3	7.3	7.3	7.3	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3
7	7.3	7.3	7.3	7.3	7.3	7.3
8	7.3	7.3	7.3	7.3	7.3	7.3

Temperature (°C)						
0	24	24	24	24	24	24
1	24	24	24	24	24	24
2	24	24	24	24	24	24
3	24	24	24	24	24	24
4	24	24	24	24	24	24
5	24	24	24	24	24	24
6	24	24	24	24	24	24
7	24	24	24	24	24	24
8	24	24	24	24	24	24

**DO Levels (60-100% saturation) -**  
4.4 to 7.3 mg/L at 24°C  
4.3 to 7.2 mg/L at 25°C  
4.2 to 7.0 mg/L at 26°C

Old Solutions					
Lab Ctl	SITE CTL	0.3%	1%	3%	10%
Day					

pH (units)					
0	8.2	8.1	8.1	8.1	8.2
1	8.2	8.1	8.1	8.1	8.2
2	8.2	8.1	8.1	8.1	8.2
3	8.2	8.1	8.1	8.1	8.2
4	8.2	8.1	8.1	8.1	8.2
5	8.2	8.1	8.1	8.1	8.2
6	8.2	8.1	8.1	8.1	8.2
7	8.2	8.1	8.1	8.1	8.2
8	8.2	8.1	8.1	8.1	8.2

Conductance (µS/cm)					
0	406	307	304	321	372
1	410	336	312	349	394
2	440	317	312	335	404
3	450	323	319	354	417
4	394	311	313	349	390
5	441	329	317	373	394
6	440	308	309	340	442
7	440	305	306	342	423
8	440	305	306	342	423

Dissolved Oxygen (mg/L) (60-100% saturation)					
0	7.0	7.0	7.0	7.0	7.0
1	7.1	7.2	7.2	7.2	7.2
2	6.9	7.1	7.2	7.2	7.2
3	7.2	7.3	7.3	7.3	7.3
4	7.1	6.9	6.9	6.9	6.9
5	7.2	7.1	7.0	6.9	6.9
6	7.0	6.9	6.9	6.9	6.9
7	7.1	6.7	6.7	6.7	6.7
8	7.1	6.7	6.7	6.7	6.7

Temperature (°C)					
0	24	24	24	24	24
1	24	24	24	24	24
2	24	24	24	24	24
3	24	24	24	24	24
4	24	24	24	24	24
5	24	24	24	24	24
6	24	24	24	24	24
7	24	24	24	24	24
8	24	24	24	24	24

Comments:

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS

Client HAT/SYN

Sample PJ2021-006

New Solutions							
Conc. (%)	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
Day							
	pH (units)						
9	8.4	8.3	8.3	8.4	8.4	8.6	8.9
10	8.1	8.1	8.0	8.0	8.3	8.4	8.7
11	8.0	8.1	8.1	8.1	8.2	8.4	8.7
12	8.2	8.2	8.2	8.2	8.3	8.4	8.7
13	8.2	8.2	8.2	8.2	8.3	8.5	8.7
14	8.2	8.2	8.2	8.2	8.3	8.4	8.7
15	8.3	8.3	8.3	8.3	8.4	8.5	8.8
16	8.2	8.2	8.2	8.2	8.3	8.4	8.7
17	8.2	8.2	8.1	8.1	8.2	8.5	8.7
	Conductance (µS/cm)						
9	390	384	394	328	399	587	1150
10	391	388	390	334	426	626	1231
11	414	307	304	337	453	500	1155
12	387	301	308	342	410	618	1222
13	385	315	323	355	453	624	1203
14	390	315	321	350	406	561	1190
15	428	321	331	356	410	563	1147
16	384	314	300	307	370	605	1158
17	395	328	331	365	429	736	1230
	Dissolved Oxygen (mg/L) (60-100% saturation)						
9	7.3	7.3	7.3	7.3	7.3	7.3	7.3
10	7.3	7.3	7.3	7.3	7.3	7.3	7.3
11	7.3	7.3	7.3	7.3	7.3	7.3	7.3
12	7.3	7.3	7.3	7.3	7.3	7.3	7.3
13	7.3	7.3	7.3	7.3	7.3	7.3	7.3
14	7.3	7.3	7.3	7.3	7.3	7.3	7.3
15	7.3	7.3	7.3	7.3	7.3	7.3	7.3
16	7.3	7.3	7.3	7.3	7.3	7.3	7.3
17	7.3	7.3	7.3	7.3	7.3	7.3	7.3
	Temperature (°C)						
9	24	24	24	24	24	24	24
10	24	24	24	24	24	24	24
11	24	24	24	24	24	24	24
12	24	24	24	24	24	24	24
13	24	24	24	24	24	24	24
14	24	24	24	24	24	24	24
15	24	24	24	24	24	24	24
16	24	24	24	24	24	24	24
17	24	24	24	24	24	24	24

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Old Solutions							
Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%	
	pH (units)						
9	8.4	8.2	8.2	8.2	8.2	8.5	
10	8.2	8.1	8.0	8.0	8.0	8.4	
11	8.0	8.1	8.0	8.0	8.0	8.5	
12	8.1	8.1	8.0	8.1	8.1	8.5	
13	8.2	8.0	8.0	8.0	8.1	8.5	
14	8.2	8.0	8.0	8.0	8.0	8.5	
15	8.1	8.0	8.0	8.0	8.4	8.5	
16	8.1	8.0	8.0	7.9	7.9	8.0	
17	8.1	8.0	8.0	7.9	7.9	8.0	
	Conductance (µS/cm)						
9	410	303	304	337	387	557	1141
10	420	303	319	238	412	599	1155
11	413	312	309	311	424	608	1210
12	402	312	310	314	400	591	1161
13	416	319	312	317	411	611	1205
14	405	311	312	302	450	642	1251
15	430	341	333	361	421	602	1202
16	411	324	335	360	405	580	1176
17	431	341	368	380	411	643	1200
	Dissolved Oxygen (mg/L) (60-100% saturation)						
9	7.0	6.8	6.8	6.7	6.7	6.6	6.4
10	7.0	6.9	7.0	6.9	6.9	6.8	6.7
11	6.5	6.4	6.3	6.3	6.3	6.3	6.0
12	6.9	6.9	6.9	6.9	6.9	6.9	6.8
13	6.7	6.9	6.9	6.9	6.9	6.9	6.6
14	6.8	6.4	6.3	6.2	6.2	6.1	6.1
15	6.8	6.0	5.9	5.9	5.9	5.6	5.6
16	5.9	5.5	5.9	5.5	5.9	5.9	6.0
17	6.6	6.6	6.4	6.4	6.3	6.2	6.2
	Temperature (°C)						
9	24	24	24	24	24	24	24
10	24	24	24	24	24	24	24
11	24	24	24	24	24	24	24
12	24	24	24	24	24	24	24
13	24	24	24	24	24	24	24
14	24	24	24	24	24	24	24
15	24	24	24	24	24	24	24
16	24	24	24	24	24	24	24
17	24	24	24	24	24	24	24

8.4

**DO Levels (60-100% saturation) -**

4.4 to 7.3 mg/L at 24°C  
4.3 to 7.2 mg/L at 25°C  
4.2 to 7.0 mg/L at 26°C

**Comments:**

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS

Client HAT/SYN

Sample PJ2021-006

New Solutions							
Conc (%)	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
Day							

pH (units)							
18	8.1	8.2	8.1	8.2	8.2	8.4	8.2
19	8.1	8.2	8.2	8.2	8.2	8.4	8.2
20	8.1	8.2	8.2	8.2	8.3	8.4	8.4
21	8.3	8.2	8.2	8.2	8.3	8.5	8.8
22	8.2	8.2	8.2	8.2	8.3	8.5	8.6
23	8.1	8.1	8.1	8.1	8.2	8.4	8.7
24	8.2	8.1	8.1	8.1	8.2	8.4	8.7
25	8.1	8.0	8.1	8.1	8.2	8.4	8.7
26	8.1	8.1	8.1	8.1	8.2	8.4	8.6

Conductance (µS/cm)							
18	394	324	329	367	424	567	1128
19	441	344	332	360	393	568	1184
20	457	329	322	350	416	597	1196
21	410	329	343	360	463	618	1235
22	372	324	305	367	524	594	1203
23	403	327	333	371	468	621	1179
24	405	324	330	364	410	623	1147
25	410	331	335	362	451	608	1172
26	391	334	330	363	499	632	1234

Dissolved Oxygen (mg/L) (60-100% saturation)							
18	7.2	7.3	7.3	7.3	7.3	7.3	7.3
19	7.2	7.3	7.3	7.3	7.3	7.3	7.3
20	7.1	7.1	7.1	7.1	7.1	7.3	7.3
21	7.3	7.3	7.3	7.3	7.3	7.3	7.3
22	7.3	7.3	7.3	7.3	7.3	7.3	7.3
23	7.3	7.3	7.3	7.3	7.3	7.3	7.3
24	7.3	7.3	7.3	7.3	7.3	7.3	7.3
25	7.3	7.3	7.3	7.3	7.3	7.3	7.3
26	7.3	7.3	7.3	7.3	7.3	7.3	7.3

Temperature (°C)							
18	24	24	24	24	24	24	24
19	24	24	24	24	24	24	24
20	24	24	24	24	24	24	24
21	24	24	24	24	24	24	24
22	24	24	24	24	24	24	24
23	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24
25	24	24	24	24	24	24	24
26	24	24	24	24	24	24	24

DO Levels (60-100% saturation) -  
4.4 to 7.3 mg/L at 24°C  
4.3 to 7.2 mg/L at 25°C  
4.2 to 7.0 mg/L at 26°C

Old Solutions						
Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%

pH (units)							
18	8.1	7.9	7.8	7.9	7.9	8.0	8.3
19	8.2	8.1	7.9	7.9	8.0	8.6	7.2
20	8.2	8.0	7.9	8.0	8.0	8.2	8.4
21	8.1	7.9	7.9	7.9	7.9	8.0	8.3
22	8.1	8.1	7.9	7.9	7.9	7.9	8.3
23	8.0	8.0	7.9	7.9	7.9	7.9	8.3
24	8.1	8.0	7.9	7.9	8.0	8.1	8.3
25	8.1	8.0	7.9	7.9	8.0	8.0	8.3
26	8.2	8.1	8.0	8.0	8.0	8.1	8.3

Conductance (µS/cm)							
18	429	345	350	378	431	694	1217
19	429	345	340	373	431	617	1236
20	430	345	344	372	418	681	1225
21	456	353	347	375	433	600	1208
22	445	349	354	389	459	617	1217
23	434	351	342	379	521	613	1198
24	441	344	342	375	481	623	1180
25	495	354	358	381	454	638	1178
26	476	348	344	378	463	626	1189

Dissolved Oxygen (mg/L) (60-100% saturation)							
18	6.5	6.5	6.2	6.1	6.0	6.1	6.0
19	6.4	6.4	6.2	6.0	6.0	6.0	6.0
20	6.4	6.4	6.2	6.2	6.0	6.0	6.1
21	7.0	6.7	6.7	6.6	6.6	6.7	6.5
22	6.0	6.0	6.0	6.0	6.0	6.0	6.0
23	6.2	6.2	6.7	6.5	6.4	6.5	6.2
24	6.9	6.8	6.2	6.2	6.3	6.3	6.4
25	6.7	6.7	6.7	6.6	6.6	6.5	6.4
26	6.7	6.7	6.6	6.6	6.3	6.4	6.3

Temperature (°C)							
18	24	24	24	24	24	24	24
19	24	24	24	24	24	24	24
20	24	24	24	24	24	24	24
21	24	24	24	24	24	24	24
22	24	24	24	24	24	24	24
23	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24
25	24	24	24	24	24	24	24
26	24	24	24	24	24	24	24

Comments:

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS

 Client HAT/SYN

 Sample PJ2021-006

New Solutions							
Conc. (%)	Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%
Day							

		pH (units)						
27		8.4	8.4	8.4	8.4	8.5	8.5	8.8
28		8.3	8.3	8.3	8.4	8.4	8.6	8.8
29		8.4	8.4	8.4	8.3	8.4	8.5	8.8
30		8.1	8.3	8.3	8.3	8.4	8.5	8.7
31		8.3	8.3	8.3	8.3	8.4	8.4	8.7
32								

Conductance (μS/cm)							
27	378	344	355	412	456	519	1183
28	398	338	340	371	427	698	1215
29	388	335	341	374	443	621	1135
30	408	389	341	393	419	553	1159
31	381	333	339	370	411	533	1138
32							

Dissolved Oxygen (mg/L) (60-100% saturation)							
27	7.3	7.3	7.3	7.3	7.3	7.3	7.3
28	7.3	7.3	7.3	7.3	7.3	7.3	7.3
29	7.3	7.3	7.3	7.3	7.3	7.3	7.3
30	7.3	7.3	7.3	7.3	7.3	7.3	7.3
31	7.3	7.3	7.3	7.3	7.3	7.3	7.3
32							

Temperature (°C)							
27	24	24	24	24	24	24	24
28	24	24	24	24	24	24	24
29	24	24	24	24	24	24	24
30	24	24	24	24	24	24	24
31	24	24	24	24	24	24	24
32							

Old Solutions						
Lab Ctl	SITE CTL	0.3%	1%	3%	10%	32%

pH (units)						
27	8.1	8.1	8.0	7.9	7.9	8.2
28	8.1	8.0	8.0	7.9	7.8	7.8
29	7.9	7.7	7.7	7.7	7.7	7.8
30	8.1	8.0	8.0	8.0	8.1	8.3
31	8.0	7.9	7.8	7.8	7.8	7.9
32	7.6	7.6	7.6	7.6	7.7	7.7

Conductance (μS/cm)							
27	463	350	352	378	496	642	1216
28	459	379	360	394	467	586	1183
29	414	323	362	389	461	674	1216
30	423	356	365	387	461	674	1167
31	420	349	351	380	426	574	1164
32	409	351	356	386	447	590	1172

Dissolved Oxygen (mg/L) (60-100% saturation)							
27	6.8	6.7	6.7	5.9	5.9	5.6	5.5
28	6.0	6.0	6.0	5.9	5.4	5.4	5.2
29	4.7	3.8	4.0	4.7	4.2	4.2	4.2
30	6.5	6.0	6.1	6.2	6.2	6.1	6.2
31	6.6	6.1	6.1	6.0	6.1	6.1	6.0
32	5.9	5.9	5.8	5.7	5.7	5.6	5.7

Temperature (°C)							
27	24	24	24	24	24	24	24
28	24	24	24	24	24	24	24
29	24	24	24	24	24	24	24
30	24	24	24	24	24	24	24
31	24	24	24	24	24	24	24
32	24	24	24	24	24	24	24

**DO Levels (60-100% saturation) -**

4.4 to 7.3 mg/L at 24°C

4.3 to 7.2 mg/L at 25°C

4.2 to 7.0 mg/L at 26°C

**Comments:**

 Reviewed By: SS

 Date Reviewed: 2021/11/15



Method FMD 32 Day ELS

 Client HAT/SYN

 Sample: PJ2021-006
**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

Lab Ctl

Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal
1	12	N	1	13	N	1	13	N	1	11	N
2	14	N	2	12	N	2	13	N	2	12	N
3	14	N	3	13	N	3	12	N	3	12	N
4	14	N	4	13	N	4	13	N	4	13	N
5	14	N	5	13	N	5	12	N	5	13	N
6	13	N	6	13	N	6	12	N	6	12	N
7	14	N	7	13	N	7	14	N	7	12	N
8	12	N	8	12	N	8	13	N	8	13	N
9	14	N	9	11	N	9	13	N	9	14	N
10	14	N	10	13	N	10	12	N	10	14	N
11	13	N	11	12	AS	11	12	N	11	13	N
12	14	N	12	13	N	12	11	N	12	13	AS
13	11	N	13	14	N	13	13	N	13	13	N
14	11	N	14	14	N	14	13	N	14	11	N
15	13	N	15	12	N	15	14	N	15	11	N
16	13	N	16	12	N	16	13	N	16	10	N
17	1	1	17	13	N	17	13	N	17	10	N
18	1	1	18	1	1	18	1	1	18	12	N
19	1	1	19	1	1	19	1	1	19	14	N
20	1	1	20	1	1	20	1	1	20	1	1
Mean Length (mm): <u>13.00</u>			Mean Length (mm): <u>12.82</u>			Mean Length (mm): <u>12.94</u>			Mean Length (mm): <u>12.47</u>		
# Normal: <u>16</u> 0.57			# Normal: <u>16</u> 0.50			# Normal: <u>17</u> 0.56			# Normal: <u>18</u> 0.55		
Comments									EV 18		

 Reviewed By: SS

 Date Reviewed: 2021/1/15



Method FMD 32 Day ELS

Client 0

Sample: 0

### 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.

Site CTL

Replicate #	Fish	Length (mm)	Normal/Abnormal
A	1	12	2
A	2	13	2
A	3	12	2
A	4	12	2
A	5	12	2
A	6	12	2
A	7	11	2
A	8	13	2
A	9	11	2
A	10	14	2
A	11	15	2
A	12	13	2
A	13	13	2
A	14	13	2
A	15	12	2
A	16	11	2
A	17	11	1
A	18	11	1
A	19	11	1
A	20	11	1
B	1	10	2
B	2	11	2
B	3	10	2
B	4	10	2
B	5	14	1
B	6	12	1
B	7	13	1
B	8	12	1
B	9	13	1
B	10	12	1
B	11	13	1
B	12	12	1
B	13	12	1
B	14	13	1
B	15	11	1
B	16	11	1
B	17	11	1
B	18	11	1
B	19	11	1
B	20	11	1
C	1	12	2
C	2	13	1
C	3	14	1
C	4	11	1
C	5	12	1
C	6	12	1
C	7	12	1
C	8	13	1
C	9	13	1
C	10	11	1
C	11	12	1
C	12	13	1
C	13	11	1
C	14	12	1
C	15	14	1
C	16	14	1
C	17	11	1
C	18	11	1
C	19	11	1
C	20	11	1
D	1	11.5	2
D	2	13	1
D	3	11	1
D	4	10	1
D	5	14	1
D	6	12	1
D	7	13	1
D	8	11	1
D	9	14	1
D	10	12	1
D	11	14	1
D	12	11	1
D	13	13	1
D	14	14	1
D	15	15	1
D	16	12	1
D	17	11	1
D	18	11	1
D	19	11	1
D	20	11	1

Mean Length (mm): 13.06	Mean Length (mm): 12.73	Mean Length (mm): 12.56	Mean Length (mm): 12.543
# Normal: 16 0.53	# Normal: 15 0.467	# Normal: 16 0.51	# Normal: 16 0.52
Comments:			

Reviewed By: SS

Date Reviewed: 2021/11/15



Method FMD 32 Day ELS Client #REF! Sample: #REF!
**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.

0.3%

Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal
1	15	N	1	11	N	1	14	N	1	13	N
2	14	↓	2	12	↓	2	13	↓	2	13	↓
3	13	AS	3	12	↓	3	9	AS	3	11	↓
4	14	N	4	13	↓	4	9	N	4	11	↓
5	12	↓	5	13	↓	5	13	↓	5	11	↓
6	14	↓	6	12	↓	6	12	↓	6	13	↓
7	13	↓	7	14	↓	7	14	↓	7	11	↓
8	14	↓	8	13	↓	8	12	↓	8	9	↓
9	15	↓	9	15	↓	9	12	↓	9	11	↓
10	14	↓	10	11	↓	10	13	↓	10	12	↓
11	15	↓	11	14	↓	11	11	↓	11	15	↓
12	13	↓	12	13	↓	12	13	↓	12	11	↓
13	-	-	13	13	↓	13	11	↓	13	11	↓
14	-	-	14	14	↓	14	10	↓	14	9	↓
15	-	-	15	11	↓	15	11	↓	15	13	↓
16	-	-	16	-	-	16	9	↓	16	12	↓
17	-	-	17	-	-	17	-	-	17	10	↓
18	-	-	18	-	-	18	-	-	18	10	↓
19	-	-	19	-	-	19	-	-	19	-	↓
20	-	-	20	-	-	20	-	-	20	-	-

Mean Length (mm): <u>13.83</u>	Mean Length (mm): <u>12.73</u>	Mean Length (mm): <u>11.83</u>	Mean Length (mm): <u>12.33</u>
# Normal: <u>11</u> 0.55	# Normal: <u>15</u> 0.80	# Normal: <u>15</u> 0.45	# Normal: <u>18</u> 0.48
Comments: <u>0.32% C - missed taking lengths for 2 fish</u>			

 Reviewed By: SS Date Reviewed: 2021/11/15



**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.

1%	Replicate #	Fish	Length (mm)	Normal/Abnormal
	A	1	6	N
	A	2	12	
	A	3	14	
	A	4	14	
	A	5	13	
	A	6	14	
	A	7	13	
	A	8	12	
	A	9	12	
	A	10	12	
	A	11	13	
	A	12	11	
	A	13	11	
	A	14	11	
	A	15	12	
	A	16	12	
	A	17	11	
	A	18	9	
	A	19	-	
	A	20	-	

Replicate #	Fish	Length (mm)	Normal/Abnormal
B	1	14	N
B	2	14	
B	3	15	
B	4	14	
B	5	11	AS
B	6	12	N
B	7	14	
B	8	14	
B	9	12	
B	10	12	
B	11	13	
B	12	-	-
B	13	-	-
B	14	-	-
B	15	-	-
B	16	-	-
B	17	-	-
B	18	-	-
B	19	-	-
B	20	-	-

Replicate #	Fish	Length (mm)	Normal/Abnormal
C	1	12	N
C	2	14	
C	3	14	
C	4	13	
C	5	14	
C	6	15	
C	7	11	
C	8	14	
C	9	11	
C	10	-	-
C	11	-	-
C	12	-	-
C	13	-	-
C	14	-	-
C	15	-	-
C	16	-	-
C	17	-	-
C	18	-	-
C	19	-	-
C	20	-	-

Replicate #	Fish	Length (mm)	Normal/Abnormal
D	1	14	N
D	2	14	
D	3	11	
D	4	14	
D	5	15	
D	6	16	
D	7	11	
D	8	13	
D	9	15	
D	10	12	
D	11	11	
D	12	-	-
D	13	-	-
D	14	-	-
D	15	-	-
D	16	-	-
D	17	-	-
D	18	-	-
D	19	-	-
D	20	-	-

Mean Length (mm) : 11.78 # Normal: 10 0.47	Mean Length (mm) : 13.18 # Normal: 10 0.37	Mean Length (mm) : 13.11 # Normal: 9 0.33	Mean Length (mm) : 13.27 # Normal: 11 0.41
Comments			

Reviewed By: SS

Date Reviewed: 2021/11/15



**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 # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal
1	13	N	1	8	N	1	11	AS	1	14	N
2	13		2	12		2	12	N	2	12	
3	13		3	11		3	13		3	12	
4	13		4	12		4	11		4	12	
5	12		5	12		5	12		5	12	
6	12		6	13		6	12		6	14	
7	12		7	11		7	12		7	11	
8	13		8	12		8	15		8	12	
9	13		9	13		9	12		9	12	
10	14		10	12		10	13		10	12	
11	14		11	11		11	13		11	11	
12	14		12	12		12	10		12	12	
13	8		13	11		13	11		13	12	
14	13		14	12		14	13		14	12	
15	-	-	15	13		15	10		15	11	
16	-	-	16	11		16	13		16	10	
17	-	-	17	12		17	13		17	9	
18	-	-	18	11		18	9		18	13	
19	-	-	19	9		19	-		19	12	
20	-	-	20	-		20	-		20	-	

Mean Length (mm): 12.04 # Normal: 14 0.42 Comments	Mean Length (mm): 11.47 # Normal: 19 0.42	Mean Length (mm): 11.94 # Normal: 18 0.45 EV 17	Mean Length (mm): 11.84 # Normal: 19 0.44
----------------------------------------------------------	----------------------------------------------	-------------------------------------------------------	----------------------------------------------

 Reviewed By: SS

 Date Reviewed: 2021/11/15



**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>		
Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal	Fish	Length (mm)	Normal/Abnormal
1	15	N	1	15	N	1	14	N	1	13	N
2	13		2	12		2	11		2	12	
3	12		3	12		3	13		3	10	
4	12		4	12		4	12		4	10	
5	13		5	14		5	13		5	9	
6	11		6	15		6	13		6	13	
7	11		7	12		7	11		7	14	
8	12		8	14		8	14		8	13	
9	13		9	13		9	12		9	15	
10	13		10	14		10	12		10	11	
11	13		11	14		11	8		11	13	
12	13		12	12		12	13		12	12	
13	13		13	-		13	12		13	13	
14	-		14	-		14	14		14	12	
15	-		15	-		15	8		15	11	
16	-		16	-		16	14		16	12	
17	-		17	-		17	-		17	10	
18	-		18	-		18	-		18	-	
19	-		19	-		19	-		19	-	
20	-		20	-		20	-		20	-	

Mean Length (mm): <u>13.31</u>	Mean Length (mm): <u>13.58</u>	Mean Length (mm): <u>12.13</u>	Mean Length (mm): <u>11.94</u>
# Normal: <u>13</u>	# Normal: <u>12</u>	# Normal: <u>14</u>	# Normal: <u>11</u>
Comments	EV 14		

 Reviewed By: SS

 Date Reviewed: 2021/11/15



**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 #	Fish	Length (mm)	Normal/Abnormal
A	1	11	N
	2	12	
	3	14	
	4	14	
	5	13	
	6	14	
	7	14	
	8	14	
	9	11	
	10	8	
	11	13	
	12	14	
	13	15	
	14	13	
	15	-	-
	16	-	-
	17	-	-
	18	-	-
	19	-	-
	20	-	-
Mean Length (mm):	12.00		
# Normal:	14	0.48	
Comments			
Replicate #	Fish	Length (mm)	Normal/Abnormal
B	1	11	N
	2	8	
	3	13	
	4	14	
	5	10	
	6	11	
	7	11	
	8	13	
	9	13	
	10	12	
	11	14	
	12	13	
	13	12	
	14	12	
	15	9	
	16	9	
	17	11	
	18	9	
	19	-	-
	20	-	-
Mean Length (mm):	11.39		
# Normal:	18	0.42	
Comments			
Replicate #	Fish	Length (mm)	Normal/Abnormal
C	1	12	N
	2	14	
	3	11	
	4	15	
	5	14	
	6	14	
	7	13	
	8	13	
	9	14	
	10	12	
	11	13	
	12	11	
	13	12	
	14	-	-
	15	-	-
	16	-	-
	17	-	-
	18	-	-
	19	-	-
	20	-	-
Mean Length (mm):	12.92		
# Normal:	13	0.43	
Comments			
Replicate #	Fish	Length (mm)	Normal/Abnormal
D	1	10	N
	2	14	
	3	13	
	4	14	
	5	14	
	6	12.5	
	7	11	
	8	9	
	9	9	
	10	10	
	11	11	
	12	11	
	13	13	
	14	11	
	15	13	
	16	14	
	17	13	
	18	12	
	19	-	-
	20	-	-
Mean Length (mm):	11.92		
# Normal:	18	0.41	
Comments			

Reviewed By: SS

Date Reviewed: 2021/11/15



# CETIS Analytical Report

Report Date: 19 Jan-22 11:29 (p 1 of 2)  
 Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (Pimephales promelas) 32-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	09-5035-8051	Endpoint:	Hatch Rate	CETIS Version:	CETISv2.1.0
Analyzed:	19 Jan-22 11:28	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	19 Jan-22 11:26	MD5 Hash:	0A2977A03A14FDD6A30EA0B22A8FE0	Editor ID:	004-569-145-5
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1384203	200	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	>100	---	---	<1	---	---
LC10	>100	---	---	<1	---	---
LC15	>100	---	---	<1	---	---
LC20	>100	---	---	<1	---	---
LC25	>100	---	---	<1	---	---
LC40	>100	---	---	<1	---	---
LC50	>100	---	---	<1	---	---

Hatch Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	80/80	1.0000	0.00%
0.32		4	0.9875	1.0000	0.9500	1.0000	2.53%	1.25%	79/80	0.9906	0.94%
1		4	0.9750	0.9750	0.9500	1.0000	2.96%	2.50%	78/80	0.9906	0.94%
3.2		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	80/80	0.9906	0.94%
10		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	80/80	0.9906	0.94%
32		4	0.9875	1.0000	0.9500	1.0000	2.53%	1.25%	79/80	0.9875	1.25%
56		4	0.9875	1.0000	0.9500	1.0000	2.53%	1.25%	79/80	0.9875	1.25%
100		4	0.9625	1.0000	0.8500	1.0000	7.79%	3.75%	77/80	0.9625	3.75%

Hatch Rate Detail					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	0.9500
1		1.0000	1.0000	0.9500	0.9500
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		0.9500	1.0000	1.0000	1.0000
56		1.0000	0.9500	1.0000	1.0000
100		1.0000	1.0000	0.8500	1.0000



# CETIS Analytical Report

Report Date: 19 Jan-22 11:29 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

## Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

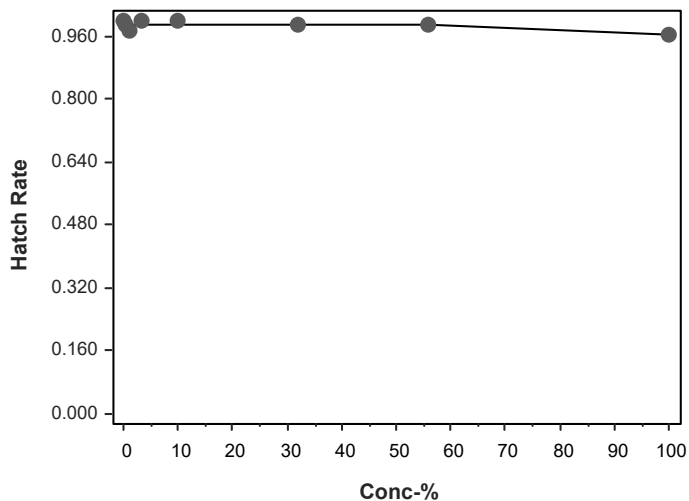
Nautilus Environmental Calgary

Analysis ID: 09-5035-8051	Endpoint: Hatch Rate	CETIS Version: CETISv2.1.0
Analyzed: 19 Jan-22 11:28	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 19 Jan-22 11:26	MD5 Hash: 0A2977A03A14FDD6A30EA0B22A8FE0	Editor ID: 004-569-145-5

### Hatch Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	20/20	20/20	20/20	20/20
0.32		20/20	20/20	20/20	19/20
1		20/20	20/20	19/20	19/20
3.2		20/20	20/20	20/20	20/20
10		20/20	20/20	20/20	20/20
32		19/20	20/20	20/20	20/20
56		20/20	19/20	20/20	20/20
100		20/20	20/20	17/20	20/20

### Graphics





# CETIS Summary Report

Report Date: 26 Aug-22 14:34 (p 1 of 1)  
 Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
09-5035-8051	Hatch Rate	Linear Interpolation (ICPIN)		LC5	>100	---	---	<1	1
				LC10	>100	---	---	<1	
				LC15	>100	---	---	<1	
				LC20	>100	---	---	<1	
				LC25	>100	---	---	<1	
				LC40	>100	---	---	<1	
				LC50	>100	---	---	<1	

Hatch Rate Summary											
Conc.-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	4	0.9875	0.9477	1.0270	0.9500	1.0000	0.0125	0.0250	2.53%	0.00%
0	XC	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.27%
0.32		4	0.9875	0.9477	1.0270	0.9500	1.0000	0.0125	0.0250	2.53%	0.00%
1		4	0.9750	0.9291	1.0210	0.9500	1.0000	0.0144	0.0289	2.96%	1.27%
3.2		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.27%
10		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.27%
32		4	0.9875	0.9477	1.0270	0.9500	1.0000	0.0125	0.0250	2.53%	0.00%
56		4	0.9875	0.9477	1.0270	0.9500	1.0000	0.0125	0.0250	2.53%	0.00%
100		4	0.9625	0.8432	1.0820	0.8500	1.0000	0.0375	0.0750	7.79%	2.53%

Hatch Rate Detail						MD5: 6F65D2323DC6E1DB886C6C4ECEE7A683					
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4						
0	LC	1.0000	1.0000	0.9500	1.0000						
0	XC	1.0000	1.0000	1.0000	1.0000						
0.32		1.0000	1.0000	1.0000	0.9500						
1		1.0000	1.0000	0.9500	0.9500						
3.2		1.0000	1.0000	1.0000	1.0000						
10		1.0000	1.0000	1.0000	1.0000						
32		0.9500	1.0000	1.0000	1.0000						
56		1.0000	0.9500	1.0000	1.0000						
100		1.0000	1.0000	0.8500	1.0000						

Hatch Rate Binomials					
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	20/20	20/20	19/20	20/20
0	XC	20/20	20/20	20/20	20/20
0.32		20/20	20/20	20/20	19/20
1		20/20	20/20	19/20	19/20
3.2		20/20	20/20	20/20	20/20
10		20/20	20/20	20/20	20/20
32		19/20	20/20	20/20	20/20
56		20/20	19/20	20/20	20/20
100		20/20	20/20	17/20	20/20



## CETIS Analytical Report

Report Date: 22 Dec-21 12:25 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 05-4055-3310	<b>Endpoint:</b> Post Hatch Survival	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 22 Dec-21 12:24	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Batch ID:</b> 01-7489-1602	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 Sep-21	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> River Water
<b>Ending Date:</b> 12 Oct-21	<b>Species:</b> <i>Pimephales promelas</i>	<b>Brine:</b>
<b>Test Length:</b> 33d 0h	<b>Taxon:</b> Actinopterygii	<b>Source:</b> Aquatox, AR <b>Age:</b>
<b>Sample ID:</b> 14-3631-9251	<b>Code:</b> PJ2021-006 ELS	<b>Project:</b>
<b>Sample Date:</b> 07 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 09 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 48h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.2125	11.47%	1.788	0.01918	61.4	56.21	67.07

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.414	2.938	0.3725	No Outliers Detected

## Post Hatch Survival Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.7875	0.7500	0.8000	0.0250	3.18%	0.0%	63/80	0.7934	0.0%
0.32		4	0.7993	0.6000	0.9474	0.1573	19.68%	-1.5%	63/79	0.7934	0.0%
1		4	0.6197	0.4500	0.9000	0.1948	31.44%	21.3%	49/79	0.7541	4.95%
3.2		4	0.8750	0.7000	0.9500	0.1190	13.60%	-11.11%	70/80	0.7541	4.95%
10		4	0.7250	0.6000	0.8500	0.1190	16.42%	7.94%	58/80	0.7541	4.95%
32		4	0.7967	0.6500	0.9000	0.1244	15.62%	-1.17%	63/79	0.7541	4.95%
56		4	0.4697	0.3500	0.5789	0.1119	23.82%	40.35%	37/79	0.4697	40.8%
100		4	0.0897	0.0500	0.2000	0.0737	82.10%	88.61%	7/77	0.08971	88.69%

## Post Hatch Survival Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.7500	0.8000	0.8000
0.32		0.6000	0.7500	0.9000	0.9474
1		0.9000	0.5500	0.4500	0.5789
3.2		0.7000	0.9500	0.9000	0.9500
10		0.6500	0.6000	0.8000	0.8500
32		0.7368	0.9000	0.6500	0.9000
56		0.4000	0.5789	0.3500	0.5500
100		0.0500	0.2000	0.0588	0.0500

## Post Hatch Survival Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	16/20	15/20	16/20	16/20
0.32		12/20	15/20	18/20	18/19
1		18/20	11/20	9/20	11/19
3.2		14/20	19/20	18/20	19/20
10		13/20	12/20	16/20	17/20
32		14/19	18/20	13/20	18/20
56		8/20	11/19	7/20	11/20
100		1/20	4/20	1/17	1/20

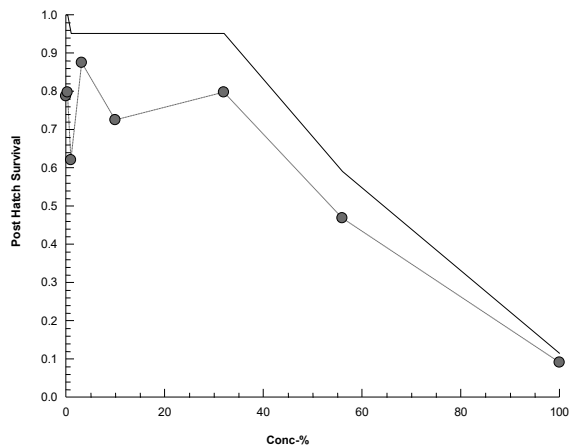


# CETIS Analytical Report

Report Date: 22 Dec-21 12:25 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (Pimephales promelas) 32-d survival and growth test			Nautilus Environmental Calgary
Analysis ID: 05-4055-3310	Endpoint: Post Hatch Survival	CETIS Version: CETISv1.9.4	
Analyzed: 22 Dec-21 12:24	Analysis: Trimmed Spearman-Kärber	Status Level: 1	

## Graphics





## CETIS Analytical Report

Report Date: 22 Dec-21 12:24 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	19-0032-9137	Endpoint:	Post Hatch Survival	CETIS Version:	CETISv1.9.4
Analyzed:	22 Dec-21 12:24	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1346066	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.414	2.938	0.3725	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	32.1	n/a	35.47	3.115	2.819	n/a
LC10	34.7	n/a	38.15	2.882	2.621	n/a
LC15	37.51	n/a	42.9	2.666	2.331	n/a
LC20	40.54	31.6	47.97	2.467	2.085	3.164
LC25	43.8	34.61	57.91	2.283	1.727	2.889
LC40	55.23	42.47	67.45	1.811	1.483	2.355
LC50	62.58	48.39	72.93	1.598	1.371	2.067

## Post Hatch Survival Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.7875	0.7500	0.8000	0.0250	3.18%	0.0%	63/80	0.7934	0.0%
0.32		4	0.7993	0.6000	0.9474	0.1573	19.68%	-1.5%	63/79	0.7934	0.0%
1		4	0.6197	0.4500	0.9000	0.1948	31.44%	21.3%	49/79	0.7541	4.95%
3.2		4	0.8750	0.7000	0.9500	0.1190	13.60%	-11.11%	70/80	0.7541	4.95%
10		4	0.7250	0.6000	0.8500	0.1190	16.42%	7.94%	58/80	0.7541	4.95%
32		4	0.7967	0.6500	0.9000	0.1244	15.62%	-1.17%	63/79	0.7541	4.95%
56		4	0.4697	0.3500	0.5789	0.1119	23.82%	40.35%	37/79	0.4697	40.8%
100		4	0.0897	0.0500	0.2000	0.0737	82.10%	88.61%	7/77	0.08971	88.69%

## Post Hatch Survival Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.7500	0.8000	0.8000
0.32		0.6000	0.7500	0.9000	0.9474
1		0.9000	0.5500	0.4500	0.5789
3.2		0.7000	0.9500	0.9000	0.9500
10		0.6500	0.6000	0.8000	0.8500
32		0.7368	0.9000	0.6500	0.9000
56		0.4000	0.5789	0.3500	0.5500
100		0.0500	0.2000	0.0588	0.0500



# CETIS Analytical Report

Report Date: 22 Dec-21 12:24 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

## Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

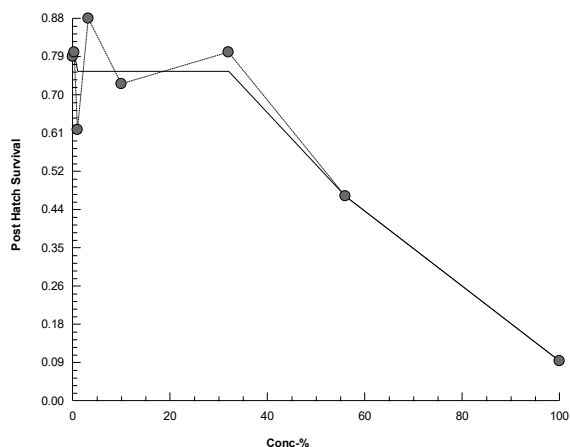
Analysis ID: 19-0032-9137      Endpoint: Post Hatch Survival  
Analyzed: 22 Dec-21 12:24      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Post Hatch Survival Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	16/20	15/20	16/20	16/20
0.32		12/20	15/20	18/20	18/19
1		18/20	11/20	9/20	11/19
3.2		14/20	19/20	18/20	19/20
10		13/20	12/20	16/20	17/20
32		14/19	18/20	13/20	18/20
56		8/20	11/19	7/20	11/20
100		1/20	4/20	1/17	1/20

### Graphics





## CETIS Analytical Report

Report Date: 22 Dec-21 12:29 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 10-5104-5275	<b>Endpoint:</b> Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 22 Dec-21 12:28	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Batch ID:</b> 01-7489-1602	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 Sep-21	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> River Water
<b>Ending Date:</b> 12 Oct-21	<b>Species:</b> <i>Pimephales promelas</i>	<b>Brine:</b>
<b>Test Length:</b> 33d 0h	<b>Taxon:</b> Actinopterygii	<b>Source:</b> Aquatox, AR <b>Age:</b>
<b>Sample ID:</b> 14-3631-9251	<b>Code:</b> PJ2021-006 ELS	<b>Project:</b>
<b>Sample Date:</b> 07 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 09 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 48h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.2125	11.11%	1.786	0.01883	61.14	56.06	66.68

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.519	2.938	0.2600	No Outliers Detected

## Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.7875	0.7500	0.8000	0.0250	3.18%	0.0%	63/80	0.7875	0.0%
0.32		4	0.7875	0.6000	0.9000	0.1436	18.24%	0.0%	63/80	0.7875	0.0%
1		4	0.6125	0.4500	0.9000	0.1974	32.23%	22.22%	49/80	0.75	4.76%
3.2		4	0.8750	0.7000	0.9500	0.1190	13.60%	-11.11%	70/80	0.75	4.76%
10		4	0.7250	0.6000	0.8500	0.1190	16.42%	7.94%	58/80	0.75	4.76%
32		4	0.7875	0.6500	0.9000	0.1315	16.70%	0.0%	63/80	0.75	4.76%
56		4	0.4625	0.3500	0.5500	0.1031	22.29%	41.27%	37/80	0.4625	41.27%
100		4	0.0875	0.0500	0.2000	0.0750	85.71%	88.89%	7/80	0.0875	88.89%

## Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.7500	0.8000	0.8000
0.32		0.6000	0.7500	0.9000	0.9000
1		0.9000	0.5500	0.4500	0.5500
3.2		0.7000	0.9500	0.9000	0.9500
10		0.6500	0.6000	0.8000	0.8500
32		0.7000	0.9000	0.6500	0.9000
56		0.4000	0.5500	0.3500	0.5500
100		0.0500	0.2000	0.0500	0.0500

## Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	16/20	15/20	16/20	16/20
0.32		12/20	15/20	18/20	18/20
1		18/20	11/20	9/20	11/20
3.2		14/20	19/20	18/20	19/20
10		13/20	12/20	16/20	17/20
32		14/20	18/20	13/20	18/20
56		8/20	11/20	7/20	11/20
100		1/20	4/20	1/20	1/20



# CETIS Analytical Report

Report Date: 22 Dec-21 12:29 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

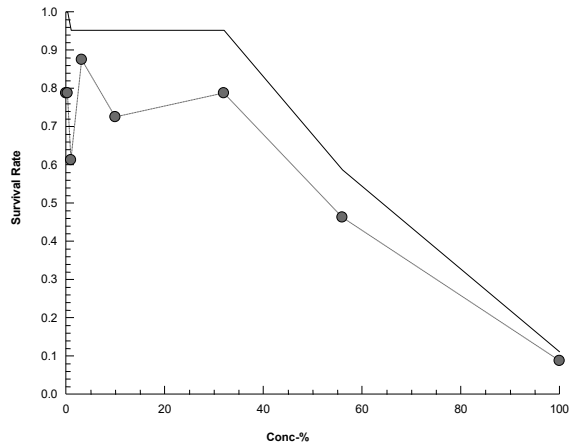
Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

Analysis ID: 10-5104-5275      Endpoint: Survival Rate  
Analyzed: 22 Dec-21 12:28      Analysis: Trimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





## CETIS Analytical Report

Report Date: 22 Dec-21 12:28 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	04-4445-3441	Endpoint:	Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	22 Dec-21 12:28	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1428930	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.519	2.938	0.2600	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	32.12	n/a	35.42	3.114	2.823	n/a
LC10	34.69	n/a	37.85	2.883	2.642	n/a
LC15	37.47	n/a	41.29	2.669	2.422	n/a
LC20	40.46	30.04	45.71	2.472	2.188	3.329
LC25	43.68	33.92	51.57	2.289	1.939	2.948
LC40	54.93	43.35	64.89	1.821	1.541	2.307
LC50	62.3	49.94	70.81	1.605	1.412	2.002

## Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.7875	0.7500	0.8000	0.0250	3.18%	0.0%	63/80	0.7875	0.0%
0.32		4	0.7875	0.6000	0.9000	0.1436	18.24%	0.0%	63/80	0.7875	0.0%
1		4	0.6125	0.4500	0.9000	0.1974	32.23%	22.22%	49/80	0.75	4.76%
3.2		4	0.8750	0.7000	0.9500	0.1190	13.60%	-11.11%	70/80	0.75	4.76%
10		4	0.7250	0.6000	0.8500	0.1190	16.42%	7.94%	58/80	0.75	4.76%
32		4	0.7875	0.6500	0.9000	0.1315	16.70%	0.0%	63/80	0.75	4.76%
56		4	0.4625	0.3500	0.5500	0.1031	22.29%	41.27%	37/80	0.4625	41.27%
100		4	0.0875	0.0500	0.2000	0.0750	85.71%	88.89%	7/80	0.0875	88.89%

## Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.7500	0.8000	0.8000
0.32		0.6000	0.7500	0.9000	0.9000
1		0.9000	0.5500	0.4500	0.5500
3.2		0.7000	0.9500	0.9000	0.9500
10		0.6500	0.6000	0.8000	0.8500
32		0.7000	0.9000	0.6500	0.9000
56		0.4000	0.5500	0.3500	0.5500
100		0.0500	0.2000	0.0500	0.0500



# CETIS Analytical Report

Report Date: 22 Dec-21 12:28 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

Analysis ID: 04-4445-3441  
Analyzed: 22 Dec-21 12:28

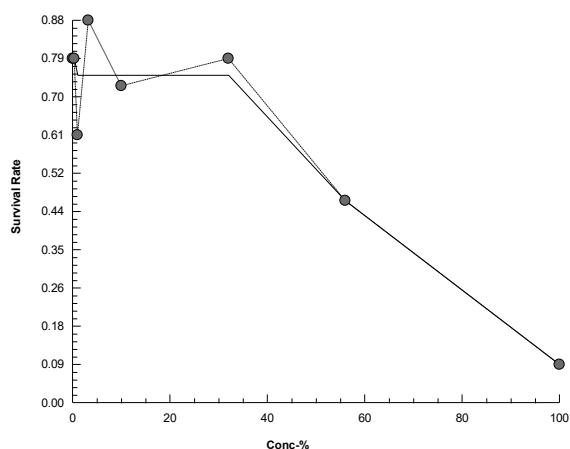
Endpoint: Survival Rate  
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	16/20	15/20	16/20	16/20
0.32		12/20	15/20	18/20	18/20
1		18/20	11/20	9/20	11/20
3.2		14/20	19/20	18/20	19/20
10		13/20	12/20	16/20	17/20
32		14/20	18/20	13/20	18/20
56		8/20	11/20	7/20	11/20
100		1/20	4/20	1/20	1/20

## Graphics





## CETIS Analytical Report

Report Date: 22 Dec-21 12:18 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	07-0371-7539	Endpoint:	Length	CETIS Version:	CETISv1.9.4
Analyzed:	22 Dec-21 12:17	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	831550	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.259	2.938	0.0106	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	62.51	n/a	n/a	1.6	n/a	n/a
IC10	83.97	48.11	n/a	1.191	n/a	2.078
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

## Length Summary

			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	4	12.73	12.5	13.1	0.263	2.07%	0.0%	12.73	0.0%
0.32		4	12.6	11.6	13.8	0.9201	7.30%	0.98%	12.73	0.0%
1		4	12.85	11.8	13.3	0.7047	5.48%	-0.98%	12.73	0.0%
3.2		4	11.95	11.5	12.6	0.4655	3.90%	6.09%	12.34	3.05%
10		4	12.73	11.9	13.6	0.85	6.68%	0.0%	12.34	3.05%
32		4	12.27	11.4	12.9	0.75	6.11%	3.54%	12.32	3.14%
56		4	12.38	11.7	12.9	0.5123	4.14%	2.75%	12.32	3.14%
100		4	11.08	8	14	2.454	22.16%	12.97%	11.08	12.97%

## Length Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	13.1	12.7	12.6	12.5
0.32		13.8	12.7	11.6	12.3
1		11.8	13.2	13.1	13.3
3.2		12.6	11.5	11.9	11.8
10		13.3	13.6	12.1	11.9
32		12.9	11.4	12.9	11.9
56		12.3	11.7	12.9	12.6
100		14	11.3	11	8

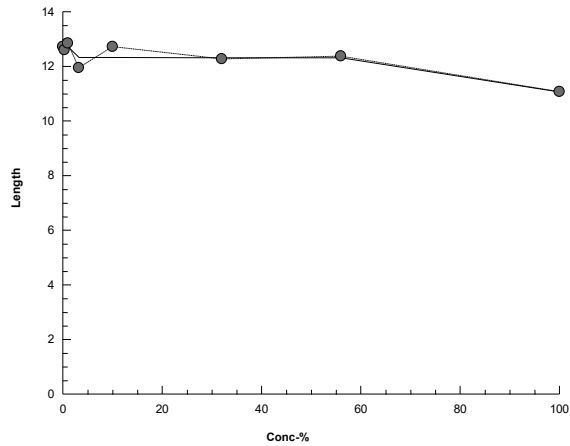


# CETIS Analytical Report

Report Date: 22 Dec-21 12:18 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (Pimephales promelas) 32-d survival and growth test			Nautilus Environmental Calgary
Analysis ID: 07-0371-7539	Endpoint: Length	CETIS Version: CETISv1.9.4	
Analyzed: 22 Dec-21 12:17	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

## Graphics





## CETIS Analytical Report

Report Date: 06 Sep-22 11:15 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
<b>Analysis ID:</b>	10-0484-8652	<b>Endpoint:</b>	Mean Dry Weight-mg	<b>CETIS Version:</b>	CETISv2.1.0
<b>Analyzed:</b>	06 Sep-22 11:13	<b>Analysis:</b>	Linear Interpolation (ICPIN)	<b>Status Level:</b>	1
<b>Edit Date:</b>	19 Jan-22 11:26	<b>MD5 Hash:</b>	DEFF29E6D17E267D2990836E56402017	<b>Editor ID:</b>	004-569-145-5
<b>Batch ID:</b>	01-7489-1602	<b>Test Type:</b>	Survival-Development-Growth	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	09 Sep-21	<b>Protocol:</b>	ASTM E1241-05 (2013)	<b>Diluent:</b>	River Water
<b>Ending Date:</b>	12 Oct-21	<b>Species:</b>	<i>Pimephales promelas</i>	<b>Brine:</b>	
<b>Test Length:</b>	33d 0h	<b>Taxon:</b>	Actinopterygii	<b>Source:</b>	Aquatox, AR
				<b>Age:</b>	
<b>Sample ID:</b>	14-3631-9251	<b>Code:</b>	PJ2021-006 ELS	<b>Project:</b>	
<b>Sample Date:</b>	07 Sep-21	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	09 Sep-21	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	48h	<b>Client:</b>	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1159162	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	3.068	---	---	32.6	---	---
IC15	>100	---	---	<1	---	---
IC20	>100	---	---	<1	---	---
IC25	>100	---	---	<1	---	---
IC40	>100	---	---	<1	---	---
IC50	>100	---	---	<1	---	---

## Mean Dry Weight-mg Summary

Mean Dry Weight-mg Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	XC	4	5.994	5.948	5.894	6.186	2.30%	0.00%	6.114	0.00%
0.32		4	6.125	5.478	4.928	8.615	27.95%	-2.18%	6.114	0.00%
1		4	6.224	6.547	4.644	7.156	18.46%	-3.83%	6.114	0.00%
3.2		4	4.835	4.619	3.988	6.114	19.01%	19.34%	5.475	10.45%
10		4	6.046	6.048	5.004	7.086	19.43%	-0.87%	5.475	10.45%
32		4	5.275	5.23	4.072	6.57	25.62%	11.99%	5.475	10.45%
56		4	5.744	5.869	4.676	6.564	15.89%	4.16%	5.475	10.45%
100		4	5.205	5.06	1.67	9.03	59.30%	13.16%	5.205	14.87%

## Mean Dry Weight-mg Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	6.186	6.001	5.894	5.894
0.32		8.615	5.88	5.076	4.928
1		4.644	6.108	6.987	7.156
3.2		6.114	3.988	4.831	4.408
10		7.086	7.041	5.054	5.004
32		6.314	4.146	6.57	4.072
56		6.564	4.676	6.441	5.296
100		9.03	5.9	4.22	1.67



# CETIS Analytical Report

Report Date: 06 Sep-22 11:15 (p 2 of 2)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

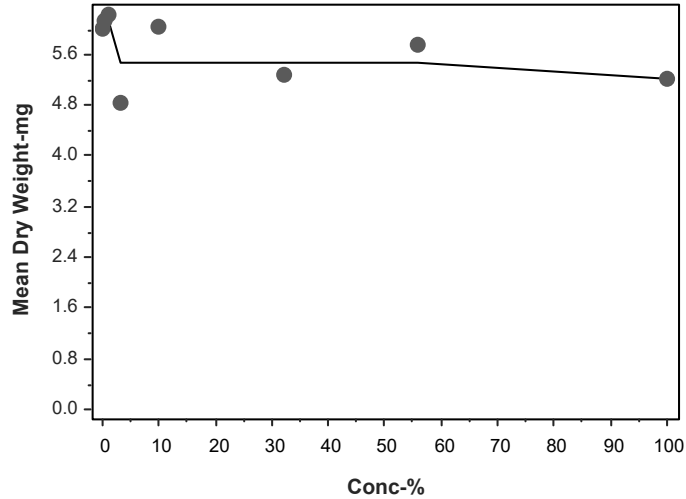
Fathead minnow (*Pimephales promelas*) 32-d survival and growth test

Nautilus Environmental Calgary

Analysis ID: 10-0484-8652      Endpoint: Mean Dry Weight-mg  
Analyzed: 06 Sep-22 11:13      Analysis: Linear Interpolation (ICPIN)  
Edit Date: 19 Jan-22 11:26      MD5 Hash: DEFF29E6D17E267D2990836E56402017

CETIS Version: CETISv2.1.0  
Status Level: 1  
Editor ID: 004-569-145-5

## Graphics





# CETIS Summary Report

Report Date: 06 Sep-22 11:21 (p 1 of 1)  
Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
09-4069-2639	Mean Dry Weight-mg	Linear Interpolation (ICPIN)	✓	IC10	3.068	---	---	32.6	1
				IC15	>100	---	---	<1	
				IC20	>100	---	---	<1	
				IC25	>100	---	---	<1	
				IC40	>100	---	---	<1	
				IC50	>100	---	---	<1	

Mean Dry Weight-mg Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	4	5.815	4.874	6.755	5.194	6.569	0.2955	0.591	10.16%	0.00%
0	XC	4	5.994	5.775	6.213	5.894	6.186	0.06883	0.1377	2.30%	-3.09%
0.32		4	6.125	3.4	8.849	4.928	8.615	0.856	1.712	27.95%	-5.34%
1		4	6.224	4.396	8.052	4.644	7.156	0.5744	1.149	18.46%	-7.04%
3.2		4	4.835	3.372	6.298	3.988	6.114	0.4596	0.9192	19.01%	16.85%
10		4	6.046	4.177	7.916	5.004	7.086	0.5874	1.175	19.43%	-3.99%
32		4	5.275	3.125	7.426	4.072	6.57	0.6757	1.351	25.62%	9.28%
56		4	5.744	4.292	7.197	4.676	6.564	0.4563	0.9126	15.89%	1.20%
100		4	5.205	0.2937	10.12	1.67	9.03	1.543	3.086	59.30%	10.48%

Mean Dry Weight-mg Detail						MD5: 13DD16E2045A5E22D73179CD35A2A295					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4						
0	LC	6.569	5.194	5.952	5.543						
0	XC	6.186	6.001	5.894	5.894						
0.32		8.615	5.88	5.076	4.928						
1		4.644	6.108	6.987	7.156						
3.2		6.114	3.988	4.831	4.408						
10		7.086	7.041	5.054	5.004						
32		6.314	4.146	6.57	4.072						
56		6.564	4.676	6.441	5.296						
100		9.03	5.9	4.22	1.67						



## CETIS Analytical Report

Report Date: 22 Dec-21 12:35 (p 1 of 2)

Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow ( <i>Pimephales promelas</i> ) 32-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	11-3231-9822	Endpoint:	Proportion Normal	CETIS Version:	CETISv1.9.4
Analyzed:	22 Dec-21 12:34	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	01-7489-1602	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 Sep-21	Protocol:	ASTM E1241-05 (2013)	Diluent:	River Water
Ending Date:	12 Oct-21	Species:	<i>Pimephales promelas</i>	Brine:	
Test Length:	33d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	14-3631-9251	Code:	PJ2021-006 ELS	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1679162	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.8	2.938	3.5E-04	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC5	64.61	52.7	n/a	1.548	n/a	1.898
LC10	81.76	46.18	n/a	1.223	n/a	2.166
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## Proportion Normal Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	63/63	1	0.0%
0.32		4	0.9375	0.8333	1.0000	0.0798	8.51%	6.25%	59/63	0.9806	1.94%
1		4	0.9773	0.9091	1.0000	0.0455	4.65%	2.27%	48/49	0.9806	1.94%
3.2		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	70/70	0.9806	1.94%
10		4	0.9688	0.8750	1.0000	0.0625	6.45%	3.13%	56/58	0.9806	1.94%
32		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	63/63	0.9806	1.94%
56		4	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	37/37	0.9806	1.94%
100		4	0.7500	0.0000	1.0000	0.5000	66.67%	25.0%	6/7	0.75	25.0%

## Proportion Normal Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	1.0000	1.0000
0.32		0.9167	1.0000	0.8333	1.0000
1		1.0000	0.9091	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	0.8750	1.0000
32		1.0000	1.0000	1.0000	1.0000
56		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.0000



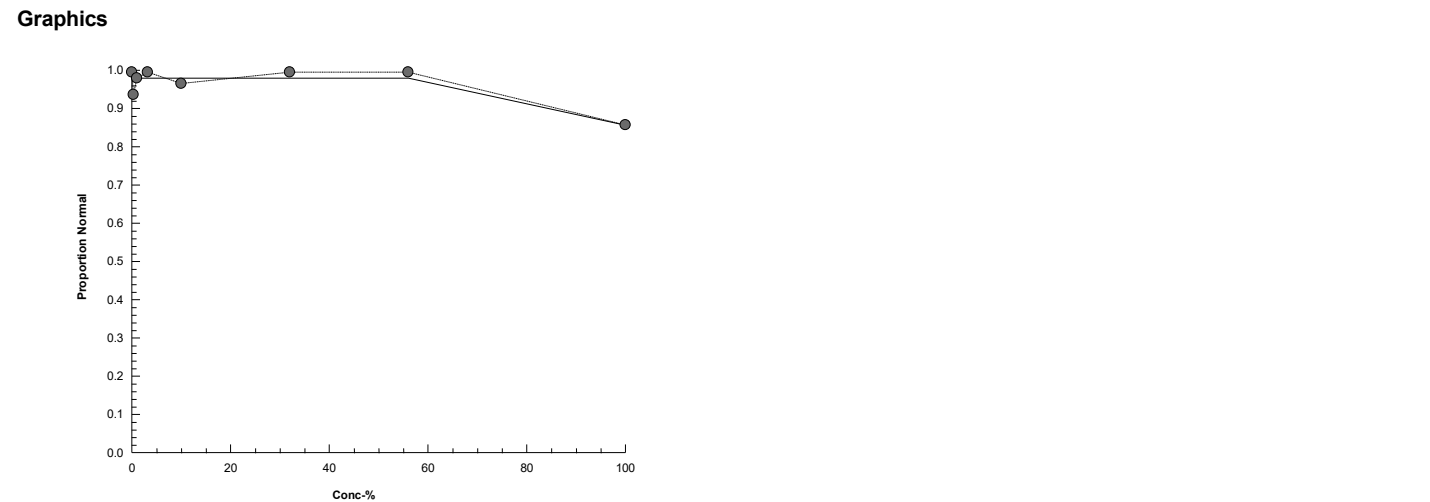
# CETIS Analytical Report

Report Date: 22 Dec-21 12:35 (p 2 of 2)  
 Test Code/ID: PJ2021-006 ELS / 01-8335-8711

Fathead minnow (*Pimephales promelas*) 32-d survival and growth test Nautilus Environmental Calgary

Analysis ID: 11-3231-9822	Endpoint: Proportion Normal	CETIS Version: CETISv1.9.4
Analyzed: 22 Dec-21 12:34	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

Proportion Normal Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	16/16	15/15	16/16	16/16
0.32		11/12	15/15	15/18	18/18
1		18/18	10/11	9/9	11/11
3.2		14/14	19/19	18/18	19/19
10		13/13	12/12	14/16	17/17
32		14/14	18/18	13/13	18/18
56		8/8	11/11	7/7	11/11
100		1/1	4/4	1/1	0/1





## **APPENDIX A - Long-term Fathead Minnow (*Pimephales promelas*) Toxicity Test Data**



Method TRD Client HAT/SYN Reference 2122-0052-01 (week 1) Chamber 5  
 PJ2021-006

## Test Log

Day	Date	Time	Initial	Chem. Cart	Daily Data Review
0	2021/09/10	1530	*JCC/DW	1	MAE
1	2021/09/11	0845	DJ	-	MAE
2	2021/09/12	0830	JCC	-	EL
3	2021/09/13	0900	AE	-	EV
4	2021/09/14	0830	MAE	1	MAE

## Sample Information

Initial pH:	<u>9.0</u>
Initial EC (µS/cm):	<u>2990</u>
Salinity (ppt):	<u>1</u>

Note: \*; time when the test was loaded with fish

## Sample Pre-Aeration

Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

0 hours	0.5 hours	1 hour	1.5 hours	2 hours
<u>6.4</u>	<u>6.7</u>	<u>7.9</u>		
<u>15</u>				

DO in mg/L (70% - 100% saturation)\*\*

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

## Test Chemistry and Biology

Conc.	Lab Ctl	Site Ctl	6.25	12.5	25	50	100
-------	---------	----------	------	------	----	----	-----

pH (units) (range: 5.5-8.5)

Day 0	<u>8.0</u>	<u>8.2</u>	<u>8.5</u>	<u>8.7</u>	<u>8.9</u>	<u>9.1</u>	<u>9.2</u>
Day 4	<u>8.2</u>	<u>8.1</u>	<u>8.0</u>	<u>8.1</u>	<u>8.3</u>	<u>8.5</u>	<u>8.7</u>

EC (µS/cm)

Day 0	<u>389</u>	<u>281</u>	<u>429</u>	<u>623</u>	<u>919</u>	<u>1617</u>	<u>2990</u>
Day 4	<u>401</u>	<u>293</u>	<u>443</u>	<u>640</u>	<u>909</u>	<u>1616</u>	<u>3010</u>

DO (mg/L) (70-100% saturation at test temp.)

Day 0	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.9</u>
Day 4	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.8</u>	<u>8.5</u>

Temperature (°C) (range: 14-16°C)

Day 0	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>
Day 4	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>

Number Alive (In brackets number stressed)

Day 0	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 1	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 2	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 3	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 4	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10(1)</u>

Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control

Unless otherwise noted, behavior is considered to be normal.

## Control Organism Data

Control Fish Length (cm) Weight (g)

1	<u>3.1</u>	<u>0.4</u>
2	<u>3.2</u>	<u>0.4</u>
3	<u>3.7</u>	<u>0.6</u>
4	<u>2.7</u>	<u>0.3</u>
5	<u>3.2</u>	<u>0.4</u>
6	<u>3.0</u>	<u>0.3</u>
7	<u>4.1</u>	<u>1.0</u>
8	<u>3.7</u>	<u>0.6</u>
9	<u>3.1</u>	<u>0.5</u>
10	<u>3.1</u>	<u>0.4</u>

Loading Density (g/L): 0.3  
 (must be ≤ 0.5 g/L)

Mean Length (cm): 3.3

Length Range (cm): 2.7-4.1

Mean Weight (g): 0.5

(Must be ≥ 0.3g)

Weight Range (g): 0.3-1.0

## Test Organism Information

Batch 20210804 TR

Source Lyndon

Tank # 5

Days Held at 15± 2°C 38  
 (must be ≥ 14 days)

Percent stock mortality 0.36  
 (7 days prior to test, must be ≤ 2%)

Test Volume (L) 18

## Comments:

Reviewed By: SS

Date Reviewed: 2021/10/28



## CETIS Analytical Report

Report Date: 03 Nov-21 08:44 (p 1 of 2)

Test Code/ID: Treated OSPW We / 01-8987-3444

Fish 96-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	11-3119-6406	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 8:43	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	03-2545-3674	Test Type:	Survival (96h)	Analyst:	Sara Thiessen
Start Date:	10 Sep-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water
Ending Date:	14 Sep-21	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	96h	Taxon:	Actinopterygii	Source:	Lyndon Hatchery
					Age: 38d
Sample ID:	12-1584-1053	Code:	Week 1, Reactor 3	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1962011	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 96h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 96h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.25		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 96h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.25		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

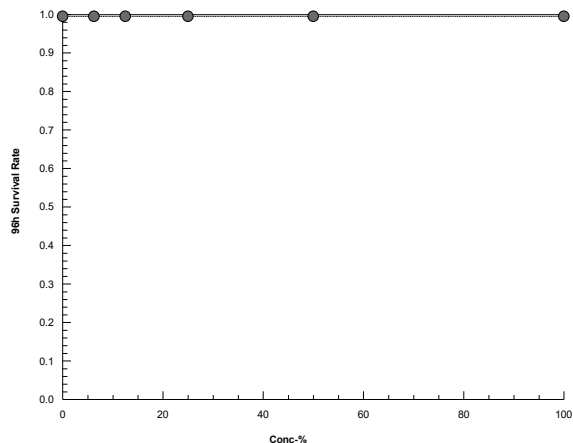


# CETIS Analytical Report

Report Date: 03 Nov-21 08:44 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 01-8987-3444

Fish 96-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID:	11-3119-6406	Endpoint:	96h Survival Rate
Analized:	03 Nov-21 8:43	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

## Graphics





Method TRD Client HAT/SYN Reference PJ2021-006 (week 2) Chamber 5
**Test Log**

Day	Date	Time	Initial	Chem, Cart	Daily Data Review
0	2021/09/17	16:50	SC / ME 1		ST
1	2021/09/18	08:55	MAF		AW
2	2021/09/19	09:00	W		AW
3	2021/09/20	09:10	KK/EN		AW
4	2021/09/21	11:15	MAF/ME 1		AL

**Sample Information**

 Initial pH: 9.1  
 Initial EC (µS/cm): 3020  
 Salinity (ppt): 1

Note: \*, time when the test was loaded with fish

**Sample Pre-Aeration**

 Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

0 hours	0.5 hours	1 hour	1.5 hours	2 hours
<u>7.2</u>	<u>7.6</u>			
<u>15</u>				

**DO in mg/L (70% - 100% saturation)\*\***

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

**Test Chemistry and Biology**

Conc.

CTL	500 µg/L	6	12	25	50	100
-----	----------	---	----	----	----	-----

pH (units) (range: 5.5-8.5)

Day 0	<u>7.1</u>	<u>7.7</u>	<u>8.1</u>	<u>8.4</u>	<u>8.7</u>	<u>8.9</u>	<u>9.1</u>
Day 4	<u>8.0</u>	<u>8.1</u>	<u>8.2</u>	<u>8.1</u>	<u>8.4</u>	<u>8.5</u>	<u>8.8</u>

EC (µS/cm)

Day 0	<u>797</u>	<u>780</u>	<u>451</u>	<u>640</u>	<u>945</u>	<u>1711</u>	<u>3050</u>
Day 4	<u>405</u>	<u>287</u>	<u>456</u>	<u>1047</u>	<u>947</u>	<u>1721</u>	<u>3010</u>

DO (mg/L) (70-100% saturation at test temp.)

Day 0	<u>7.9</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>7.6</u>
Day 4	<u>7.8</u>	<u>8.4</u>	<u>8.3</u>	<u>7.8</u>	<u>8.3</u>	<u>8.3</u>	<u>8.3</u>

Temperature (°C) (range: 14-16°C)

Day 0	<u>16</u>	<u>16</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>
Day 4	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>

Number Alive (In brackets number stressed)

Day 0	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 1	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 2	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 3	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>9</u>	<u>10</u>
Day 4	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>9</u>	<u>10</u>

Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control

Unless otherwise noted, behavior is considered to be normal

**Control Organism Data**

Control Fish Length (cm) Weight (g)

1	<u>3.0</u>	<u>0.3</u>
2	<u>3.0</u>	<u>0.3</u>
3	<u>3.4</u>	<u>0.5</u>
4	<u>3.7</u>	<u>0.6</u>
5	<u>4.3</u>	<u>1.0</u>
6	<u>3.3</u>	<u>0.3</u>
7	<u>3.6</u>	<u>0.5</u>
8	<u>3.7</u>	<u>0.6</u>
9	<u>3.9</u>	<u>0.6</u>
10	<u>3.8</u>	<u>0.6</u>

 Loading Density (g/L):  
 (must be ≤ 0.5 g/L)

0.3

Mean Length (cm):

3.6

Length Range (cm):

3.0 - 4.3

Mean Weight (g):

0.6

(Must be ≥ 0.3g)

Weight Range (g):

0.3 - 1.0
**Test Organism Information**

 Batch 20210817R  
 Source JAM LIVINGSTON  
 Tank # 2  
 Days Held at 15 ± 2°C 32  
 (must be ≥ 14 days)  
 Percent stock mortality 0  
 (7 days prior to test, must be ≤ 2%)  
 Test Volume (L) 18L
**Comments :**
\* fish jumped from tank - exclude from mortality.

 Reviewed By: SS

 Date Reviewed: 2021/11/02



## CETIS Analytical Report

Report Date: 06 Sep-22 11:46 (p 1 of 2)  
 Test Code/ID: 77328963 / 19-9980-0675

Fish 96-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	05-4881-6038	Endpoint:	96h Mortality Rate	CETIS Version:	CETISv2.1.0
Analyzed:	06 Sep-22 11:45	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	06 Sep-22 11:44	MD5 Hash:	6B669EFD6A266B4004B8153A7BAEDCB3	Editor ID:	003-581-756-9
Batch ID:	20-6853-8482	Test Type:	Survival (96h)	Analyst:	Stephanie Schiffer
Start Date:	17 Sep-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water
Ending Date:	21 Sep-21	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	96h	Taxon:	Actinopterygii	Source:	Troutlodge
Sample ID:	16-2544-9570	Code:	Week 2	Project:	
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	710496	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	>100	---	---	<1	---	---
LC15	>100	---	---	<1	---	---
LC20	>100	---	---	<1	---	---
LC25	>100	---	---	<1	---	---
LC40	>100	---	---	<1	---	---
LC50	>100	---	---	<1	---	---

## 96h Mortality Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
6		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
12		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
25		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
50		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	9/9	1.0000	0.00%
100		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%

## 96h Mortality Rate Detail

Conc.-%	Code	Rep 1
0	N	1.0000
6		1.0000
12		1.0000
25		1.0000
50		1.0000
100		1.0000

## 96h Mortality Rate Binomials

Conc.-%	Code	Rep 1
0	N	10/10
6		10/10
12		10/10
25		10/10
50		9/9
100		10/10

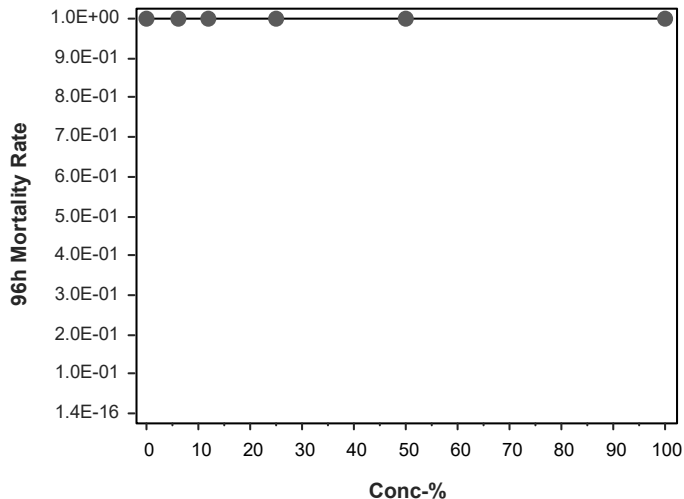


# CETIS Analytical Report

Report Date: 06 Sep-22 11:46 (p 2 of 2)  
Test Code/ID: 77328963 / 19-9980-0675

Fish 96-h Acute Survival Test			Nautilus Environmental Calgary	
Analysis ID:	05-4881-6038	Endpoint:	96h Mortality Rate	CETIS Version: CETISv2.1.0
Analyzed:	06 Sep-22 11:45	Analysis:	Linear Interpolation (ICPIN)	Status Level: 1
Edit Date:	06 Sep-22 11:44	MD5 Hash:	6B669EFD6A266B4004B8153A7BAEDCB3	Editor ID: 003-581-756-9

## Graphics





Method TR0 Client HAT/SYN Reference PJ 2021-006 Chamber 2
**Test Log**
week 3
**Sample Information**

Day	Date	Time	Initial	Chem. Cart	Daily Data Review	Initial pH:
0	2021/09/25	12:30	SC/ST	3	ST	9.1
1	2021/09/26	08:40	EV	-	VL	Initial EC (µS/cm):
2	2021/09/27	09:20	EV	-	MF	Salinity (ppt):
3	2021/09/28	08:20	DI	-	AV	
4	2021/09/29	08:45	MAF	4	VL	

Note: \* ; time when the test was loaded with fish

**Sample Pre-Aeration**

 Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

0 hours	0.5 hours	1 hour	1.5 hours	2 hours
7.6	7.9			
15				

**DO in mg/L (70% - 100% saturation)\*\***

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

**Test Chemistry and Biology**

Conc.	CTL	STP	4	12	25	50	100
-------	-----	-----	---	----	----	----	-----

Day 0	8.3	8.3	8.4	8.7	8.8	9.0	9.1
Day 4	8.0	8.0	8.0	8.1	8.2	8.4	8.6

pH (units) (range: 5.5-8.5)

Day 0	376	310	491	718	1025	1731	3010
Day 4	378	327	523	756	1083	1886	390

EC (µS/cm)

Day 0	8.9	8.9	8.8	8.8	8.8	8.3	7.9
Day 4	8.8	8.8	8.8	8.8	8.8	8.8	8.8

DO (mg/L) (70-100% saturation at test temp.)

Day 0	14	14	15	15	15	15	15
Day 4	15	15	15	15	15	15	15

Temperature (°C) (range: 14-16°C)

Day 0	10	10	10	10	10	10	10
Day 1	10	10	10	10	10	10	10
Day 2	10	10	10	10	10	10	10
Day 3	10	10	10	10	10	10	10
Day 4	10	10	10	10	10	10	10

Number Alive (In brackets number stressed)

**Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control**

Unless otherwise noted, behavior is considered to be normal

Control Organism Data			Test Organism Information	
Control Fish	Length (cm)	Weight (g)	Batch	
1	3.5	0.4	20210824TR	
2	3.6	0.5	Source	JAM LIVINGSTON
3	3.2	0.4	Tank #	2
4	3.0	0.3	Days Held at 15± 2°C	72
5	3.3	0.4	(must be ≥14 days)	
6	3.4	0.5	Percent stock mortality	0
7	3.3	0.3	(7 days prior to test, must be ≤2%)	
8	2.8	0.2	Test Volume (L)	18L
9	2.9	0.2		
10	3.1	0.3		
Loading Density (g/L):			0.2	
(must be ≤0.5 g/L)				
Mean Length (cm):			3.2	
Length Range (cm):			2.8-3.6	
Mean Weight (g):			0.4	
(Must be ≥0.3g)				
Weight Range (g):			0.2-0.5	
Comments: Fish jumped				

 Reviewed By: SS

 Date Reviewed: 2021/10/28



# CETIS Analytical Report

Report Date: 03 Nov-21 09:52 (p 1 of 2)  
Test Code/ID: 2122-0052 TRD 3 / 19-7588-4343

Fish 96-h Acute Survival Test				Nautilus Environmental Calgary			
Analysis ID:	15-2050-6435	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.4		
Analyzed:	03 Nov-21 9:52	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1		
Batch ID:	13-2071-9959	Test Type:	Survival (96h)	Analyst:	Sara Thiessen		
Start Date:	25 Sep-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water		
Ending Date:	29 Sep-21	Species:	Oncorhynchus mykiss	Brine:			
Test Length:	96h	Taxon:	Actinopterygii	Source:	Sam Livingston Fish Hatch		
				Age:	32d		
Sample ID:	06-1464-4486	Code:	Week 3, Reactor 3	Project:			
Sample Date:	20 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.		
Receipt Date:	22 Sep-21	CAS (PC):		Station:	Treated OSPW		
Sample Age:	5d 0h	Client:	Syncrude Canada Ltd				

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	202781	1	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

96h Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	9/9	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

96h Survival Rate Detail		
Conc-%	Code	Rep 1
0	XC	1.0000
6.25		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

96h Survival Rate Binomials		
Conc-%	Code	Rep 1
0	XC	10/10
6.25		9/9
12.5		10/10
25		10/10
50		10/10
100		10/10

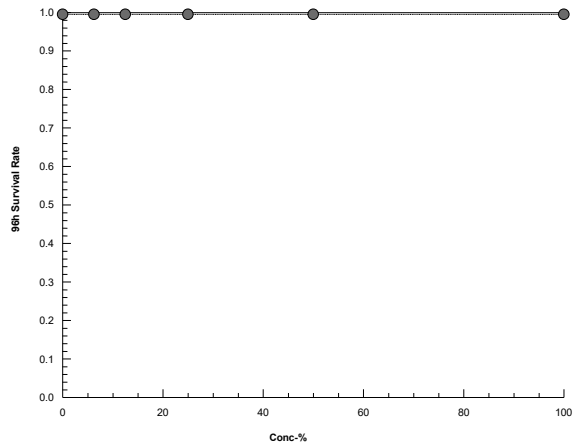


# CETIS Analytical Report

Report Date: 03 Nov-21 09:52 (p 2 of 2)  
Test Code/ID: 2122-0052 TRD 3 / 19-7588-4343

Fish 96-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID:	15-2050-6435	Endpoint:	96h Survival Rate
Analized:	03 Nov-21 9:52	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

## Graphics





Method TRD Client HAT/SYN Reference PJ2021-006 (week 4) Chamber 3
**Test Log**

Day	Date	Time	Initial	Chem. Cart	Daily Data Review	Initial pH:
0	2021/09/13	1530	MF/ev	1	R	9.1
1	2021/10/01	1030	JCC	-	R	Initial EC (µS/cm): 2450
2	2021/10/02	0945	JCC	-	MAF	Salinity (ppt): 1
3	2021/10/03	0940	JCC	-	MF	
4	2021/10/04	1015	SC/ev	1	MF	

Note: \* , time when the test was loaded with fish

**Sample Pre-Aeration**

 Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

	0 hours	0.5 hours	1 hour	1.5 hours	2 hours
DO (mg/L)	8.1	8.3			
Temp (°C)	16				

**DO in mg/L (70% - 100% saturation)\*\***

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

**Test Chemistry and Biology**

Conc.	Lab Ctl	Site Ctl	6.3	12.5	25	50	100
-------	---------	----------	-----	------	----	----	-----

	pH (units) (range: 5.5-8.5)						
Day 0	7.8	8.2	8.5	8.7	8.8	9.0	9.2
Day 4	7.1	7.9	8.0	8.1	8.3	8.5	8.6

	EC (µS/cm)						
Day 0	411	305	517	710	987	1107	3000
Day 4	431	331	543	752	1045	1755	3130

	DO (mg/L) (70-100% saturation at test temp.)						
Day 0	7.7	8.5	8.6	8.6	8.6	8.6	8.3
Day 4	8.6	8.6	8.6	8.6	8.6	8.6	8.6

	Temperature (°C) (range: 14-16°C)						
Day 0	16	16	16	16	16	16	16
Day 4	16	16	16	16	16	16	16

	Number Alive (In brackets number stressed)						
Day 0	10	10	10	10	10	10	10
Day 1	10	10	10	10	10	10	10
Day 2	10	10	10	10	10	10	10
Day 3	10	10	10	10	10	10	10
Day 4	10	10	10	10	10	10	10(1)

Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control

Unless otherwise noted, behavior is considered to be normal

Control Organism Data			Test Organism Information	
Control Fish	Length (cm)	Weight (g)	Batch	20210817TR
1	3.4	0.5	Source	Sam Livingston
2	3.1	0.3	Tank #	5
3	2.5	0.2	Days Held at 15± 2°C (must be ≥14 days)	37
4	3.6	0.6	Percent stock mortality (7 days prior to test, must be ≤2%)	0.04
5	4.0	0.9	Test Volume (L)	18
6	2.9	0.2		
7	3.5	0.5		
8	3.8	0.7		
9	3.1	0.3		
10	2.5	0.5		
Loading Density (g/L): (must be ≤0.5 g/L)			0.3	
Mean Length (cm):			3.3	
Length Range (cm):			2.5-4.0	
Mean Weight (g): (Must be ≥0.3g)			0.5	
Weight Range (g):			0.2-0.9	
Comments:				

 Reviewed By: 10

 Date Reviewed: 2021/11/01



## CETIS Analytical Report

Report Date: 10 Nov-21 14:53 (p 1 of 2)  
 Test Code/ID: 2122-0052 TR W4 / 09-3739-5968

Fish 96-h Acute Survival Test				Nautilus Environmental Calgary			
Analysis ID:	17-9494-2925	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.4		
Analyzed:	10 Nov-21 14:52	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1		
Batch ID:	05-3627-7947	Test Type:	Survival (96h)	Analyst:	Stephanie Schiffer		
Start Date:	30 Sep-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water		
Ending Date:	07 Oct-21	Species:	Oncorhynchus mykiss	Brine:			
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Sam Livingston Fish Hatch		
				Age:	37d		
Sample ID:	18-0236-5492	Code:	Week 4, Reactor 3	Project:	PJ2021-006		
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.		
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW		
Sample Age:	72h	Client:	Syncrude Canada Ltd				

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	438537	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

96h Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 96h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 96h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

Report Date: 10 Nov-21 14:53 (p 2 of 2)  
Test Code/ID: 2122-0052 TR W4 / 09-3739-5968

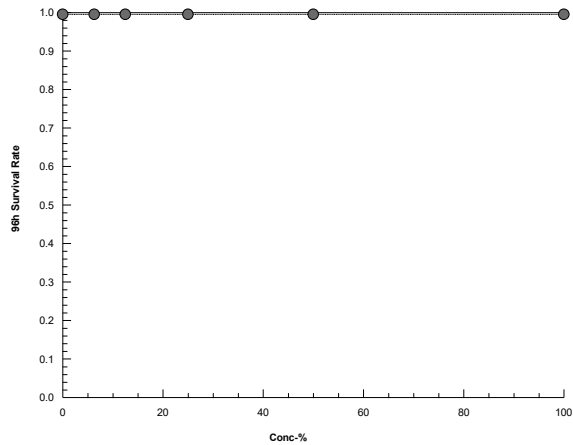
## Fish 96-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID: 17-9494-2925      Endpoint: 96h Survival Rate  
Analyzed: 10 Nov-21 14:52      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# Trout Bench Sheet

PJ2021-006 (week 4)  
2122-0202 (redctor 2)

Method TRD Client                      HAT/SYN                      Reference PJ2021-006 (week 4) Chamber 3  
2021-0052-01 OSPW

## Test Log

Day	Date	Time	Initial	Chem. Cart	Daily Data Review	Sample Information
0	2021/09/30	1530	MF-EV			Initial pH: <u>8.3</u>
1	2021/10/01	1030	JCC			Initial EC (µS/cm): <u>2990</u>
2	2021/10/02	0945	JCC			Salinity (ppt): <u>1</u>
3	2021/10/03	0950	JCC			
4	2021/10/04	1030	EV/SC			

Note: \*; time when the test was loaded with fish

## Sample Pre-Aeration

Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

0 hours	0.5 hours	1 hour	1.5 hours	2 hours
<u>7.9</u>	<u>8.2</u>			

DO in mg/L (70% - 100% saturation)\*\*

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

## Test Chemistry and Biology

Conc.	Lab Ctl	Site Ctl	6.3	12.5	25	50	100
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Day 0	<u>7.8</u>	<u>8.3</u>	<u>8.3</u>	<u>8.3</u>	<u>8.3</u>	<u>8.3</u>	<u>8.4</u>
Day 4	<u>8.1</u>	<u>8.1</u>	<u>8.2</u>	<u>8.2</u>	<u>8.3</u>	<u>8.3</u>	<u>8.6</u>

pH (units) (range: 5.5-8.5)

Day 0	<u>401</u>	<u>302</u>	<u>524</u>	<u>053</u>	<u>973</u>	<u>1039</u>	<u>3010</u>
Day 4	<u>431</u>	<u>334</u>	<u>549</u>	<u>699</u>	<u>1038</u>	<u>1433</u>	<u>3180</u>

EC (uS/cm)

Day 0	<u>7.9</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.3</u>	<u>8.2</u>	
Day 4	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	<u>8.0</u>	

DO (mg/L) (70-100% saturation at test temp.)

Day 0	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	
Day 4	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	

Temperature (°C) (range: 14-16°C)

Day 0	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	
Day 1	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	
Day 2	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	
Day 3	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	
Day 4	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	

Number Alive (In brackets number stressed)

Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control  
Unless otherwise noted, behavior is considered to be normal

## Control Organism Data

Control Fish	Length (cm)	Weight (g)
1	<u>3.3</u>	<u>0.5</u>
2	<u>3.4</u>	<u>0.5</u>
3	<u>3.3</u>	<u>0.4</u>
4	<u>3.4</u>	<u>0.4</u>
5	<u>3.3</u>	<u>0.5</u>
6	<u>3.5</u>	<u>0.5</u>
7	<u>3.3</u>	<u>0.4</u>
8	<u>3.2</u>	<u>0.3</u>
9	<u>3.2</u>	<u>0.4</u>
10	<u>2.8</u>	<u>0.3</u>

Loading Density (g/L):  
(must be ≤ 0.5 g/L)

Mean Length (cm):

Length Range (cm):

Mean Weight (g):  
(Must be ≥ 0.3g)

Weight Range (g):

## Test Organism Information

Batch	<u>20210817T2</u>
Source	<u>Sam Livingston</u>
Tank #	<u>5</u>
Days Held at 15± 2°C (must be ≥ 14 days)	<u>37</u>
Percent stock mortality (7 days prior to test, must be ≤ 2%)	<u>0.04</u>
Test Volume (L)	<u>18</u>

Comments :

Reviewed By: 10

Date Reviewed: 2021/11/01



## CETIS Analytical Report

Report Date: 18 Nov-21 08:21 (p 1 of 2)  
 Test Code/ID: 2122-0202 TRD 4 / 05-7965-0945

Fish 96-h Acute Survival Test			Nautilus Environmental Calgary		
Analysis ID:	18-8348-4598	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-21 8:20	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	05-3627-7947	Test Type:	Survival (96h)	Analyst:	Sara Thiessen
Start Date:	30 Sep-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water
Ending Date:	04 Oct-21	Species:	Oncorhynchus mykiss	Brine:	
Test Length:	96h	Taxon:	Actinopterygii	Source:	Sam Livingston Fish Hatch Age: 37d
Sample ID:	06-7424-7467	Code:	Week 4 Reactor 2	Project:	
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1978666	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	53.61	n/a	n/a	1.865	n/a	n/a
LC5	70.77	n/a	n/a	1.413	n/a	n/a
LC10	100	n/a	n/a	1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 96h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	0.9000	0.9000	0.9000	0.0000	0.00%	10.0%	9/10	0.9	10.0%

## 96h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		0.9000

## 96h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		9/10

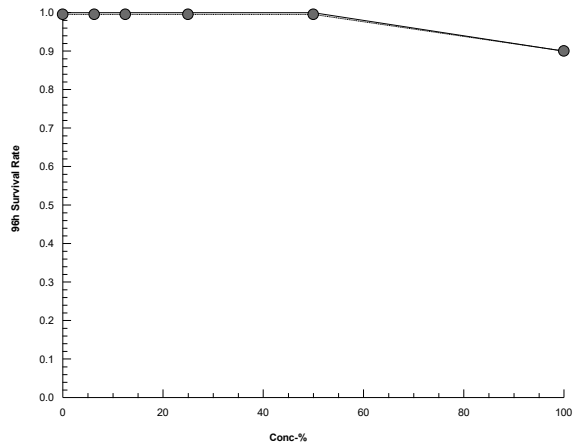


# CETIS Analytical Report

Report Date: 18 Nov-21 08:21 (p 2 of 2)  
Test Code/ID: 2122-0202 TRD 4 / 05-7965-0945

Fish 96-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID:	18-8348-4598	Endpoint:	96h Survival Rate
Analized:	18 Nov-21 8:20	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

## Graphics





Method TRD Client HAT/SYN Reference PJ2021-006 (week 4) Chamber 3  
2122-0202 (reactor 2)
**Test Log**

Day	Date	Time	Initial	Chem. Cart	Daily Data Review
0	2021/10/15	015	MF/NOV/CL	1	AW
1	2021/10/18	0830	KL	-	KL
2	21/10/19	0830	MAF	-	KL
3	2021/10/18	1000	JCC	-	AW
4	2021/10/19	1030	JCC/LEV	1	AW

**Sample Information**

 Initial pH: 9.40  
 Initial EC (µS/cm): 2950 → 2990  
 Salinity (ppt): 1

Note: \* ; time when the test was loaded with fish

**Sample Pre-Aeration**

 Aeration rate adjusted to 6.5 +/- 1 mL/min/L: yes/no

Preaeration time

DO(mg/L) of 100%

Temp (°C) of 100%

0 hours	0.5 hours	1 hour	1.5 hours	2 hours
<u>8.6</u>	<u>8.4</u>			
<u>16</u>				

**DO in mg/L (70% - 100% saturation)\*\***

6.2 mg/L - 8.9 mg/L at 14°C

6.1 mg/L - 8.8 mg/L at 15°C

6.0 mg/L - 8.6 mg/L at 16°C

\*\*corrected for altitude

**Test Chemistry and Biology**

Conc.	Lab Ctl	Site Ctl	6.3	12.5	25	50	100
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pH (units) (range: 5.5-8.5)

Day 0	<u>7.9</u>	<u>8.3</u>	<u>8.5</u>	<u>8.8</u>	<u>8.8</u>	<u>9.0</u>	<u>9.2</u>
Day 4	<u>7.9</u>	<u>7.9</u>	<u>7.9</u>	<u>8.8</u>	<u>8.1</u>	<u>8.2</u>	<u>8.4</u>

EC (µS/cm)

Day 0	<u>451</u>	<u>345</u>	<u>534</u>	<u>668</u>	<u>1013</u>	<u>1884</u>	<u>3150</u>
Day 4	<u>472</u>	<u>335</u>	<u>813</u>	<u>668</u>	<u>1029</u>	<u>1824</u>	<u>3050</u>

DO (mg/L) (70-100% saturation at test temp.)

Day 0	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>
Day 4	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>	<u>8.6</u>

Temperature (°C) (range: 14-16°C)

Day 0	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>
Day 4	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>

Number Alive (In brackets number stressed)

Day 0	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 1	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 2	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 3	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
Day 4	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>

Validity Criteria: must be ≤ 10% mortality and/or stressed behavior in the control

Unless otherwise noted, behavior is considered to be normal

**Control Organism Data**

Control Fish Length (cm) Weight (g)

1	<u>3.3</u>	<u>0.4</u>
2	<u>3.4</u>	<u>0.5</u>
3	<u>3.5</u>	<u>0.6</u>
4	<u>3.6</u>	<u>0.6</u>
5	<u>2.6</u>	<u>0.2</u>
6	<u>3.2</u>	<u>0.4</u>
7	<u>3.8</u>	<u>0.7</u>
8	<u>3.2</u>	<u>0.4</u>
9	<u>3.7</u>	<u>0.6</u>
10	<u>3.6</u>	<u>0.6</u>

 Loading Density (g/L): 0.3  
 (must be ≤ 0.5 g/L)

 Mean Length (cm): 3.4

 Length Range (cm): 2.6-3.8

 Mean Weight (g): 0.5

(Must be ≥ 0.3g)

 Weight Range (g): 0.2-0.7
**Test Organism Information**

 Batch 20210824TR

 Source John Livingston

 Tank # 6

 Days Held at 15± 2°C 44  
 (must be ≥ 14 days)

 Percent stock mortality 0  
 (7 days prior to test, must be ≤ 2%)

 Test Volume (L) 18
**Comments :**

 Reviewed By: ML

 Date Reviewed: 2021/10/29



## CETIS Analytical Report

Report Date: 04 Nov-21 16:58 (p 1 of 2)  
 Test Code/ID: 2122-0052 TR W5 / 07-0351-7734

Fish 96-h Acute Survival Test				Nautilus Environmental Calgary			
Analysis ID:	21-3311-3605	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.4		
Analyzed:	04 Nov-21 16:58	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1		
Batch ID:	07-2617-8461	Test Type:	Survival (96h)	Analyst:	Stephanie Schiffer		
Start Date:	07 Oct-21	Protocol:	EC/EPS 1/RM/13	Diluent:	River Water		
Ending Date:	11 Oct-21	Species:	Oncorhynchus mykiss	Brine:			
Test Length:	96h	Taxon:	Actinopterygii	Source:	Sam Livingston Fish Hatch		
				Age:	44d		
Sample ID:	19-9289-0141	Code:	Week 5 TR, Reactor 3	Project:	PJ2021-006		
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.		
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW		
Sample Age:	72h	Client:	Syncrude Canada Ltd				

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	966031	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 96h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 96h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 96h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

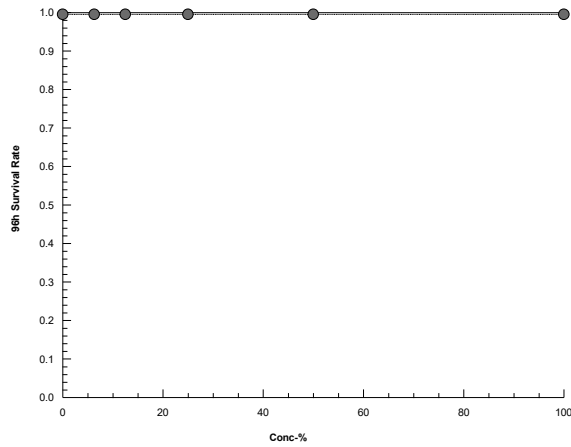


# CETIS Analytical Report

Report Date: 04 Nov-21 16:58 (p 2 of 2)  
Test Code/ID: 2122-0052 TR W5 / 07-0351-7734

Fish 96-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID:	21-3311-3605	Endpoint:	96h Survival Rate
Analized:	04 Nov-21 16:58	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

## Graphics





## **APPENDIX C – *Daphnia magna* Toxicity Test Data**



# Daphnia Bench Sheet

 Method DAD

 Client HAT/SYN  
PJ2021-006

 Reference 2122-0052-01 (week 1)

**Test Log**

						Sample Information	
Day	Date	Time	Technician	Chem. Cart	Daily Data Review	Initial pH:	<div>33 H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O H2O</div>

day	pH (units) (range: 6.0-8.5)
0	<u>8.4</u> <u>8.3</u> <u>8.6</u> <u>8.7</u> <u>8.9</u> <u>9.0</u> <u>9.2</u>
2	<u>8.2</u> <u>8.1</u> <u>8.2</u> <u>8.3</u> <u>8.4</u> <u>8.6</u> <u>8.9</u>

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

day	EC (uS/cm)
0	<u>306</u> <u>789</u> <u>954</u> <u>612</u> <u>948</u> <u>1615</u> <u>2490</u>
2	<u>405</u> <u>303</u> <u>457</u> <u>625</u> <u>952</u> <u>1615</u> <u>3000</u>

day	DO (mg/L) (40-100% saturation at test temp.)
0	<u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.8</u> <u>7.2</u>
2	<u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u> <u>7.9</u>

day	Temperature (°C) (range: 18-22 °C)
0	<u>20</u> <u>20</u> <u>20</u> <u>20</u> <u>20</u> <u>19</u> <u>19</u>
2	<u>20</u> <u>20</u> <u>20</u> <u>20</u> <u>20</u> <u>20</u> <u>20</u>

day	Number Alive (l, immobile)
0	<u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u>
1	<u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u>
2	<u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u> <u>10</u>

Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

**Culture**

 Young jar CS

 Jar(s) mortality 7 days prior to test (must be ≤25%) 0
**QA (previous month)**

 Days to first brood (≤12 days) 8

 Average number of young produced (≥15 young) 31

 Were test treatments randomized on test tray? Yes / No

**Control Validity Criteria**

 Mean % mortality at 48 hours - 0  
 (must be ≤10%)

**Sample**

 DO (mg/L) of sample prior to aeration: 6.4

 Temperature (°C) of sample prior to aeration: 20

 DO % of sample prior to aeration: 80

 Is aeration required (<40% or >100%)? Yes or No

 Duration of aeration (37.5 +/- 12.5 mL/min/L): -

 Filtered with 110µm screen prior to testing Yes or No

 Hardness (mg CaCO<sub>3</sub>/L) of 100%: 82 2065

 Is hardness adjustment required (<25 mg CaCO<sub>3</sub>/L)? Yes or No

 Hardness of sample after adjustment (must be between 25 - 30 mg CaCO<sub>3</sub>/L) -

 Alkalinity of 100% sample (mg CaCO<sub>3</sub>/L): 368
**Dilution Water**

 Pail label / preparation date 2:05/102 (Lab Ctl)

 Hardness of dilution water (mg/L) 177
**DO Levels (40-100% saturation) - corrected for altitude -**

3.3 to 8.2 mg/L at 18°C

3.1 to 7.7 mg/L at 21°C

3.2 to 8.1 mg/L at 19°C

3.0 to 7.6 mg/L at 22°C

3.2 to 7.9 mg/L at 20°C

**Comments/Observations:**

 Reviewed By: SS

 Date Reviewed: 2021/10/28



## CETIS Analytical Report

Report Date: 03 Nov-21 08:38 (p 1 of 2)

Test Code/ID: Treated OSPW We / 10-7537-6642

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	07-7360-9487	Endpoint:	48h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 8:37	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	18-4252-7200	Test Type:	Survival (48h)	Analyst:	Sara Thiessen
Start Date:	09 Sep-21	Protocol:	EC/EPS 1/RM/14	Diluent:	River Water
Ending Date:	11 Sep-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
					Age: <24
Sample ID:	07-7268-3404	Code:	Week 1, Reactor 3	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	17779	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.25		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.25		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

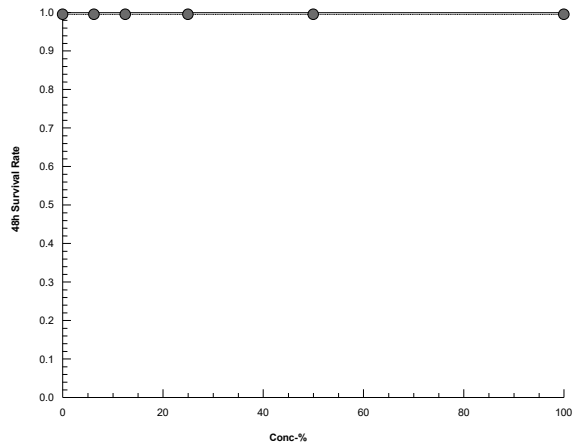


# CETIS Analytical Report

Report Date: 03 Nov-21 08:38 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 10-7537-6642

Daphnia magna 48-h Acute Survival Test		Nautilus Environmental Calgary
Analysis ID: 07-7360-9487	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 03 Nov-21 8:37	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

## Graphics





# CETIS Analytical Report

Report Date: 03 Nov-21 08:39 (p 1 of 2)  
 Test Code/ID: Treated OSPW We / 10-7537-6642

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary			
Analysis ID:	05-2347-9210	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv1.9.4		
Analyzed:	03 Nov-21 8:39	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1		
Batch ID:	18-4252-7200	Test Type:	Survival (48h)	Analyst:	Sara Thiessen		
Start Date:	09 Sep-21	Protocol:	EC/EPS 1/RM/14	Diluent:	River Water		
Ending Date:	11 Sep-21	Species:	Daphnia magna	Brine:			
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House	Age: <24	
Sample ID:	07-7268-3404	Code:	Week 1, Reactor 3	Project:			
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.		
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW		
Sample Age:	48h	Client:	Syncrude Canada Ltd				

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	300637	1	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

48h Immobility Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

48h Immobility Rate Detail		
Conc-%	Code	Rep 1
0	XC	1.0000
6.25		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

48h Immobility Rate Binomials		
Conc-%	Code	Rep 1
0	XC	10/10
6.25		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

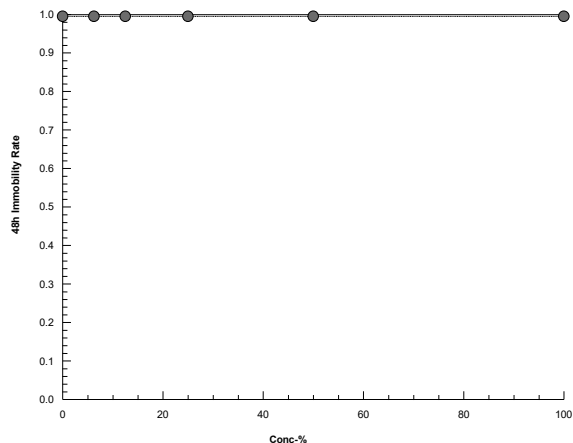


# CETIS Analytical Report

Report Date: 03 Nov-21 08:39 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 10-7537-6642

Daphnia magna 48-h Acute Survival Test		Nautilus Environmental Calgary
Analysis ID: 05-2347-9210	Endpoint: 48h Immobility Rate	CETIS Version: CETISv1.9.4
Analyzed: 03 Nov-21 8:39	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

## Graphics





Method DAD

 Client HAT/SYN  
PJ2021-006

 Reference 2122 -0052-01 (week 2)
**Test Log**

Day	Date	Time	Technician	Chem. Cart	Daily Data Review	Sample Information		
0	2021/09/16	1525	STMF	3	MAE	Initial pH:		9.1
1	2021/09/17	0835	MAE	-	BJ	Initial EC (µS/cm):		3020
2	2021/09/18	0815	ST	2	JK	Salinity (ppt):		6
Lab Code	Lab Ctl	Site Ctl	6.25	12.5	25	50	100	

day	pH (units) (range: 6.0-8.5)						
0	8.4	8.3	8.5	8.4	8.8	8.9	9.1
2	8.6	8.4	8.4	8.5	8.7	8.8	9.1

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

	EC (µS/cm)						
0	392	291	448	625	958	1612	2970
2	409	301	458	630	979	1645	3070

	DO (mg/L) (40-100% saturation at test temp.)						
0	8.1	8.1	8.1	8.1	8.1	8.0	7.9
2	8.5	7.9	7.9	8.5	7.9	7.7	7.8

	Temperature (°C) (range: 18-22 °C)						
0	19	19	19	19	19	19	19
2	20	20	20	20	20	20	20

	Number Alive (I, immobile)						
0	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10

Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

<b>Culture</b>	
Young jar <u>C5</u>	Jar(s) mortality 7 days prior to test (must be ≤25%) <u>0</u>
<b>QA (previous month)</b> Days to first brood (≤12 days) <u>8</u> Average number of young produced (≥15 young) <u>31</u> Were test treatments randomized on test tray? <input checked="" type="radio"/> Yes <input type="radio"/> No	
<b>Control Validity Criteria</b> Mean % mortality at 48 hours - (must be ≤10%) <u>0</u>	
<b>Sample</b> DO (mg/L) of sample prior to aeration: <u>7.4</u> Temperature (°C) of sample prior to aeration: <u>19</u> DO % of sample prior to aeration: <u>91</u> Is aeration required (<40% or >100%)? <input checked="" type="radio"/> Yes <input type="radio"/> No Duration of aeration (37.5 +/- 12.5 mL/min/L): <u>20 min</u> Filtered with 110µm screen prior to testing <input checked="" type="radio"/> Yes <input type="radio"/> No Hardness (mg CaCO <sub>3</sub> /L) of 100%: <u>70</u> Is hardness adjustment required (<25 mg CaCO <sub>3</sub> /L)? <input checked="" type="radio"/> Yes <input type="radio"/> No Hardness of sample after adjustment (must be between 25 - 30 mg CaCO <sub>3</sub> /L) <u>-</u> Alkalinity of 100% sample (mg CaCO <sub>3</sub> /L): <u>368</u>	
<b>Dilution Water</b> Pail label / preparation date <u>Site River Water</u> Hardness of dilution water (mg/L) <u>5</u>	
<b>DO Levels (40-100% saturation) - corrected for altitude -</b> 3.3 to 8.2 mg/L at 18°C      3.1 to 7.7 mg/L at 21°C 3.2 to 8.1 mg/L at 19°C      3.0 to 7.6 mg/L at 22°C 3.2 to 7.9 mg/L at 20°C	
<b>Comments/Observations:</b>	

 Reviewed By: SS

 Date Reviewed: 2021/12/21



## CETIS Analytical Report

Report Date: 28 Jan-22 14:33 (p 1 of 2)

Test Code/ID: 2122-0052 DA W2 / 05-6087-5093

## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 09-4007-6761	<b>Endpoint:</b> 48h Survival Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 28 Jan-22 14:32	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Edit Date:</b> 28 Jan-22 14:31	<b>MD5 Hash:</b> 6B669EFD6A266B4004B8153A7BAEDCB3	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 10-0120-5059	<b>Test Type:</b> Survival (48h)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 16 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/9	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 18 Sep-21	<b>Species:</b> Daphnia magna	<b>Brine:</b>
<b>Test Length:</b> 48h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b>
<b>Sample ID:</b> 11-6076-2769	<b>Code:</b> Week 2, Reactor 3	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 13 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 15 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1062819	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC15	>100	---	---	<1	---	---
LC20	>100	---	---	<1	---	---
LC25	>100	---	---	<1	---	---
LC40	>100	---	---	<1	---	---
LC50	>100	---	---	<1	---	---

## 48h Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
6		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
12		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
25		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
50		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
100		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	N	1.0000
6		1.0000
12		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	N	10/10
6		10/10
12		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

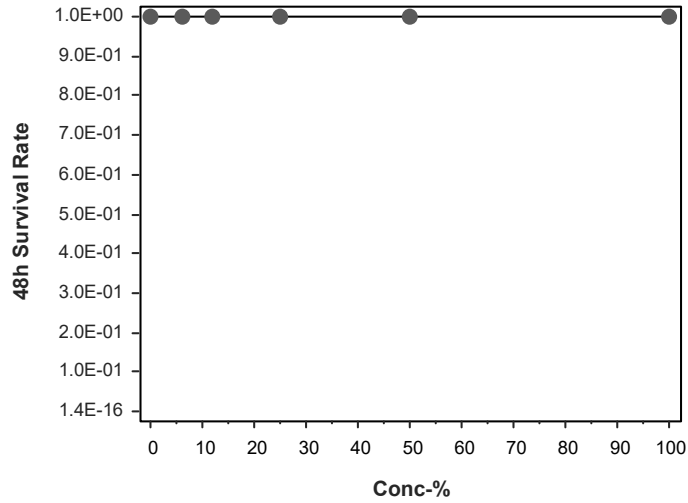
Report Date: 28 Jan-22 14:33 (p 2 of 2)  
Test Code/ID: 2122-0052 DA W2 / 05-6087-5093

## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID:	09-4007-6761	Endpoint:	48h Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	28 Jan-22 14:32	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	28 Jan-22 14:31	MD5 Hash:	6B669EFD6A266B4004B8153A7BAEDCB3	Editor ID:	003-581-756-9

### Graphics





## CETIS Analytical Report

Report Date: 28 Jan-22 14:36 (p 1 of 2)

Test Code/ID: 2122-0052 DA W2 / 05-6087-5093

## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

<b>Analysis ID:</b>	10-2731-0459	<b>Endpoint:</b>	48h Imobility Rate	<b>CETIS Version:</b>	CETISv2.1.0
<b>Analyzed:</b>	28 Jan-22 14:34	<b>Analysis:</b>	Linear Interpolation (ICPIN)	<b>Status Level:</b>	1
<b>Edit Date:</b>	28 Jan-22 14:31	<b>MD5 Hash:</b>	6B669EFD6A266B4004B8153A7BAEDCB3	<b>Editor ID:</b>	003-581-756-9
<b>Batch ID:</b>	10-0120-5059	<b>Test Type:</b>	Survival (48h)	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	16 Sep-21	<b>Protocol:</b>	EC/EPS 1/RM/9	<b>Diluent:</b>	Dechlorinated Tap Water
<b>Ending Date:</b>	18 Sep-21	<b>Species:</b>	Daphnia magna	<b>Brine:</b>	
<b>Test Length:</b>	48h	<b>Taxon:</b>	Branchiopoda	<b>Source:</b>	In-House Culture
				<b>Age:</b>	
<b>Sample ID:</b>	11-6076-2769	<b>Code:</b>	Week 2, Reactor 3	<b>Project:</b>	PJ2021-006
<b>Sample Date:</b>	13 Sep-21	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	15 Sep-21	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	72h	<b>Client:</b>	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	548797	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC15	>100	---	---	<1	---	---
LC20	>100	---	---	<1	---	---
LC25	>100	---	---	<1	---	---
LC40	>100	---	---	<1	---	---
LC50	>100	---	---	<1	---	---

## 48h Immobility Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
6		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
12		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
25		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
50		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%
100		1	1.0000	1.0000	1.0000	1.0000	---	0.00%	10/10	1.0000	0.00%

## 48h Immobility Rate Detail

Conc-%	Code	Rep 1
0	N	1.0000
6		1.0000
12		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Immobility Rate Binomials

Conc-%	Code	Rep 1
0	N	10/10
6		10/10
12		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

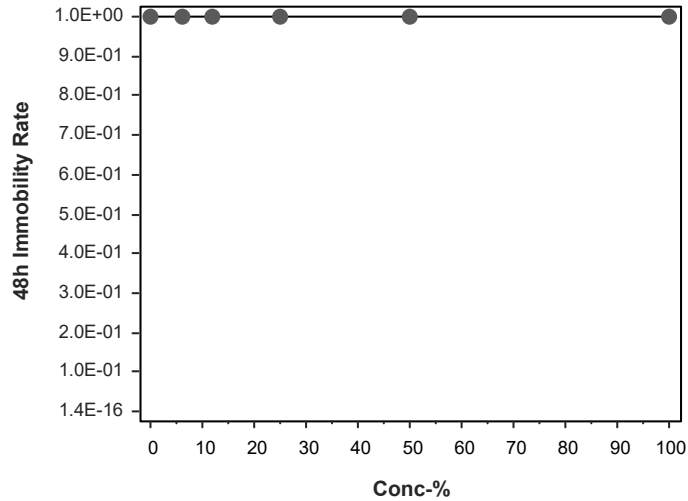
Report Date: 28 Jan-22 14:36 (p 2 of 2)  
Test Code/ID: 2122-0052 DA W2 / 05-6087-5093

## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID:	10-2731-0459	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv2.1.0
Analyzed:	28 Jan-22 14:34	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	28 Jan-22 14:31	MD5 Hash:	6B669EFD6A266B4004B8153A7BAEDCB3	Editor ID:	003-581-756-9

### Graphics





Method DAD

 Client HAT/SYN

 Reference PJ2021-006 (Week 3)
**Test Log**

Day	Date	Time	Technician	Chem. Cart	Daily Data Review	Initial pH:
0	2021/09/22	1700	AN/BL	3	EV	9.1
1	2021/09/23	0945	EV	-	ICL	Initial EC (µS/cm):
2	2021/09/24	0810	AN	3	MAF	Salinity (ppt):
Lab Code						
100 CTL SPEC CTL 6 12 25 50 100						

**Sample Information**

day

pH (units) (range: 6.0-8.5)

0	8.2	8.1	8.3	8.5	8.7	8.9	9.1			
2	8.3	8.3	8.3	8.4	8.5	8.7	8.9			

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

EC (µS/cm)

0	400	313	464	622	955	1642	2950			
2	400	315	463	619	970	1655	3040			

DO (mg/L) (40-100% saturation at test temp.)

0	8.1	8.2	8.2	8.2	8.2	8.2	8.1			
2	7.9	7.9	7.9	7.8	7.7	8.1	7.6			

Temperature (°C) (range: 18-22 °C)

0	19	18	18	18	18	18	19			
2	20	20	20	20	20	20	20			

Number Alive

(I, immobile)

0	10	10	10	10	10	10	10			
1	10	10	10	10	10	10	10			
2	10	10	10	10	10	10	10			

Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

<b>Culture</b>		
Young jar <u>C202/05</u>	Jar(s) mortality 7 days prior to test (must be ≤25%) <u>2%</u>	
<b>QA (previous month)</b>		
Days to first brood (≤12 days) <u>8</u>	<b>Control Validity Criteria</b> Mean % mortality at 48 hours - (must be ≤10%) <u>0</u>	
Average number of young produced (≥15 young) <u>29</u>		
Were test treatments randomized on test tray? <u>Yes</u> <input checked="" type="checkbox"/> No <input type="checkbox"/>		
<b>Sample</b>		
DO (mg/L) of sample prior to aeration: <u>8.1</u>	Temperature (°C) of sample prior to aeration: <u>19</u>	
DO % of sample prior to aeration: <u>100%</u>	Is aeration required (<40% or >100%)? <u>Yes or No</u> <input checked="" type="checkbox"/>	
Duration of aeration (37.5 +/- 12.5 mL/min/L): <u>-</u>	Filtered with 110µm screen prior to testing <u>Yes or No</u> <input checked="" type="checkbox"/>	
Hardness (mg CaCO <sub>3</sub> /L) of 100%: <u>76</u>	Is hardness adjustment required (<25 mg CaCO <sub>3</sub> /L)? <u>Yes or No</u> <input checked="" type="checkbox"/>	
Hardness of sample after adjustment (must be between 25 - 30 mg CaCO <sub>3</sub> /L): <u>-</u>		
Alkalinity of 100% sample (mg CaCO <sub>3</sub> /L): <u>360</u>		
<b>Dilution Water</b>		
Pail label / preparation date <u>2:09/14 (LabCL)</u>	<b>DO Levels (40-100% saturation) - corrected for altitude -</b> 3.3 to 8.2 mg/L at 18°C      3.1 to 7.7 mg/L at 21°C 3.2 to 8.1 mg/L at 19°C      3.0 to 7.6 mg/L at 22°C 3.2 to 7.9 mg/L at 20°C	
Hardness of dilution water (mg/L) <u>186</u>		
<b>Comments/Observations:</b>		
<u>Small organisms attached to daphnia in the 50+100% jars.</u>		

 Reviewed By: SS

 Date Reviewed: 2021/10/28



## CETIS Analytical Report

Report Date: 03 Nov-21 09:48 (p 1 of 2)

Test Code/ID: 2122-0052 DAD 3 / 04-6377-0504

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	09-8269-9466	Endpoint:	48h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:47	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	14-9786-8817	Test Type:	Survival (48h)	Analyst:	Sara Thiessen
Start Date:	22 Sep-21	Protocol:	EC/EPS 1/RM/14	Diluent:	River Water
Ending Date:	24 Sep-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
Sample ID:	06-1464-4486	Code:	Week 3, Reactor 3	Project:	
Sample Date:	20 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	22 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	596612	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

Report Date: 03 Nov-21 09:48 (p 2 of 2)  
Test Code/ID: 2122-0052 DAD 3 / 04-6377-0504

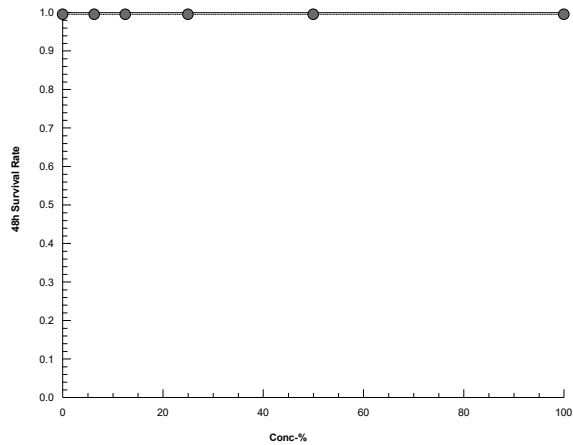
## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID: 09-8269-9466      Endpoint: 48h Survival Rate  
Analyzed: 03 Nov-21 9:47      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# CETIS Analytical Report

Report Date: 03 Nov-21 09:49 (p 1 of 2)  
Test Code/ID: 2122-0052 DAD 3 / 04-6377-0504

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	19-6317-8354	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:48	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	14-9786-8817	Test Type:	Survival (48h)	Analyst:	Sara Thiessen
Start Date:	22 Sep-21	Protocol:	EC/EPS 1/RM/14	Diluent:	River Water
Ending Date:	24 Sep-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
Sample ID:	06-1464-4486	Code:	Week 3, Reactor 3	Project:	
Sample Date:	20 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	22 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	450377	1	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

48h Immobility Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

48h Immobility Rate Detail		
Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

48h Immobility Rate Binomials		
Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

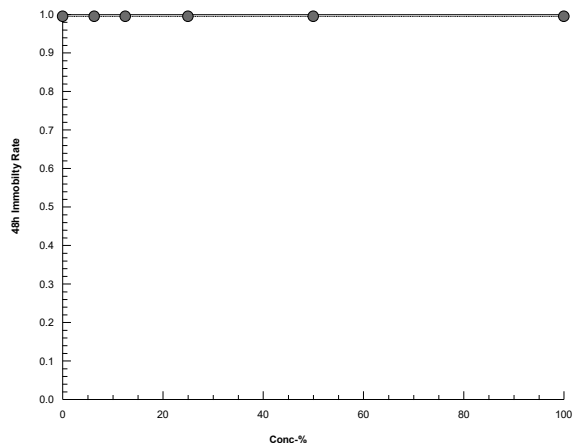


# CETIS Analytical Report

Report Date: 03 Nov-21 09:49 (p 2 of 2)  
Test Code/ID: 2122-0052 DAD 3 / 04-6377-0504

Daphnia magna 48-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID: 19-6317-8354	Endpoint: 48h Immobility Rate	CETIS Version: CETISv1.9.4	
Analyzed: 03 Nov-21 9:48	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

## Graphics





# Daphnia Bench Sheet

 Method DAD

 Client HAT/SYN

 Reference PJ2021-006 (Week 4)  
2122-0052-01
**Test Log**

							Sample Information		
Day	Date	Time	Technician	Chem. Cart	Daily Data Review		Initial pH:		
0	2021/10/01	1450	DW/MAF	3	MF		Initial EC (µS/cm):	9.1	2950
1	2021/10/02	1155	DW	-	MAF		Salinity (ppt):		1
2	2021/10/03	0930	EV	3	MF				
Lab Code	Lab Ctl	Site Ctl	6.3	12.5	25	50	100		

day	pH (units) (range: 6.0-8.5)						
0	7.7	8.0	8.1	8.2	8.4	8.6	8.8
2	8.0	8.0	8.1	8.2	8.2	8.4	8.6

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

	EC (µS/cm)						
0	331	319	472	636	961	1415	3870
2	304	320	470	635	963	1428	3090

	DO (mg/L) (40-100% saturation at test temp.)						
0	7.9	7.9	7.9	7.9	7.9	7.9	7.9
2	7.9	7.9	7.8	7.9	7.9	7.8	7.6

	Temperature (°C) (range: 18-22 °C)						
0	20	20	20	20	20	20	20
2	20	20	20	20	20	20	20

	Number Alive (I, immobile)						
0	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10

**Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control**

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

<b>Culture</b>	
Young jar <u>C3</u>	Jar(s) mortality 7 days prior to test (must be ≤25%) <u>6%</u>
<b>QA (previous month)</b> Days to first brood (≤12 days) <u>8</u> Average number of young produced (≥15 young) <u>29</u> Were test treatments randomized on test tray? <input checked="" type="radio"/> Yes <input type="radio"/> No	<b>Control Validity Criteria</b> Mean % mortality at 48 hours - (must be ≤10%) <u>0</u>
<b>Sample</b> DO (mg/L) of sample prior to aeration: <u>7.9</u> Temperature (°C) of sample prior to aeration: <u>20</u> DO % of sample prior to aeration: <u>100%</u> Is aeration required (<40% or >100%)? <input checked="" type="radio"/> Yes <input type="radio"/> No Duration of aeration (37.5 +/- 12.5 mL/min/L): <u>—</u> Filtered with 110µm screen prior to testing <input checked="" type="radio"/> Yes <input type="radio"/> No Hardness (mg CaCO <sub>3</sub> /L) of 100%: <u>73</u> Is hardness adjustment required (<25 mg CaCO <sub>3</sub> /L)? <input checked="" type="radio"/> Yes <input type="radio"/> No Hardness of sample after adjustment (must be between 25 - 30 mg CaCO <sub>3</sub> /L) <u>—</u> Alkalinity of 100% sample (mg CaCO <sub>3</sub> /L): <u>354</u>	
<b>Dilution Water</b> Pail label / preparation date <u>2: 09/29</u> Hardness of dilution water (mg/L) <u>146</u>	
<b>Comments/Observations:</b>  	

 Reviewed By: 10

 Date Reviewed: 2021/10/01



## CETIS Analytical Report

Report Date: 10 Nov-21 15:22 (p 1 of 2)

Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	21-4366-4833	Endpoint:	48h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	10 Nov-21 15:22	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	17-6140-4370	Test Type:	Survival (48h)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/9	Diluent:	River Water
Ending Date:	03 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
					Age: <24h
Sample ID:	05-4544-7656	Code:	Week 4, Reactor 3	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2081905	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

Report Date: 10 Nov-21 15:22 (p 2 of 2)  
Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

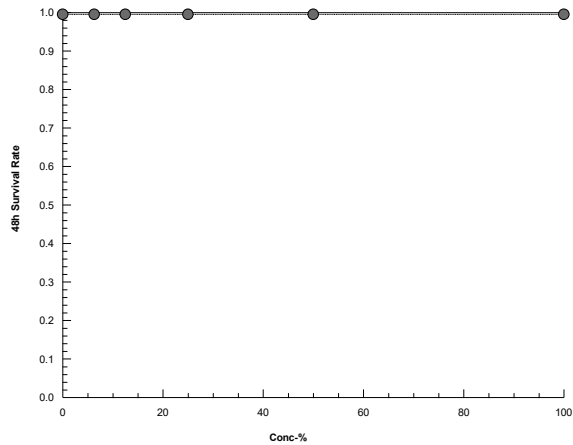
## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID: 21-4366-4833      Endpoint: 48h Survival Rate  
Analyzed: 10 Nov-21 15:22      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 18 Nov-21 08:19 (p 1 of 2)

Test Code/ID: 2122-0052 DA W4 / 05-6645-0575

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	10-7281-4938	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-21 8:19	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	17-6140-4370	Test Type:	Survival (48h)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/9	Diluent:	River Water
Ending Date:	03 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
				Age:	<24h
Sample ID:	07-8596-3353	Code:	Week 4, Reactor 3	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1302413	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Immobility Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Immobility Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Immobility Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

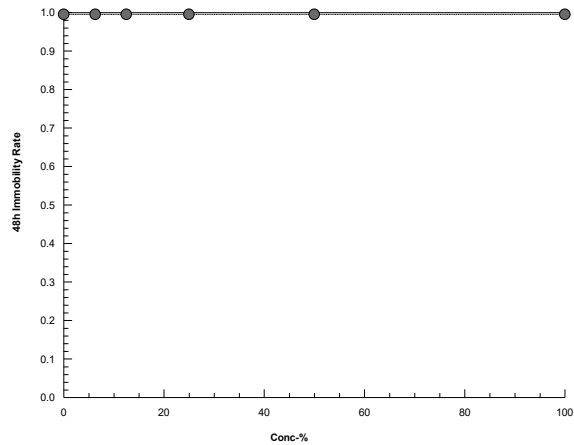


# CETIS Analytical Report

Report Date: 18 Nov-21 08:19 (p 2 of 2)  
Test Code/ID: 2122-0052 DA W4 / 05-6645-0575

Daphnia magna 48-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID:	10-7281-4938	Endpoint:	48h Immobility Rate
Analysed:	18 Nov-21 8:19	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

## Graphics





# Daphnia Bench Sheet

 Method DAD

 Client HAT/SYN

 Reference PJ2021-006 (Week 4)  
2122-0202 Reactor 2
**Test Log**

Day	Date	Time	Technician	Chem. Cart	Daily Data Review	Initial pH:	8.3
0	2021/10/01	1445	Q. J. MAF	3	ME	Initial EC (µS/cm):	2990
1	2021/10/02	1105	AW	-	MAF	Salinity (ppt):	1
2	2021/10/03	0915	AV	3	ME		
						III 65	
Lab Code	Lab Ctl	Site Ctl	6.3	12.5	25	50	100

day	pH (units) (range: 6.0-8.5)						
0	7.7	7.9	8.0	8.1	8.1	8.2	8.3
2	8.1	8.0	8.0	8.1	8.2	8.4	8.5

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

	EC (µS/cm)						
0	353	320	496	696	1070	1708	3040
2	365	324	493	692	1007	1660	3030

	DO (mg/L) (40-100% saturation at test temp.)						
0	7.9	7.9	7.9	7.9	7.9	7.9	7.9
2	7.9	7.9	7.9	7.8	7.8	7.8	7.7

	Temperature (°C) (range: 18-22 °C)						
0	20	20	20	20	20	20	20
2	20	20	20	20	20	20	20

	Number Alive (I, immobile)						
0	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10

Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

<b>Culture</b>	
Young jar <u>CS/DS/CS</u>	Jar(s) mortality 7 days prior to test (must be ≤25%) <u>3%</u>
<b>QA</b> (previous month)	<b>Control Validity Criteria</b>
Days to first brood (≤12 days) <u>9</u>	Mean % mortality at 48 hours - (must be ≤10%) <u>0</u>
Average number of young produced (≥15 young)	
Were test treatments randomized on test tray? <input checked="" type="radio"/> Yes <input type="radio"/> No <u>34</u>	
<b>Sample</b>	
DO (mg/L) of sample prior to aeration: <u>10.79</u>	Temperature (°C) of sample prior to aeration: <u>20</u>
DO % of sample prior to aeration: <u>100%</u>	Is aeration required (<40% or >100%)? <input checked="" type="radio"/> Yes <input type="radio"/> No
Duration of aeration (37.5 +/- 12.5 mL/min/L): <u>-</u>	Filtered with 110µm screen prior to testing <input checked="" type="radio"/> Yes <input type="radio"/> No
Hardness (mg CaCO <sub>3</sub> /L) of 100%: <u>74</u>	Is hardness adjustment required (<25 mg CaCO <sub>3</sub> /L)? <input checked="" type="radio"/> Yes <input type="radio"/> No
Hardness of sample after adjustment (must be between 25 - 30 mg CaCO <sub>3</sub> /L)	
Alkalinity of 100% sample (mg CaCO <sub>3</sub> /L): <u>369</u>	
<b>Dilution Water</b>	
Pail label / preparation date <u>2:09/29</u>	<b>DO Levels (40-100% saturation) - corrected for altitude -</b>
Hardness of dilution water (mg/L) <u>146</u>	3.3 to 8.2 mg/L at 18°C      3.1 to 7.7 mg/L at 21°C
	3.2 to 8.1 mg/L at 19°C      3.0 to 7.6 mg/L at 22°C
	3.2 to 7.9 mg/L at 20°C
<b>Comments/Observations:</b>	

 Reviewed By: VP

 Date Reviewed: 25/10/21



## CETIS Analytical Report

Report Date: 17 Nov-21 13:31 (p 1 of 2)

Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	14-8124-2377	Endpoint:	48h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	17 Nov-21 13:31	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	17-6140-4370	Test Type:	Survival (48h)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/9	Diluent:	River Water
Ending Date:	03 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
					Age: <24h
Sample ID:	05-4544-7656	Code:	Week 4 Reactor 2	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2022042	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

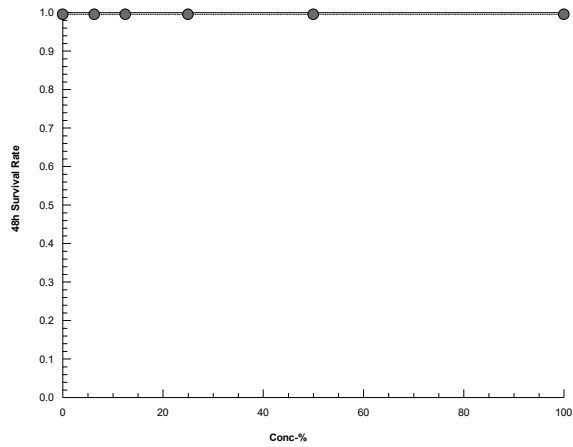


# CETIS Analytical Report

Report Date: 17 Nov-21 13:31 (p 2 of 2)  
Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

Daphnia magna 48-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID: 14-8124-2377	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 17 Nov-21 13:31	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

## Graphics





## CETIS Analytical Report

Report Date: 17 Nov-21 13:32 (p 1 of 2)

Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

Daphnia magna 48-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	02-8981-2357	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv1.9.4
Analyzed:	17 Nov-21 13:31	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	17-6140-4370	Test Type:	Survival (48h)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/9	Diluent:	River Water
Ending Date:	03 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In House
					Age: <24h
Sample ID:	05-4544-7656	Code:	Week 4 Reactor 2	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1090490	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Immobility Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Immobility Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Immobility Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10



# CETIS Analytical Report

Report Date: 17 Nov-21 13:32 (p 2 of 2)  
Test Code/ID: 2122-0202 DA W4 / 13-5859-8326

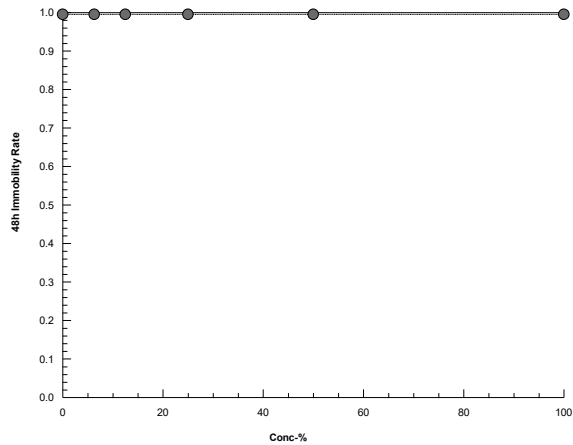
## Daphnia magna 48-h Acute Survival Test

Nautilus Environmental Calgary

Analysis ID: 02-8981-2357      Endpoint: 48h Immobility Rate  
Analyzed: 17 Nov-21 13:31      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





Method DAD

 Client HAT/SYN

 Reference PJ2021-006 (Week 5)
**Test Log**

Day	Date	Time	Technician	Chem. Cart	Daily Data Review
0	2021/10/08	1410	DJ/MAF	3	LA
1	2021/10/09	2910	LA		MAF
2	2021/10/10	1120	EV	3	MAF

**Sample Information**

 Initial pH: 9.0  
 Initial EC (µS/cm): 3050  
 Salinity (ppt): 1

Lab Code	Lab Ctl	Site Ctl	6.3	12.5	25	50	100
----------	---------	----------	-----	------	----	----	-----

day

pH (units) (range: 6.0-8.5)

0	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5			
2	8.0	8.0	8.0	8.0	8.2	8.4	8.6				

The pH of the sample was not adjusted prior to test setting, unless noted in the comments below

EC (µS/cm)

0	431	344	498	679	1008	1124	3050				
2	425	351	510	684	1019	1076	3080				

DO (mg/L) (40-100% saturation at test temp.)

0	7.9	7.9	7.9	7.9	7.9	7.9	7.9				
2	7.9	7.9	7.9	7.9	7.9	7.9	7.9				

Temperature (°C) (range: 18-22 °C)

0	20	20	20	20	20	20	20				
2	20	20	20	20	20	20	20				

 Number Alive  
 (I, immobile)

0	10	10	10	10	10	10	10				
1	10	10	10	10	10	10	10				
2	10	10	10	10	10	10	10				

Validity Criteria: must be ≤ 10% mortality and/or abnormal behavior in the control

Notes: Immobile; daphnid can't swim after 60 sec. even if antenna still move

Unless otherwise noted, behaviour is considered to be normal

**Culture**

 Young jar 51

 Jar(s) mortality 7 days prior to test (must be ≤25%) 0
**QA (previous month)**

 Days to first brood (≤12 days) 9

 Average number of young produced (≥15 young) 32

 Were test treatments randomized on test tray? ☒ Yes ☐ No

**Control Validity Criteria**

 Mean % mortality at 48 hours - 0  
 (must be ≤10%)

**Sample**

 DO (mg/L) of sample prior to aeration: 8.81

 DO % of sample prior to aeration: 100

 Duration of aeration (37.5 +/- 12.5 mL/min/L): —

 Hardness (mg CaCO<sub>3</sub>/L) of 100%: 100

 Hardness of sample after adjustment (must be between 25 - 30 mg CaCO<sub>3</sub>/L): —

 Alkalinity of 100% sample (mg CaCO<sub>3</sub>/L): 317

 Temperature (°C) of sample prior to aeration: 19

 Is aeration required (<40% or >100%)? ☒ Yes ☐ No

 Filtered with 110µm screen prior to testing ☒ Yes ☐ No

 Is hardness adjustment required (<25 mg CaCO<sub>3</sub>/L)? ☒ Yes ☐ No

**Dilution Water**

 Pail label / preparation date 1:10/01

 Hardness of dilution water (mg/L) 154
**DO Levels (40-100% saturation) - corrected for altitude -**

3.3 to 8.2 mg/L at 18°C

3.1 to 7.7 mg/L at 21°C

3.2 to 8.1 mg/L at 19°C

3.0 to 7.6 mg/L at 22°C

3.2 to 7.9 mg/L at 20°C

**Comments/Observations:**

 Reviewed By: MLG

 Date Reviewed: 2021/10/29



## CETIS Analytical Report

Report Date: 04 Nov-21 16:59 (p 1 of 2)

Test Code/ID: 2122-0052 DA W5 / 06-8469-3704

Daphnia magna 96-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	09-1520-2089	Endpoint:	48h Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	04 Nov-21 16:58	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	07-6193-4709	Test Type:	Survival (96h)	Analyst:	Stephanie Schiffer
Start Date:	08 Oct-21	Protocol:	EPA/821/R-02-012 (2002)	Diluent:	River Water
Ending Date:	10 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In-House Culture
				Age:	<24h
Sample ID:	07-7551-6631	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	175002	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Survival Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Survival Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

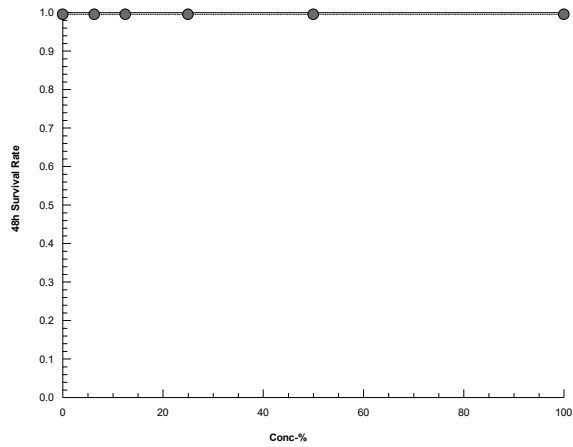


# CETIS Analytical Report

Report Date: 04 Nov-21 16:59 (p 2 of 2)  
Test Code/ID: 2122-0052 DA W5 / 06-8469-3704

Daphnia magna 96-h Acute Survival Test		Nautilus Environmental Calgary
Analysis ID: 09-1520-2089	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 04 Nov-21 16:58	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

## Graphics





## CETIS Analytical Report

Report Date: 18 Nov-21 08:26 (p 1 of 2)  
 Test Code/ID: 2122-0052 DA W5 / 06-8469-3704

Daphnia magna 96-h Acute Survival Test				Nautilus Environmental Calgary	
Analysis ID:	08-5863-3170	Endpoint:	48h Immobility Rate	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-21 8:26	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	07-6193-4709	Test Type:	Survival (96h)	Analyst:	Stephanie Schiffer
Start Date:	08 Oct-21	Protocol:	EPA/821/R-02-012 (2002)	Diluent:	River Water
Ending Date:	10 Oct-21	Species:	Daphnia magna	Brine:	
Test Length:	48h	Taxon:	Branchiopoda	Source:	In-House Culture
					Age: <24
Sample ID:	07-7551-6631	Code:	Week 5	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	264931	1	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	>100	n/a	n/a	<1	n/a	n/a
LC5	>100	n/a	n/a	<1	n/a	n/a
LC10	>100	n/a	n/a	<1	n/a	n/a
LC15	>100	n/a	n/a	<1	n/a	n/a
LC20	>100	n/a	n/a	<1	n/a	n/a
LC25	>100	n/a	n/a	<1	n/a	n/a
LC40	>100	n/a	n/a	<1	n/a	n/a
LC50	>100	n/a	n/a	<1	n/a	n/a

## 48h Immobility Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		1	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

## 48h Immobility Rate Detail

Conc-%	Code	Rep 1
0	XC	1.0000
6.3		1.0000
12.5		1.0000
25		1.0000
50		1.0000
100		1.0000

## 48h Immobility Rate Binomials

Conc-%	Code	Rep 1
0	XC	10/10
6.3		10/10
12.5		10/10
25		10/10
50		10/10
100		10/10

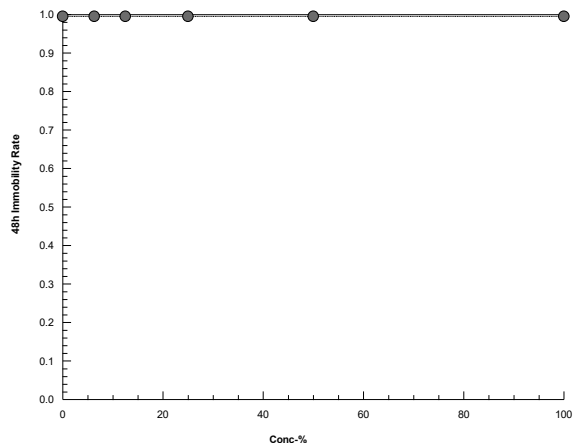


# CETIS Analytical Report

Report Date: 18 Nov-21 08:26 (p 2 of 2)  
Test Code/ID: 2122-0052 DA W5 / 06-8469-3704

Daphnia magna 96-h Acute Survival Test		Nautilus Environmental Calgary	
Analysis ID: 08-5863-3170	Endpoint: 48h Immobility Rate	CETIS Version: CETISv1.9.4	
Analyzed: 18 Nov-21 8:26	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

## Graphics





## **APPENDIX D – *Ceriodaphnia dubia* Toxicity Test Data**



# Ceriodaphnia Bench Sheet

Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week 1)

## Test Log

Date	Day	Time	Technician	Chem. Cart Used	Subsample Fed (✓)	Daily Data Review	Subsample Used
2021/09/09	0	1100	SC	2	✓	ME	Day 0 ✓
2021/09/10	1	0930	SC	2	✓	MAE	Day 1 ✓
2021/09/11	2	1100	SC	2	✓	MAE	Day 2 ✓
2021/09/12	3	0845	EV	2	✓	RL	Day 3 ✓
2021/09/13	4	1145	EV	2	✓	RL	Day 4 ✓
2021/09/14	5	1100	EV	2	✓	SL	Day 5 ✓
2021/09/15	6	1130	EV	2	✓	AW	Day 6 ✓
2021/09/16	7	1100	EV	2	—	AW	Day 7 —
	8						

## Sample Information

Initial pH: 2.2  
Initial EC (µS/cm): 2990  
Initial DO (mg/L): 5.7  
Initial Temp (°C): 15  
Filtered with 60 µm nitrate screen  
Yes/No  
Sample pre-aerated/acidness/pH adjust:  
Yes/No  
\*If yes, describe procedure, rate and duration

**Test Specifics** \*use river water as dilution water for site control and test concentrations

Food expiration: 09/12/21

Dilution water vessel and preparation date: LABOR: 6:09/06, 2:09/10, 4:09/12

Cup	Control Validity	
	Day 4	
	Number of Young	Number of Broods
1	34	3
2	30	1
3	33	1
4	30	1
5	33	1
6	35	1
7	27	1
8	4	1
9	29	3
10	32	1

Average # of Young: 28

% with ≥ 3 Broods: 90

Control Mortality: 0  
(must be ≤20%)

**Reproduction Validity Criteria:** the average number of young produced in first three broods is ≥ 15, when 60% of control organisms had 3 or more broods:

Yes No

Reviewed By: SS

Date Reviewed: 2021/10/28



# Ceriodaphnia Bench Sheet

 Method CDD Client SYN/HAT (PJ2021-006)

 Reference 2122-0052-01 (week1)

## Chemistry

New Solutions								Old Solutions									
Conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	
Day																	
pH (units) (range: 6.5-8.5)																	
0	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	0	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
1	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	1	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
2	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	2	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
3	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	3	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
4	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	4	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
5	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	5	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
6	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	6	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
7	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	7	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
8	7.6	7.6	7.9	8.7	8.7	8.5	8.6	8.8	8	8.2	8.0	8.1	8.1	8.2	8.5	8.6	8.9
Conductance (µS/cm)																	
0	96	96	97	94	97	94	97	94	0	140	144	132	137	144	138	146	158
1	96	96	97	94	97	94	97	94	1	140	144	132	137	144	138	146	158
2	96	96	97	94	97	94	97	94	2	140	144	132	137	144	138	146	158
3	96	96	97	94	97	94	97	94	3	140	144	132	137	144	138	146	158
4	96	96	97	94	97	94	97	94	4	140	144	132	137	144	138	146	158
5	96	96	97	94	97	94	97	94	5	140	144	132	137	144	138	146	158
6	96	96	97	94	97	94	97	94	6	140	144	132	137	144	138	146	158
7	96	96	97	94	97	94	97	94	7	140	144	132	137	144	138	146	158
8	96	96	97	94	97	94	97	94	8	140	144	132	137	144	138	146	158
Dissolved Oxygen (mg/L) (40-100% saturation)																	
0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	0	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	1	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	2	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	3	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	4	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	5	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
8	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	8	6.9	6.8	6.4	6.4	6.4	6.4	6.4	6.7
Temperature 24 - 26 (°C)																	
0	24	24	24	24	24	24	24	24	0	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	1	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	2	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	3	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	4	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	5	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	6	24	24	24	24	24	24	24	24
7	24	24	24	24	24	24	24	24	7	24	24	24	24	24	24	24	24
8	24	24	24	24	24	24	24	24	8	24	24	24	24	24	24	24	24

**DO Levels (40-100% saturation) -**  
 2.9 to 7.3 mg/L at 24°C  
 2.9 to 7.2 mg/L at 25°C  
 2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By SS

 Date Reviewed: 2021/10/28



# Ceriodaphnia Bench Sheet

Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week 1)

## Chemistry

New Solutions										Old Solutions									
Conc. (%)	100									100									
Day																			

pH (units) (range: 6.5-8.5)

0	9.1									0	9.1								
1	9.1									1	9.1								
2	9.0									2	9.0								
3	8.9									3	8.8								
4										4	8.8								
5										5									
6										6									
7										7									
8										8									

Conductance (µS/cm)

0	3030									0	3030								
1	3160									1	3190								
2	3220									2	3190								
3	3120									3	3180								
4										4	3060								
5										5									
6										6									
7										7									
8										8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	6.8									0									
1	7.0									1	6.2								
2	7.0									2	6.0								
3	7.3									3	6.4								
4										4	5.4								
5										5									
6										6									
7										7									
8										8									

Temperature 24 - 26 (°C)

0	24									0									
1	24									1	24								
2	24									2	24								
3	24									3	24								
4										4	24								
5										5									
6										6									
7										7									
8										8									

DO Levels (40-100% saturation)\* -

2.9 to 7.3 mg/L at 24°C

2.9 to 7.2 mg/L at 25°C

2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

Reviewed By: SS

Date Reviewed: 202110128



# Ceriodaphnia Bench Sheet

Method CDD Client SYN/HAT (PJ2021-006)

Reference 2122-0052-01 (week 1)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				Lab Ctl				
1	0	0	0	5	0	11	18	
2	0	0	0	5	0	13	13	
3	0	0	0	5	0	13	13	
4	0	0	0	5	0	11	13	
5	0	0	0	5	0	13	13	
6	0	0	0	5	0	14	13	
7	0	0	0	5	0	11	13	
8	0	0	0	5	0	11	13	
9	0	0	0	5	0	11	13	
10	0	0	0	5	0	11	13	
				Site Ctl				
1	0	0	0	5	0	13	16	
2	0	0	0	5	0	13	16	
3	0	0	0	5	0	13	16	
4	0	0	0	5	0	13	16	
5	0	0	0	5	0	13	16	
6	0	0	0	5	0	13	16	
7	0	0	0	5	0	13	16	
8	0	0	0	5	0	13	16	
9	0	0	0	5	0	13	16	
10	0	0	0	5	0	13	16	
				1.6%				
1	0	0	0	5	0	14	17	
2	0	0	0	5	0	14	17	
3	0	0	0	5	0	14	17	
4	0	0	0	5	0	14	17	
5	0	0	0	5	0	14	17	
6	0	0	0	5	0	14	17	
7	0	0	0	5	0	14	17	
8	0	0	0	5	0	14	17	
9	0	0	0	5	0	14	17	
10	0	0	0	5	0	14	17	
				3.2%				
1	0	0	0	5	0	14	17	
2	0	0	0	5	0	14	17	
3	0	0	0	5	0	14	17	
4	0	0	0	5	0	14	17	
5	0	0	0	5	0	14	17	
6	0	0	0	5	0	14	17	
7	0	0	0	5	0	14	17	
8	0	0	0	5	0	14	17	
9	0	0	0	5	0	14	17	
10	0	0	0	5	0	14	17	
				50%				
1	0	0	0	5	0	14	17	
2	0	0	0	5	0	14	17	
3	0	0	0	5	0	14	17	
4	0	0	0	5	0	14	17	
5	0	0	0	5	0	14	17	
6	0	0	0	5	0	14	17	
7	0	0	0	5	0	14	17	
8	0	0	0	5	0	14	17	
9	0	0	0	5	0	14	17	
10	0	0	0	5	0	14	17	

Reviewed By: SS

Date Reviewed: 202110128



# Ceriodaphnia Bench Sheet

Method CDD Client SYN/HAT (PJ2021-006)

Reference 2122-0052-01 (week1)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				100%				
1	0	0	0	X <sub>0</sub>				
2			X <sub>0</sub>					
3			X <sub>0</sub>					
4		X	X <sub>0</sub>					
5		X						
6		X						
7		X	0	X <sub>0</sub>				
8			0	X <sub>0</sub>				
9			X <sub>0</sub>					
10			X <sub>0</sub>					

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Reviewed By SS

Date Reviewed: 2021/10/28



**Test Organism Information**

Client: SYN/HAT (PJ2021-006)

Culture history for adults used in the test for sample reference: 2122-WS2-01

Day Used: 2021/09/09

Test organisms appeared healthy before use: ☒ Yes ☐ No

Number of young produced per brood adult within first three broods:

Brood	row/replicate	A3	A4	D4	B5	E1	E2	E7	E4	E5		
-------	---------------	----	----	----	----	----	----	----	----	----	--	--

Culture(s) Used for Testing:

wed B

number of young	6	5	6	5	7	4	4	5	5		
-----------------	---	---	---	---	---	---	---	---	---	--	--

number of young	9	11	8	8	10	6	6	6	10		
-----------------	---	----	---	---	----	---	---	---	----	--	--

number of young	13	12	13	11	9	12	10	10	11		
-----------------	----	----	----	----	---	----	----	----	----	--	--

number of young	16	5	11	15	17	16	12	13	15		
-----------------	----	---	----	----	----	----	----	----	----	--	--

Number of Adults Alive in Culture 7 days prior: 25 day used: 25

Notes: all cups have 1 adult

Average No. of young in first 3 broods: 25

(must be  $\geq 15$ )

Culture % mortality (7-days prior to testing): 0

(must be  $\leq 20\%$ )

Number of young produced by each brood organism in last complete brood is  $\geq 8$ : Y

☒ Yes (Y) or No (N)

Reviewed By: SS

Date Reviewed: 2021/10/28



# CETIS Analytical Report

Report Date: 03 Nov-21 08:54 (p 1 of 2)  
 Test Code/ID: Treated OSPW We / 15-3783-4256

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 07-1514-3242	<b>Endpoint:</b> 7d Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 03 Nov-21 8:53	<b>Analysis:</b> Untrimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Batch ID:</b> 08-6574-2927	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Sara Thiessen
<b>Start Date:</b> 09 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 16 Sep-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In House <b>Age:</b> <24
<b>Sample ID:</b> 07-7268-3404	<b>Code:</b> Week 1, Reactor 3	<b>Project:</b>
<b>Sample Date:</b> 07 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 09 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 48h	<b>Client:</b> Syncrude Canada Ltd	

## Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.789	0.04039	61.56	51.11	74.14

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



# CETIS Analytical Report

Report Date: 03 Nov-21 08:54 (p 2 of 2)

Test Code/ID: Treated OSPW We / 15-3783-4256

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 07-1514-3242

Endpoint: 7d Survival Rate

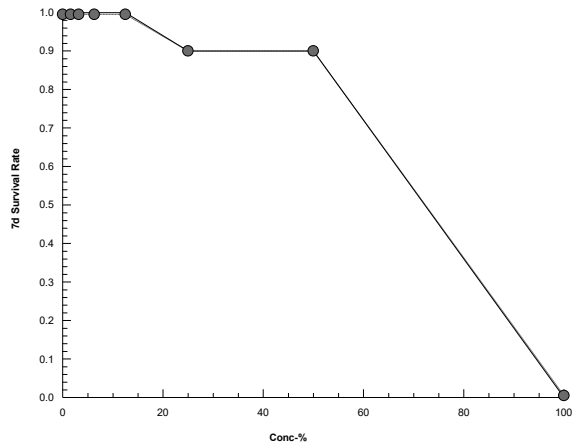
CETIS Version: CETISv1.9.4

Analyzed: 03 Nov-21 8:53

Analysis: Untrimmed Spearman-Kärber

Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 03 Nov-21 09:01 (p 1 of 2)

Test Code/ID: Treated OSPW We / 15-3783-4256

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 13-1114-3492	<b>Endpoint:</b> 7d Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 03 Nov-21 9:01	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 08-6574-2927	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Sara Thiessen
<b>Start Date:</b> 09 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 16 Sep-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In House <b>Age:</b> <24
<b>Sample ID:</b> 07-7268-3404	<b>Code:</b> Week 1, Reactor 3	<b>Project:</b>
<b>Sample Date:</b> 07 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 09 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 48h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1739119	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	13.41	12.95	50.35	7.455	1.986	7.722
LC5	17.73	14.9	51.77	5.639	1.932	6.71
LC10	50	17.73	53.61	2	1.865	5.639
LC15	51.97	21.07	55.5	1.924	1.802	4.746
LC20	54.02	25	57.47	1.851	1.74	4
LC25	56.15	35.41	59.5	1.781	1.681	2.824
LC40	63.05	55.23	66.03	1.586	1.514	1.811
LC50	68.1	60.99	70.77	1.468	1.413	1.639

## 7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	LC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	LC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



# CETIS Analytical Report

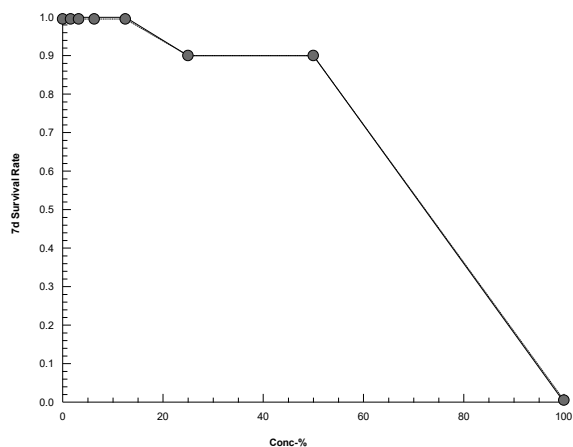
Report Date: 03 Nov-21 09:01 (p 2 of 2)  
 Test Code/ID: Treated OSPW We / 15-3783-4256

## Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental Calgary

Analysis ID: 13-1114-3492	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 03 Nov-21 9:01	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	LC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

### Graphics





# CETIS Analytical Report

Report Date: 03 Nov-21 09:00 (p 1 of 2)  
 Test Code/ID: Treated OSPW We / 15-3783-4256

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
<b>Analysis ID:</b> 12-9801-3222		<b>Endpoint:</b> Reproduction		<b>CETIS Version:</b> CETISv1.9.4	
<b>Analyzed:</b> 03 Nov-21 9:00		<b>Analysis:</b> Linear Interpolation (ICPIN)		<b>Status Level:</b> 1	
<b>Batch ID:</b> 08-6574-2927		<b>Test Type:</b> Reproduction-Survival (7d)		<b>Analyst:</b> Sara Thiessen	
<b>Start Date:</b> 09 Sep-21		<b>Protocol:</b> EC/EPS 1/RM/21		<b>Diluent:</b> River Water	
<b>Ending Date:</b> 16 Sep-21		<b>Species:</b> Ceriodaphnia dubia		<b>Brine:</b>	
<b>Test Length:</b> 7d 0h		<b>Taxon:</b> Branchiopoda		<b>Source:</b> In House <b>Age:</b> <24	
<b>Sample ID:</b> 07-7268-3404		<b>Code:</b> Week 1, Reactor 3		<b>Project:</b>	
<b>Sample Date:</b> 07 Sep-21		<b>Material:</b> Ambient Sample		<b>Source:</b> Syncrude Canada Ltd.	
<b>Receipt Date:</b> 09 Sep-21		<b>CAS (PC):</b>		<b>Station:</b> Treated OSPW	
<b>Sample Age:</b> 48h		<b>Client:</b> Syncrude Canada Ltd			

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1178814	200	Yes	Two-Point Interpolation

Residual Analysis					
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	4.093	3.306	0.0012	Outlier Detected

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	2.534	0.2612	12.78	39.46	7.824	382.9
IC5	13.11	2.442	14.06	7.628	7.11	40.96
IC10	14.61	9.897	16.1	6.847	6.213	10.1
IC15	16.26	13.7	18.4	6.15	5.434	7.301
IC20	18.09	15.2	21.14	5.527	4.73	6.577
IC25	20.12	16.87	24.71	4.971	4.048	5.929
IC40	27.12	21.47	30.66	3.687	3.262	4.658
IC50	32.23	25.41	35.41	3.102	2.824	3.936

Reproduction Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	10	30.9	14	37	6.471	20.94%	0.0%	32	0.0%
1.6		10	33.1	28	39	3.573	10.79%	-7.12%	32	0.0%
3.2		10	31.5	27	36	3.375	10.71%	-1.94%	31.5	1.56%
6.3		10	31.3	25	38	4.165	13.31%	-1.29%	31.3	2.19%
12.5		10	31.1	26	38	3.695	11.88%	-0.65%	31.1	2.81%
25		10	20.7	5	27	5.964	28.81%	33.01%	20.7	35.31%
50		10	7.8	0	12	4.131	52.96%	74.76%	7.8	75.63%
100		10	0	0	0	0		100.0%	0	100.0%

Reproduction Detail											
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	33	32	33	31	14	27	37	34	34	34
1.6		32	31	35	29	31	33	37	39	28	36
3.2		27	30	33	35	32	28	27	36	35	32
6.3		35	26	31	32	31	25	38	29	36	30
12.5		38	31	29	26	26	35	31	33	31	31
25		5	21	27	22	22	18	22	23	24	23
50		10	12	11	0	7	3	4	11	11	9
100		0	0	0	0	0	0	0	0	0	0



# CETIS Analytical Report

Report Date: 03 Nov-21 09:00 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 15-3783-4256

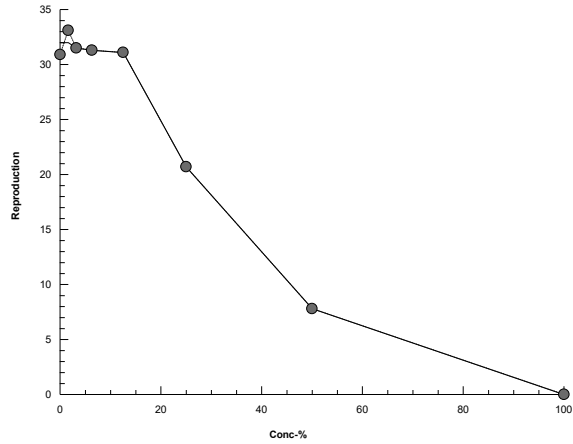
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 12-9801-3222      Endpoint: Reproduction  
Analyzed: 03 Nov-21 9:00      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## Ceriodaphnia Bench Sheet

 Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week2)
**Test Log**

Date	Day	Time	Technician	Chem. Cart Used	Subsample Fed (✓)	Daily Data Review	Subsample Used
2021/09/16	0	1330	SS	2	✓	AW	Day 0 ✓
2021/09/17	1	11045	SS	2	✓	AW	Day 1 ✓
2021/09/18	2	1520	SC	2	✓	ST	Day 2 ✓
2021/09/19	3	0920	EV	2	✓	AW	Day 3 ✓
2021/09/20	4	1100	EV	2	✓	AW	Day 4 ✓
2021/09/21	5	0900	SC	2	✓	AW	Day 5 ✓
2021/09/22	6	0900	SC	2	✓	AW	Day 6 ✓
2021/09/23	7	0915	TC	2	✓		Day 7 ✓
	8						

**Sample Information**

 Initial pH: 9.1  
 Initial EC (µS/cm): 3020  
 Initial DO (mg/L): 7.7  
 Initial Temp (°C): 18.8  
 Filtered with 60 µm nitex screen Yes/No Yes  
 Sample pre-aerated/hardness/pH adjust: Yes/No No  
 \*if yes, describe procedure, rate and duration

**Test Specifics** \*use river water as dilution water for site control and test concentrations

 Food expiration: 1m-09/27, 10/09

 Dilution water vessel and preparation date: 4/09/14
5:09/12, 1:09/14, 6:09/14

Control Validity		
Day 7		
Cup	Number of Young	Number of Broods
1	37	3
2	37	3
3	35	3
4	37	3
5	22	3
6	19	3
7	32	3
8	22	3
9	22	3
10	25	3

 Average # of Young: 27

 % with ≥ 3 Broods: 100

 Control Mortality: 0  
 (must be ≤20%)

Reproduction Validity Criteria: the average number of young produced in first three broods is ≥ 15, when 60% of control organisms had 3 or more broods:

 Yes / No Yes

 Reviewed By: SS

 Date Reviewed: 2021/11/02



# Ceriodaphnia Bench Sheet

 Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week2)

## Chemistry

New Solutions									Old Solutions								
Conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	
Day																	

pH (units) (range: 6.5-8.5)

0	7.8	8.1	8.2	8.3	8.4	8.5	8.7	8.8	0								
1	8.0	8.1	8.2	8.2	8.3	8.5	8.6	8.8	1	8.1	8.0	8.1	8.1	8.2	8.3	8.5	8.6
2	8.3	8.0	8.1	8.2	8.2	8.7	8.5	8.6	2	8.3	8.1	8.1	8.2	8.2	8.2	8.5	
3	8.0	8.3	8.4	8.4	8.5	8.6	8.8	9.0	3	8.1	8.1	8.2	8.2	8.3	8.4	8.5	8.7
4	7.5	7.8	8.0	8.1	8.2	8.4	8.6	8.7	4	7.8	7.9	7.6	7.6	7.8	8.1	8.3	8.5
5	7.7	7.8	8.1	8.1	8.2	8.4	8.6	8.8	5	8.1	7.8	7.9	7.9	8.0	8.0	8.3	8.5
6	7.9	8.0	8.1	8.2	8.3	8.5	8.6	8.7	6	8.1	7.9	7.9	7.9	7.9	8.3	8.5	
7									7	7.7	7.6	7.8	7.9	8.0	8.0	8.2	8.5
8									8								

1.6 3.2  
\* 8.0 8.0

Conductance (µS/cm)

0	198	289	341	390	484	662	1042	1729	0								
1	196	286	342	394	494	678	1061	1769	1	212	293	346	397	488	495	1036	1735
2	194	285	346	393	497	677	1105	1711	2	211	292	344	395	490	664	1060	1778
3	191	284	332	385	476	657	1074	1713	3	219	294	348	396	521	697	1104	1721
4	193	283	331	381	475	656	1011	172	4	195	287	334	390	481	666	1034	1737
5	195	290	341	390	501	678	1051	1644	5	210	293	346	394	492	655	1001	1690
6	197	286	343	390	510	674	1078	1715	6	210	294	346	395	517	655	1055	1694
7									7	221	307	356	402	508	672	1064	1915
8									8								

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	0								
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	1	7.2	7.2	7.2	7.2	7.2	7.2	7.1	7.1
2	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	2	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.6
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	3	7.2	6.8	6.6	6.9	6.5	6.4	6.5	6.3
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	4	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	5	6.2	6.2	6.3	6.2	6.1	6.1	6.1	6.2
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6	6.0	6.0	6.0	6.0	6.0	6.0	5.9	5.9
7									7	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.9
8									8								

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	0								
1	24	24	24	24	24	24	24	24	1	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	2	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	3	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	4	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	5	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	6	24	24	24	24	24	24	24	24
7									7	24	24	24	24	24	24	24	24
8									8								

DO Levels (40-100% saturation) -  
 2.9 to 1.3 mg/L at 24°C  
 2.9 to 7.2 mg/L at 25°C  
 2.8 to 1.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: SS

 Date Reviewed: 2021/11/02



# Ceriodaphnia Bench Sheet

 Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week2)

## Chemistry

New Solutions										Old Solutions									
Conc (%)	100									100									
Day																			

pH (units) (range: 6.5-8.5)

0	9.0									0	8.8								
1	8.9									1	8.9								
2	8.9									2	9.0								
3	9.2									3	8.9								
4	/									4	/								
5										5									
6										6									
7										7									
8										8									

Conductance (µS/cm)

0	3240									0	3250								
1	3250									1	3200								
2	3410									2	3360								
3	3200									3	3310								
4	/									4	/								
5										5									
6										6									
7										7									
8										8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.0									0	7.0								
1	7.2									1	6.9								
2	6.8									2	6.3								
3	7.3									3	6.2								
4	/									4	/								
5										5									
6										6									
7										7									
8										8									

Temperature 24 - 26 (°C)

0	24									0	24								
1	24									1	24								
2	24									2	24								
3	24									3	24								
4	/									4	/								
5										5									
6										6									
7										7									
8										8									

DO Levels (40-100% saturation) \* -

4.9 to 7.3 mg/L at 24°C

4.9 to 7.2 mg/L at 25°C

4.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: SS

 Date Reviewed: 202111102



# Ceriodaphnia Bench Sheet

 Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week2)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				Lab Ctl				
1	0	0	0	5	0	1	9	—
2	0	0	0	5	0	1	9	—
3	0	0	0	5	0	1	9	—
4	0	0	0	5	0	1	9	—
5	0	0	0	5	0	1	9	—
6	0	0	0	5	0	1	9	—
7	0	0	0	5	0	1	9	—
8	0	0	0	5	0	1	9	—
9	0	0	0	5	0	1	9	—
10	0	0	0	5	0	1	9	—
				Site Ctl				
1	0	0	0	5	0	1	9	—
2	0	0	0	5	0	1	9	—
3	0	0	0	5	0	1	9	—
4	0	0	0	5	0	1	9	—
5	0	0	0	5	0	1	9	—
6	0	0	0	5	0	1	9	—
7	0	0	0	5	0	1	9	—
8	0	0	0	5	0	1	9	—
9	0	0	0	5	0	1	9	—
10	0	0	0	5	0	1	9	—
				1.6%				
1	0	0	0	5	0	1	9	—
2	0	0	0	5	0	1	9	—
3	0	0	0	5	0	1	9	—
4	0	0	0	5	0	1	9	—
5	0	0	0	5	0	1	9	—
6	0	0	0	5	0	1	9	—
7	0	0	0	5	0	1	9	—
8	0	0	0	5	0	1	9	—
9	0	0	0	5	0	1	9	—
10	0	0	0	5	0	1	9	—
				3.2%				
1	0	0	0	5	0	1	9	—
2	0	0	0	5	0	1	9	—
3	0	0	0	5	0	1	9	—
4	0	0	0	5	0	1	9	—
5	0	0	0	5	0	1	9	—
6	0	0	0	5	0	1	9	—
7	0	0	0	5	0	1	9	—
8	0	0	0	5	0	1	9	—
9	0	0	0	5	0	1	9	—
10	0	0	0	5	0	1	9	—
				50%				
1	0	0	0	5	0	1	9	—
2	0	0	0	5	0	1	9	—
3	0	0	0	5	0	1	9	—
4	0	0	0	5	0	1	9	—
5	0	0	0	5	0	1	9	—
6	0	0	0	5	0	1	9	—
7	0	0	0	5	0	1	9	—
8	0	0	0	5	0	1	9	—
9	0	0	0	5	0	1	9	—
10	0	0	0	5	0	1	9	—

 Reviewed By: SS

 Date Reviewed: 2021/11/02



# Ceriodaphnia Bench Sheet

Method CDD Client SYN/HAT (PJ2021-006) Reference 2122-0052-01 (week2)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				100%				
1	0	0	X <sub>0</sub>					
2			X <sub>0</sub>					
3			X <sub>0</sub>					
4			0	X <sub>0</sub>				
5		X <sub>0</sub>						
6			X <sub>0</sub>					
7			X <sub>0</sub>					
8			X <sub>0</sub>					
9			X <sub>0</sub>					
10			X <sub>0</sub>					

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

1	2	3	4	5	6	7	8
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Reviewed By: 2021/11/02 Date Reviewed: SS



# Ceriodaphnia Bench Sheet

## Test Organism Information

Client: SYN/HAT (PJ2021-006)

Culture history for adults used in the test for sample reference: PJ2021-006

Day Used: 2021/09/16

Test organisms appeared healthy before use: ☒ Yes ☐ No

Number of young produced per brood adult within first three broods:

Brood	row/replicate	D4	D5	C1	C2	E1	E2	E3	E4	D2	D3	
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Culture(s) Used for Testing: Thurs B

number of young	6	5	5	4	3	4	4	4	3	3		
-----------------	---	---	---	---	---	---	---	---	---	---	--	--

number of young	10	8	6	7	10	11	10	10	4	9		
-----------------	----	---	---	---	----	----	----	----	---	---	--	--

number of young	2											
-----------------	---	--	--	--	--	--	--	--	--	--	--	--

number of young	9	8	13	8	9	10	11	9	11	10		
-----------------	---	---	----	---	---	----	----	---	----	----	--	--

Number of Adults Alive in Culture

7 days prior:	25	day used:	25
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Notes: all cups have 1 adult

Average No. of young in first 3 broods: 22

(must be  $\geq 15$ )

Culture % mortality (7-days prior to testing): 0%

(must be  $\leq 20\%$ )

Number of young produced by each brood organism in last complete brood is  $\geq 8$ : 4

Yes (Y) or No (N)

Reviewed By: SS

Date Reviewed: 2021/11/02



# CETIS Analytical Report

Report Date: 03 Nov-21 09:30 (p 1 of 2)  
 Test Code/ID: Treated OSPW We / 06-9490-5072

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	21-2396-8620	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:30	Analysis:	Untrimmed Spearman-Kärber	Status Level:	1
Batch ID:	16-8930-6580	Test Type:	Reproduction-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	16 Sep-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	23 Sep-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In House
Sample ID:	13-3663-0190	Code:	Week 2, Reactor 3	Project:	
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

Spearman-Kärber Estimates							
Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.669	0.05551	46.65	36.13	60.24

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
50		10	0.5000	0.0000	1.0000	0.5270	105.40%	50.0%	5/10	0.5	50.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

7d Survival Rate Detail											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
50		0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



# CETIS Analytical Report

Report Date: 03 Nov-21 09:30 (p 2 of 2)

Test Code/ID: Treated OSPW We / 06-9490-5072

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 21-2396-8620

Endpoint: 7d Survival Rate

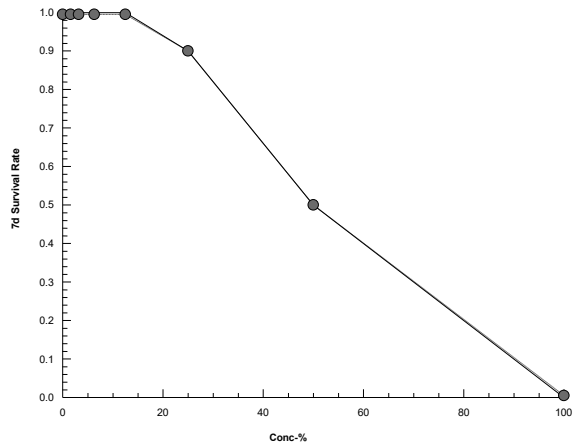
CETIS Version: CETISv1.9.4

Analyzed: 03 Nov-21 9:30

Analysis: Untrimmed Spearman-Kärber

Status Level: 1

### Graphics





# CETIS Analytical Report

Report Date: 03 Nov-21 09:30 (p 1 of 2)  
Test Code/ID: Treated OSPW We / 06-9490-5072

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	05-7172-2162	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:30	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	16-8930-6580	Test Type:	Reproduction-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	16 Sep-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	23 Sep-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In House
Sample ID:	13-3663-0190	Code:	Week 2, Reactor 3	Project:	
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	114072	200	Yes	Two-Point Interpolation

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	13.41	12.8	25.59	7.455	3.908	7.814
LC5	17.73	14.06	28.09	5.639	3.56	7.113
LC10	25	15.8	35.41	4	2.824	6.331
LC15	27.28	17.73	42.09	3.665	2.376	5.639
LC20	29.77	19.9	50	3.359	2	5.026
LC25	32.47	22.31	52.23	3.079	1.915	4.482
LC40	42.09	29.77	59.5	2.376	1.681	3.359
LC50	50	37.21	64.89	2	1.541	2.687

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
50		10	0.5000	0.0000	1.0000	0.5270	105.40%	50.0%	5/10	0.5	50.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

7d Survival Rate Detail											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



# CETIS Analytical Report

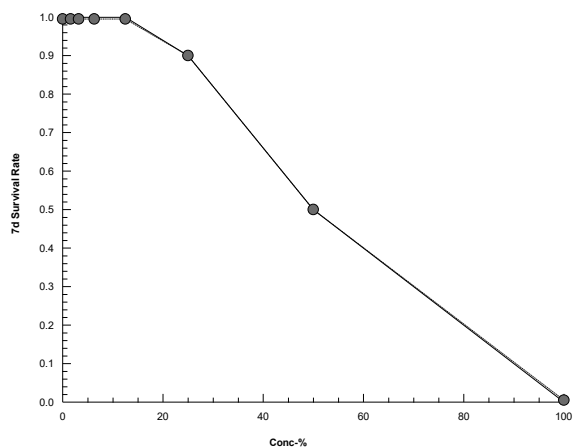
Report Date: 03 Nov-21 09:30 (p 2 of 2)  
 Test Code/ID: Treated OSPW We / 06-9490-5072

## Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental Calgary

Analysis ID: 05-7172-2162	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 03 Nov-21 9:30	Analysis: Linear Interpolation (ICPIN)	Status Level: 1

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
50		0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

### Graphics





## CETIS Analytical Report

Report Date: 03 Nov-21 09:33 (p 1 of 2)

Test Code/ID: Treated OSPW We / 06-9490-5072

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 15-9674-0887	<b>Endpoint:</b> Reproduction	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 03 Nov-21 9:32	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 16-8930-6580	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Sara Thiessen
<b>Start Date:</b> 16 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River water
<b>Ending Date:</b> 23 Sep-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In House <b>Age:</b> <24
<b>Sample ID:</b> 13-3663-0190	<b>Code:</b> Week 2, Reactor 3	<b>Project:</b>
<b>Sample Date:</b> 13 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 15 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1824094	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	4.442	3.306	1.6E-04	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	0.1724	0.08522	2.081	580	48.06	1173
IC5	1.215	0.5052	6.521	82.29	15.33	198
IC10	5.844	1.266	14.71	17.11	6.798	79.02
IC15	14.05	5.453	20.16	7.118	4.96	18.34
IC20	17.05	10.4	25.72	5.865	3.888	9.62
IC25	20.65	14.16	27.16	4.843	3.681	7.06
IC40	29.31	20.07	33.52	3.412	2.984	4.982
IC50	34.34	25.11	40.74	2.912	2.454	3.983

## Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	10	28.3	25	32	2.497	8.82%	0.0%	28.3	0.0%
1.6		10	26.6	24	31	2.797	10.51%	6.01%	26.6	6.01%
3.2		10	26	23	33	2.981	11.47%	8.13%	26	8.13%
6.3		10	25.4	20	31	3.34	13.15%	10.25%	25.4	10.25%
12.5		10	24.9	19	31	4.533	18.20%	12.01%	24.9	12.01%
25		10	19.8	0	28	7.786	39.32%	30.04%	19.8	30.04%
50		10	7.4	0	18	7.691	103.90%	73.85%	7.4	73.85%
100		10	0	0	0	0		100.0%	0	100.0%

## Reproduction Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	30	32	30	30	28	25	29	25	25	29
1.6		25	26	25	27	31	24	29	31	24	24
3.2		23	23	28	25	25	27	33	27	25	24
6.3		31	31	25	25	25	24	23	25	25	20
12.5		21	20	20	26	19	27	30	26	31	29
25		28	21	23	23	21	14	23	21	24	0
50		3	17	12	0	18	3	0	4	0	17
100		0	0	0	0	0	0	0	0	0	0



# CETIS Analytical Report

Report Date: 03 Nov-21 09:33 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 06-9490-5072

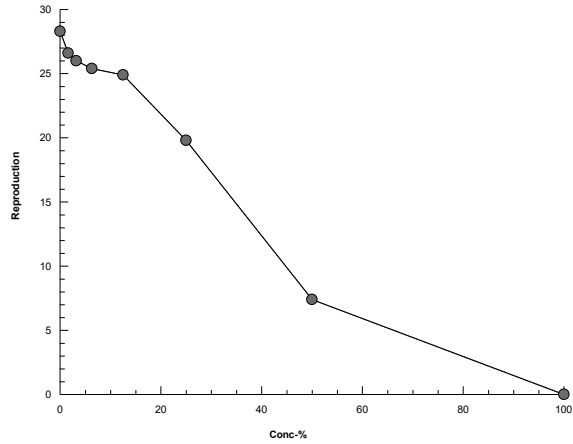
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 15-9674-0887      Endpoint: Reproduction  
Analyzed: 03 Nov-21 9:32      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## Ceriodaphnia dubia Summary Sheet

Client: Hatfield  
Work Order No.: 211939

Start Date/Time: Sept. 24/21 @ 1430h  
Set up by: SAL on JZL

### Sample Information:

Sample ID: Treated OSPW  
Sample Date: Sept. 19/21  
Date Received: Sept. 23/21  
Sample Volume: 2 x 20L

### 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  $\geq 15$  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 ( $^{\circ}\text{C}$ ) =  $25 \pm 1$ ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

### Test Organism Information:

Broodstock No.: B8091521 Y<sup>sm</sup>  
Age of young (Day 0): <24-h (within 12-h)  
Avg No. young in first 3 broods of previous 7 d: 21  
Mortality (%) in previous 7 d: 0  
Individual female # used  $\geq 8$  young on test day: # 1, 3-11

### NaCl Reference Toxicant Results:

Reference Toxicant ID: cd 293  
Stock Solution ID: 21 NaO2  
Date Initiated: Oct. 5/21

7-d LC50 (95% CL): 2.0 (1.7-2.3) g/L NaCL  
7-d IC50 (95% CL): 1.7 (1.3-1.9) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCL CV (%): 5  
7-d IC50 Reference Toxicant Mean and Historical Range: 1.8 (1.4-2.2) g/L NaCL CV (%): 12

### Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	46.6 (36.0-60.4)	
IC25 % (v/v) (95% CL)		30.8 (27.2-32.4)
IC50 % (v/v) (95% CL)		39.8 (36.3-42.6)

Reviewed by: JGw

Date reviewed: Nov. 16/21



# Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: SynGene in Hatfield  
Sample ID: Treated OSPW  
Work Order #: 211939

Start Date & Time: Sept. 24/21 @ 1430h  
Stop Date & Time: Sept. 30/21 @ 1400h  
CER #: 4  
Test Species: Ceriodaphnia dubia

Site Control Concentration (River Water)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	24.0	25.5	24.0	24.0	24.0		
DO (mg/L)	8.2	7.2	7.8	7.1	7.4	7.2	8.2	7.3	7.6	7.1	7.8	6.9		
pH	8.1	7.8	7.8	7.7	7.9	7.8	8.0	7.7	8.0	7.8	7.9	7.8		
Cond. (µS/cm)	303	303		302		306		308		304		301		
Initials	JRL	JRL		RZ		SAM		JRL		JRL		JRL		

Concentration 1.56	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	25.0	25.0	25.0	25.0	24.0	24.0	25.5	24.0	24.0	24.5		
DO (mg/L)	8.2	7.3	7.9	7.0	7.4	7.3	8.1	7.3	7.8	7.2	7.8	7.0		
pH	8.1	7.8	7.9	7.8	7.9	7.9	8.1	7.7	8.1	7.8	8.0	7.9		
Cond. (µS/cm)	348	354		349		349		348		350		406		
Initials	JRL	JRL		RZ		SAM		JRL		JRL		JRL		

Concentration 12.5	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	25.0	25.0	25.0	25.0	24.0	24.0	25.0	24.0	24.0	24.5		
DO (mg/L)	8.2	7.3	7.9	7.0	7.5	7.3	8.2	7.4	7.8	7.2	7.9	7.0		
pH	8.5	8.0	8.1	7.9	8.2	8.0	8.5	7.9	8.4	7.9	8.3	8.0		
Cond. (µS/cm)	665	662		655		665		660		660		644		
Initials	JRL	JRL		RZ		SAM		JRL		JRL		JRL		

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	25.0	25.5	25.0	25.0	24.0							
DO (mg/L)	7.4	7.3	7.9	6.7	7.6	7.3	6.6							
pH	9.2	9.0	9.1	8.7	9.0	8.7	9.2							
Cond. (µS/cm)	3060	3080		3080		3060								
Initials	JRL	JRL		RZ		SAM		JRL						

Thermometer: CER #4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control	100% River Water	Treated OSPW	
Hardness*	96	138	70	
Alkalinity*	92	114	390	

Analysts: SAK, JRL, RES, GJU, PRK

Reviewed by: JRL  
Date reviewed: Nov. 15/21

\* mg/L as CaCO3

Sample Description: Yellow-green, slightly turbid, odourless, liquid w/ some particulates

Comments: Broodboard Used: BB091521 (# 1, 3-11)



# Chronic Freshwater Toxicity Test

## Initial and Final Water Quality Measurements

Client: Synchrude  
 Sample ID: Treated OSPN  
 Work Order #: 211939

Start Date & Time: Sept. 24 / 21 @ 1430h  
 Stop Date & Time: Sept. 30 / 21 @ 1400h  
 CER #: 4  
 Test Species: Ceriodaphnia dubia

Lab Concentration Control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	25.0	25.0	25.5	25.0	25.0	24.0	24.0	24.0	25.0	24.5		
DO (mg/L)	8.0	7.0	8.0	7.1	7.5	7.1	8.2	7.3	8.1	6.9	8.1	6.9		
pH	8.0	7.7	8.0	7.7	8.0	7.9	8.2	7.7	7.9	7.6	8.1	7.7		
Cond. (µS/cm)	212	211		212		210		210		208		210		
Initials	JRZ	JRZ		JRZ		SPN		JRZ		JRZ		JRZ		

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

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

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

Thermometer: CER #4 DO meter/probe: 1 / 1 pH meter/probe: 1 / 1 Conductivity meter/probe: 1 / 1

	Control			
Hardness*	96			
Alkalinity*	92			

\* mg/L as CaCO<sub>3</sub>

Analysts: SAK, JRZ, RES, GJU, PRK

Reviewed by: JGR  
 Date reviewed: Nov. 15 / 21

Sample Description: See pg 1

Comments: Broodboard Used: BB091521 (# 1, 3-11)



# Chronic Freshwater Toxicity Test C. dubia Reproduction Data

Client: SynGene Inc. Hatfield  
Sample ID: Treated OSPW  
Work Order: 211939

Start Date & Time: Sept. 24/21 @ 1430h  
Stop Date & Time: Sept. 30/21 @ 1400h  
Set up by: JEL

% (V/V)

Days	Concentration:										Lab Control (20% Petrus)										Concentration: Site Control										Concentration: 156									
	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	1	1	1	1	1	1	1	1	1	1	JAL	1	1	1	1	1	1	1	1	1	1	JAL	1	1	1	1	1	1	1	1	1	1	JAL							
2	1	1	1	1	1	1	1	1	1	1	RCS	1	1	1	1	1	1	1	1	1	1	RCS	1	1	1	1	1	1	1	1	1	1	RCS							
3	1	1	1	1	1	1	1	1	1	1	SPW	2	3	2	3	2	1	1	2	1	1	SPW	4	2	2	2	3	1	1	2	2	1	SPW							
4	1	1	1	1	1	1	1	1	1	1	SPW	1	1	1	1	1	1	2	2	1	1	SPW	3	2	1	1	1	1	1	6	8	7	SPW							
5	7	9	5	9	10	9	8	10	10	9	JAL	10	10	11	10	6	10	2	6	9	5	JAL	12	9	10	10	11	5	9	6	8	7	JAL							
6	13	12	8	12	10	11	12	13	12	12	JAL	12	12	12	11	11	10	12	13	16	7	JAL	11	12	11	11	12	13	9	12	12	12	JAL							
7																																								
8																																								
Total	23	25	16	23	23	22	24	23	23	26	23	25	25	25	24	19	20	16	21	25	12	23	22	28	22	23	26	23	18	20	22	19	23							

Days	Concentration: 3x12										Concentration: 6.25										Concentration: 12.5												
	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	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init
2	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init
3	4	3	2	3	4	2	3	3	2	3	SPW	4	2	3	2	2	4	4	2	4	2	SPW	4	2	2	4	2	4	2	4	2	SPW	
4	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init	1	1	1	1	1	1	1	1	1	1	Init
5	9	8	8	6	7	10	1	8	11	7	Init	10	9	8	7	9	5	9	7	11	4	Init	9	11	9	13	7	8	10	9	8	Init	
6	7	12	11	10	13	12					Init	8	10	7	13	11	9	11	11	10	12	Init	11	13	11	13	7	12	11	12	11	12	Init
7																																	
8																																	
Total	20	23	21	19	24	24	3x	23	21	20	23	22	21	18	22	22	14	24	20	25	19	23	24	24	22	26	16	25	23	16	20	20	23

Days	Concentration: 25											Concentration: 50											Concentration: 100										
	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	1	1	1	1	1	1	1	1	1	1	102	1	1	1	1	1	1	1	1	1	1	102	1	1	1	1	1	1	1	1	1	1	102
2	1	1	1	1	1	1	1	1	1	1	102	1	1	1	1	1	1	1	1	1	1	102	1	1	1	1	1	1	1	1	1	1	102
3	2	1	4	3	3	4	4	4	4	4	102	2	1	3	1	4	4	3	4	3	4	102	2	1	3	1	4	4	3	4	3	4	102
4	5	1	1	8	12	7	7	10	6	10	102	5	1	7	3	1	4	4	3	4	3	102	5	1	7	3	1	4	4	3	4	3	102
5	13	8	8	13	10	10	7	10	8	10	102	13	8	10	13	10	10	7	10	8	10	102	13	8	10	13	10	10	7	10	8	10	102
6											102										102											102	
7											102										102											102	
8											102										102											102	
Total	20	15	22	24	21	26	18	24	14	24	602	20	15	22	24	21	26	18	24	14	24	602	20	15	22	24	21	26	18	24	14	24	602

Notes: X = mortality.

Comments: 1. Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.  
2. Ephyppia present in Controls (M)(N)?

Reviewed by: JEL

Date reviewed: Nov. 15/21



# CETIS Summary Report

Report Date: 16 Nov-21 13:02 (p 1 of 2)  
Test Code/ID: 211939 / 11-9044-2025

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 10-7790-5564	Test Type: Reproduction-Survival (7d)	Analyst: Jacky Law
Start Date: 24 Sep-21 14:30 ✓	Protocol: EC/EPS 1/RM/21	Diluent: River Water
Ending Date: 30 Sep-21 14:00 ✓	Species: Ceriodaphnia dubia	Brine:
Test Length: 6d	Taxon: Branchiopoda	Source: In-House Culture
		Age: <24
Sample ID: 15-3324-7584	Code: 5B638060	Project:
Sample Date: 19 Sep-21 12:00 ✓	Material: Water Sample	Source: Hatfield ✓
Receipt Date: 23 Sep-21 12:33 ✓	CAS (PC):	Station: Treated OSPW ✓
Sample Age: 5d 2h (15.8 °C) ✓	Client: Hatfield	

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
17-9664-5201	6d Survival Rate	Spearman-Kärber	EC50	46.65	36.02	60.41	2.144	1
06-8662-7784	Reproduction	Linear Interpolation (ICPIN)	IC5	25.16	0.7619	26.35	3.974	1
			IC10	26.49	3.038	27.76	3.775	
			IC15	27.89	18.07	29.25	3.586	
			IC20	29.35	25.6	30.82	3.407	
			IC25	30.89	27.46	32.46	3.237	
			IC40	36	32.75	38.33	2.778	
			IC50	39.85	36.63	42.7	2.509	
19-4138-5815	Reproduction	Linear Interpolation (ICPIN)	✓ IC5	25.07	0.7304	26.27	3.988	1
			✓ IC10	26.4	2.2	27.63	3.787	
			✓ IC15	27.8	15.76	29.11	3.597	
			✓ IC20	29.27	25.57	30.65	3.416	
			✓ IC25	30.82	27.22	32.41	3.245	
			✓ IC40	35.94	32.58	38	2.783	
			✓ IC50	39.8	36.26	42.58	2.512	

## 6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	XC	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1.56		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.12		10	0.9000	0.6738	1.0000	0.0000	1.0000	0.1000	0.3162	35.14%	10.00%
6.25		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12.5		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
25		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	0.5000	0.1230	0.8770	0.0000	1.0000	0.1667	0.5270	105.41%	50.00%
100		10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

## Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	10	22.8	20.9	24.7	16	26	0.8406	2.658	11.66%	0.00%
0	XC	10	21.2	17.97	24.43	12	25	1.428	4.517	21.30%	7.02%
1.56		10	22.3	20.14	24.46	18	28	0.9551	3.02	13.54%	2.19%
3.12		10	19.8	15.39	24.21	3	24	1.948	6.161	31.12%	13.16%
6.25		10	20.7	18.44	22.96	14	25	1.001	3.164	15.29%	9.21%
12.5		10	21.6	19.07	24.13	16	26	1.118	3.534	16.36%	5.26%
25		10	20.8	17.9	23.7	14	26	1.281	4.05	19.47%	8.77%
50		10	6	3.592	8.408	0	10	1.065	3.367	56.11%	73.68%
100		10	0	0	0	0	0	0	0		100.00%

N = Lab Control (20% Permer)

XC = Site Control (River water)



## CETIS Summary Report

Report Date:

16 Nov-21 13:02 (p 2 of 2)

Test Code/ID:

211939 / 11-9044-2025

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

## 6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	23	25	16	23	23	22	24	23	26	23
0	XC	25	25	25	24	19	20	16	21	25	12
1.56		22	28	22	23	26	23	18	20	22	19
3.12		20	23	21	19	24	24	3	23	21	20
6.25		22	21	18	22	22	14	24	20	25	19
12.5		24	24	22	26	16	25	23	16	20	20
25		20	15	22	24	21	26	18	24	14	24
50		9	9	10	3	4	9	0	3	7	6
100		0	0	0	0	0	0	0	0	0	0

## 6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	N	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	1/1	0/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



## CETIS Analytical Report

 Report Date: 16 Nov-21 12:59 (p 1 of 2)  
 Test Code/ID: 211939 / 11-9044-2025

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-9664-5201	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 27 Oct-21 12:29	Analysis: Untrimmed Spearman-Kärber	Status Level: 1
Batch ID: 10-7790-5564	Test Type: Reproduction-Survival (7d)	Analyst: Jacky Law
Start Date: 24 Sep-21 14:30	Protocol: EC/EPS 1/RM/21	Diluent: River Water
Ending Date: 30 Sep-21 14:00	Species: Ceriodaphnia dubia	Brine:
Test Length: 6d	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 15-3324-7584	Code: 5B638060	Project:
Sample Date: 19 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 5d 2h (15.8 °C)	Client: Hatfield	

## Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.669	0.05613	46.65	36.02	60.41

## 6d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.56		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.12		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.975	2.5%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.975	2.5%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.975	2.5%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.975	2.5%
50		10	0.5000	0.0000	1.0000	0.5270	105.40%	50.0%	5/10	0.5	50.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## 6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	1/1	0/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



# CETIS Analytical Report

Report Date: 16 Nov-21 12:59 (p 2 of 2)  
Test Code/ID: 211939 / 11-9044-2025

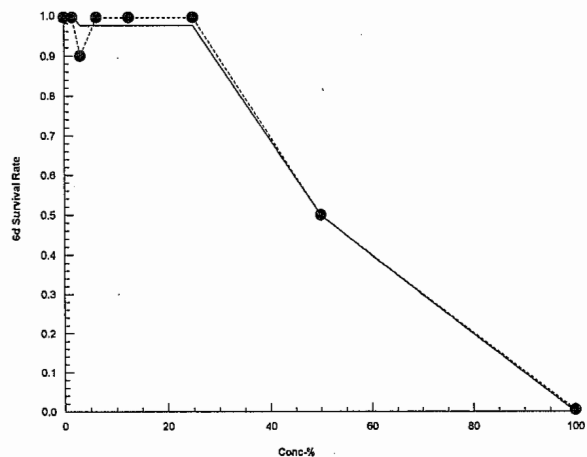
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-9664-5201      Endpoint: 6d Survival Rate  
Analyzed: 27 Oct-21 12:29      Analysis: Untrimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## CETIS Analytical Report

 Report Date: 16 Nov-21 12:59 (p 1 of 4)  
 Test Code/ID: 211939 / 11-9044-2025

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 19-4138-5815	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 27 Oct-21 12:30	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 10-7790-5564	Test Type: Reproduction-Survival (7d)	Analyst: Jacky Law
Start Date: 24 Sep-21 14:30	Protocol: EC/EPS 1/RM/21	Diluent: River Water
Ending Date: 30 Sep-21 14:00	Species: Ceriodaphnia dubia	Brine:
Test Length: 6d	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 15-3324-7584	Code: 5B638060	Project:
Sample Date: 19 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 5d 2h (15.8 °C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	528865	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	4.588	3.306	6.4E-05	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	25.07	0.7304	26.27	3.988	3.807	136.9
IC10	26.4	2.2	27.63	3.787	3.619	45.45
IC15	27.8	15.76	29.11	3.597	3.435	6.347
IC20	29.27	25.57	30.65	3.416	3.263	3.91
IC25	30.82	27.22	32.41	3.245	3.085	3.673
IC40	35.94	32.58	38	2.783	2.631	3.07
IC50	39.8	36.26	42.58	2.512	2.348	2.758

## Reproduction Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	10	21.2	12	25	4.517	21.30%	0.0%	21.75	0.0%
1.56		10	22.3	18	28	3.02	13.54%	-5.19%	21.75	0.0%
3.12		10	19.8	3	24	6.161	31.12%	6.6%	20.72	4.71%
6.25		10	20.7	14	25	3.164	15.29%	2.36%	20.72	4.71%
12.5		10	21.6	16	26	3.534	16.36%	-1.89%	20.72	4.71%
25		10	20.8	14	26	4.05	19.47%	1.89%	20.72	4.71%
50		10	6	0	10	3.367	56.11%	71.7%	6	72.41%
100		10	0	0	0	0		100.0%	0	100.0%

## Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	25	25	25	24	19	20	16	21	25	12
1.56		22	28	22	23	26	23	18	20	22	19
3.12		20	23	21	19	24	24	3	23	21	20
6.25		22	21	18	22	22	14	24	20	25	19
12.5		24	24	22	26	16	25	23	16	20	20
25		20	15	22	24	21	26	18	24	14	24
50		9	9	10	3	4	9	0	3	7	6
100		0	0	0	0	0	0	0	0	0	0



# CETIS Analytical Report

Report Date: 16 Nov-21 12:59 (p 2 of 4)  
Test Code/ID: 211939 / 11-9044-2025

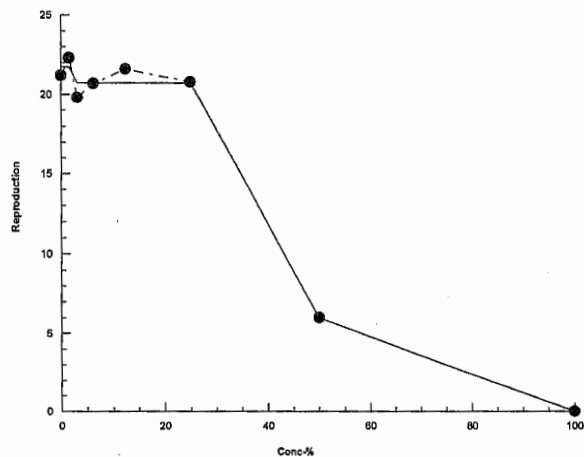
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 19-4138-5815      Endpoint: Reproduction  
Analyzed: 27 Oct-21 12:30      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# Ceriodaphnia Bench Sheet

Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Test Log

Date	Day	Time	Technician	Chem. Cart Used	Subsample Fed (✓)	Daily Data Review	Subsample Used	Sample Information
2021/10/30	0	1600	SC	3	✓	EV	Day 0	Initial pH: <u>9.1</u> Initial EC (µS/cm): <u>2950</u> Initial DO (mg/L): <u>9.3</u> Initial Temp (°C): <u>17.7</u>
2021/10/31	1	1533	SS	3	✓	MF	Day 1	Filtered with 60 µm nitex screen Yes/No
2021/10/31	2	0910	W	3	✓	MF	Day 2	Sample pre-aerated/hardness/pH adjust: Yes/No
2021/10/31	3	0103	EV	3	✓	MF	Day 3	*if yes, describe procedure, rate and duration
2021/10/31	4	1000	SC	3	✓	MF	Day 4	
2021/10/31	5	1150	EV	3	✓	MF	Day 5	
2021/10/31	6	1700	SS	4	✓	MF	Day 6	
2021/10/31	7	1340	EV	3	✓	MF	Day 7	
	8							

## Test Specifics

\*USE RIVER WATER (2022-0052-02) as dilution H<sub>2</sub>O

Food expiration: 10/09 in-H

Dilution water vessel and preparation date:  
N2 10/04

N3 09/23, 09/28, 6/09/29, N2 09/26

Cup	Control Validity	
	Day 7	Day 7
	Number of Young	Number of Broods
1	31	3
2	23	2
3	15	2
4	26	3
5	29	3
6	28	2
7	32	3
8	31	3
9	29	3
10	28	3

Average # of Young: 27

% with ≥ 3 Broods: 70

Control Mortality: 0  
(must be ≤20%)

Reproduction Validity Criteria: the average number of young produced in first three broods is ≥ 15, when 60% of control organisms had 3 or more broods:

Yes No

Reviewed By: VO

Date Reviewed: 2021/11/01



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Chemistry

New Solutions								Old Solutions									
Conc (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	
Day																	
pH (units) (range: 6.5-8.5)																	
0	7.9	7.8	8.1	8.1	8.1	8.2	8.6	8.7	0								
1	7.4	7.7	7.7	7.8	7.9	7.9	8.2	8.6	1	7.6	7.8	7.9	7.9	7.9	8.1	8.2	8.3
2	8.0	8.0	8.0	8.0	8.1	8.3	8.5	8.7	2	7.8	7.9	7.9	7.9	7.9	8.0	8.2	8.4
3	7.8	7.9	7.9	7.9	8.0	8.2	8.4	8.6	3	7.7	7.8	7.8	7.8	7.8	7.9	8.1	8.3
4	7.4	7.5	7.7	7.8	7.9	8.0	8.2	8.5	4	7.7	7.8	7.8	7.9	7.9	8.0	8.1	8.2
5	7.9	8.2	8.2	8.3	8.3	8.4	8.6	8.6	5	8.1	8.2	8.2	8.2	8.3	8.3	8.5	8.5
6	7.9	8.2	8.2	8.3	8.4	8.5	8.8	8.8	6	8.0	8.0	8.0	7.9	7.9	8.0	8.2	8.5
7									7	7.8	8.0	8.0	8.0	8.1	8.1	8.3	8.5
8									8								
Conductance (µS/cm)																	
0	100	100	96	411	488	777	923	1181	0								
1	201	311	360	402	484	653	975	1135	1	234	328	372	425	489	728	933	1494
2	444	315	361	413	501	679	1029	1105	2	258	319	363	403	486	613	971	1578
3	198	314	356	409	500	671	1021	1064	3	210	304	359	406	493	661	981	1639
4	165	327	372	417	514	664	1057	1170	4	205	315	371	422	498	680	1071	1680
5	202	313	364	411	500	670	1073	1190	5	215	318	366	413	503	653	1012	1654
6	206	313	369	414	523	680	1041	1167	6	225	326	378	425	517	682	1033	1698
7									7	206	307	362	410	490	656	984	1624
8									8								
Dissolved Oxygen (mg/L) (40-100% saturation)																	
0	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	0								
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	1	7.3	7.2	7.2	7.2	7.2	7.2	7.2	7.2
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	2	6.9	6.9	6.9	6.9	6.9	6.8	6.8	6.7
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	3	6.7	6.9	6.8	6.7	6.7	6.6	6.6	6.6
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	4	6.9	6.9	6.5	6.5	6.7	6.4	6.4	6.4
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	5	7.1	7.2	7.0	7.0	7.0	7.1	7.0	6.9
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6	6.3	6.1	5.2	5.3	5.4	5.4	5.3	5.2
7									7	6.4	6.4	6.4	6.3	6.4	6.4	6.4	-
8									8								
Temperature 24 - 26 (°C)																	
0	24	24	24	24	24	24	24	24	0								
1	24	24	24	24	24	24	24	24	1	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	2	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	3	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	4	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	5	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	6	24	24	24	24	24	24	24	24
7									7	24	24	24	24	24	24	24	24
8									8								

**DO Levels (40-100% saturation)\* -**  
 2.9 to 7.3 mg/L at 24°C  
 2.9 to 7.2 mg/L at 25°C  
 2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: JO

 Date Reviewed: 2021/11/21



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Chemistry

### New Solutions

Conc. (%)	100								
Day									

### Old Solutions

100									
-----	--	--	--	--	--	--	--	--	--

### pH (units) (range: 6.5-8.5)

0	8.9									0	8.7								
1	8.8									1	8.7								
2	8.9									2	8.7								
3										3	8.6								
4										4									
5										5									
6										6									
7										7									
8										8									

### Conductance (µS/cm)

0	2990									0									
1	3010									1	3080								
2	3140									2	3080								
3										3	3030								
4										4									
5										5									
6										6									
7										7									
8										8									

### Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3									0									
1	7.3									1	6.9								
2	7.2									2	6.8								
3										3	6.4								
4										4									
5										5									
6										6									
7										7									
8										8									

### Temperature 24 - 26 (°C)

0	24									0									
1	24									1	24								
2	25									2	24								
3										3	24								
4										4									
5										5									
6										6									
7										7									
8										8									

### DO Levels (40-100% saturation)\* -

2.9 to 7.3 mg/L at 24°C

2.9 to 7.2 mg/L at 25°C

2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: VO

 Date Reviewed: MON 11/10/21



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

Lab Ctl

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

Site Ctl

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

1.6

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

3.2

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

50

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0	2	0	0	0	0
2	0	0	0	2	0	0	0	0
3	0	0	0	2	0	0	0	0
4	0	0	0	2	0	0	0	0
5	0	0	0	2	0	0	0	0
6	0	0	0	2	0	0	0	0
7	0	0	0	2	0	0	0	0
8	0	0	0	2	0	0	0	0
9	0	0	0	2	0	0	0	0
10	0	0	0	2	0	0	0	0

 Reviewed By: h

 Date Reviewed: 22/11/21



# Ceriodaphnia Bench Sheet

Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				100				
1	0	X0						
2			X0					
3			X0					
4			X0					
5			X0					
6			X0					
7			X0					
8			X0					
9			X0					
10			X0					
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Reviewed By: W

Date Reviewed: 2021/11/01



## Test Organism Information

 Client: HAT/SHN

 Culture history for adults used in the test for sample reference: 2122-0052

 Day Used: 2021/09/30 PJ 2021-006

 Test organisms appeared healthy before use: ☒ Yes ☐ No

Number of young produced per brood adult within first three broods:

Brood	row/replicate	A1	A2	A5	B1	B3	B4	B5				
-------	---------------	----	----	----	----	----	----	----	--	--	--	--

 Culture(s) Used for Testing: YES B1

number of young	4	4	3	5	6	5	4					
-----------------	---	---	---	---	---	---	---	--	--	--	--	--

number of young	14	7	11	11	12	10	10					
-----------------	----	---	----	----	----	----	----	--	--	--	--	--

number of young	9	10	14	9	10	13	11					
-----------------	---	----	----	---	----	----	----	--	--	--	--	--

number of young	15	16	14	16	13	12	14					
-----------------	----	----	----	----	----	----	----	--	--	--	--	--

 Number of Adults Alive in Culture 7 days prior: 25 day used: 25

Notes: all cups have 1 adult

 Average No. of young in first 3 broods: 26  
 (must be  $\geq 15$ )

 Culture % mortality (7-days prior to testing): 0  
 (must be  $\leq 20\%$ )

 Number of young produced by each brood organism in last complete brood is  $\geq 8$ : Y

Yes (Y) or No (N)

 Reviewed By: W

 Date Reviewed: 2021/11/01



## CETIS Analytical Report

Report Date: 10 Nov-21 14:44 (p 1 of 2)  
 Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 04-7088-7789	<b>Endpoint:</b> 7d Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 10 Nov-21 14:43	<b>Analysis:</b> Untrimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Batch ID:</b> 12-0807-7185	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 30 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 07 Oct-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24
<b>Sample ID:</b> 12-2865-4412	<b>Code:</b> Week 4, Reactor 3	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.1	0.00%	1.824	0.02651	66.68	59.01	75.34

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9833	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9	8.48%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



# CETIS Analytical Report

Report Date: 10 Nov-21 14:44 (p 2 of 2)  
Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

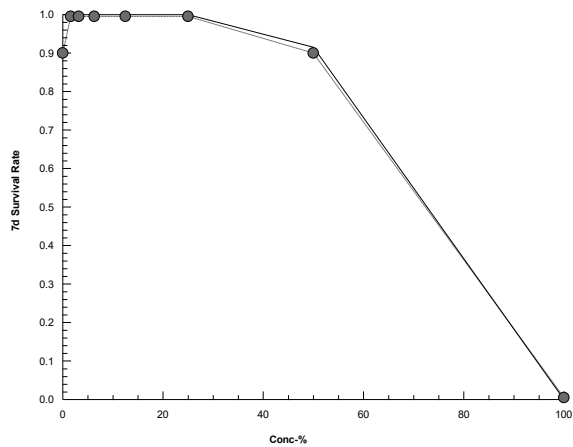
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 04-7088-7789      Endpoint: 7d Survival Rate  
Analyzed: 10 Nov-21 14:43      Analysis: Untrimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 10 Nov-21 14:44 (p 1 of 2)  
 Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	00-3680-0069	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	10 Nov-21 14:44	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	12-0807-7185	Test Type:	Reproduction-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	30 Sep-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	07 Oct-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In-House Culture
					Age: <24
Sample ID:	12-2865-4412	Code:	Week 4, Reactor 3	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	124279	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	27.15	25.59	50.35	3.683	1.986	3.908
LC5	37.69	28.09	51.77	2.653	1.932	3.56
LC10	50.58	31.55	53.61	1.977	1.865	3.17
LC15	52.55	35.41	55.5	1.903	1.802	2.824
LC20	54.58	39.74	57.47	1.832	1.74	2.516
LC25	56.7	44.58	59.5	1.764	1.681	2.243
LC40	63.53	55.23	66.03	1.574	1.514	1.811
LC50	68.54	60.99	70.77	1.459	1.413	1.639

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9833	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	-11.11%	10/10	0.9833	0.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9	8.48%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



# CETIS Analytical Report

Report Date: 10 Nov-21 14:44 (p 2 of 2)  
 Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

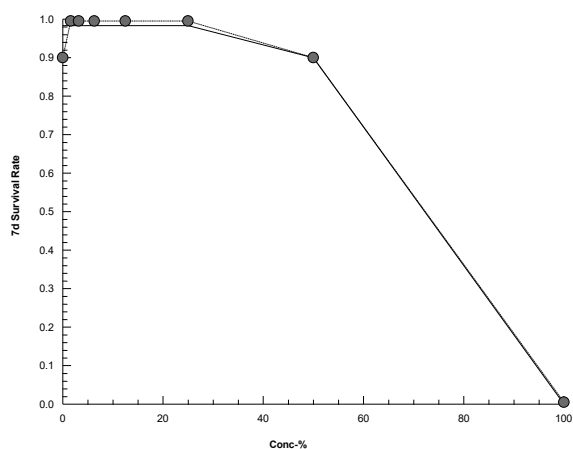
## Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental Calgary

Analysis ID: 00-3680-0069      Endpoint: 7d Survival Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 10 Nov-21 14:44      Analysis: Linear Interpolation (ICPIN)      Status Level: 1

### 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

### Graphics





# CETIS Analytical Report

Report Date: 10 Nov-21 14:47 (p 1 of 2)  
Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 03-2194-8528	<b>Endpoint:</b> Reproduction	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 10 Nov-21 14:46	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 12-0807-7185	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 30 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 07 Oct-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24
<b>Sample ID:</b> 12-2865-4412	<b>Code:</b> Week 4, Reactor 3	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	638298	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.002	3.306	0.1628	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	7.984	0.046	25.33	12.52	3.948	2174
IC5	13.65	0.2522	26.7	7.328	3.745	396.5
IC10	16.89	0.568	28.52	5.922	3.506	176.1
IC15	20.84	0.9634	30.46	4.798	3.284	103.8
IC20	25.3	1.459	32.52	3.952	3.075	68.56
IC25	27.78	9.897	34.71	3.599	2.881	10.1
IC40	36.72	19.19	43.36	2.723	2.306	5.21
IC50	44.18	25.74	51.36	2.264	1.947	3.885

## Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	10	21.7	0	34	12.35	56.90%	0.0%	21.95	0.0%
1.6		10	17.5	0	28	7.442	42.53%	19.35%	21.95	0.0%
3.2		10	23.8	13	34	6.477	27.22%	-9.68%	21.95	0.0%
6.3		10	24.8	14	30	5.138	20.72%	-14.29%	21.95	0.0%
12.5		10	21.3	3	32	9.214	43.26%	1.84%	21.3	2.96%
25		10	17.7	0	26	9.499	53.67%	18.43%	17.7	19.36%
50		10	9.5	3	13	2.677	28.18%	56.22%	9.5	56.72%
100		10	0	0	0	0		100.0%	0	100.0%

## Reproduction Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	31	27	20	29	21	23	32	0	34	0
1.6		17	28	15	0	14	19	17	21	20	24
3.2		34	29	28	19	19	21	19	13	28	28
6.3		30	22	25	28	30	20	14	27	23	29
12.5		27	30	3	14	12	25	23	19	28	32
25		0	20	26	21	22	0	22	22	24	20
50		11	10	11	9	10	13	9	11	3	8
100		0	0	0	0	0	0	0	0	0	0



# CETIS Analytical Report

Report Date: 10 Nov-21 14:47 (p 2 of 2)  
Test Code/ID: 2122-0052 CD W4 / 08-2440-1742

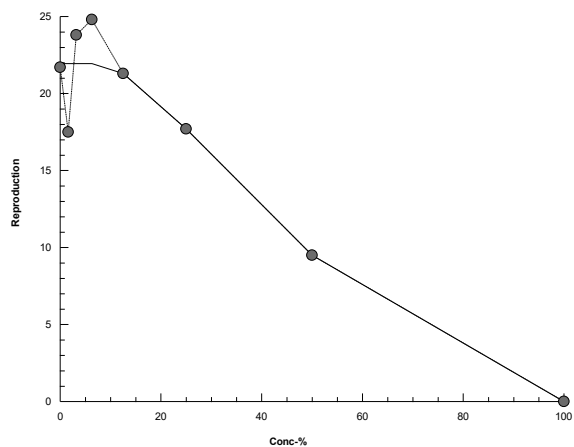
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 03-2194-8528      Endpoint: Reproduction  
Analyzed: 10 Nov-21 14:46      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0202 (Reactor 2)

### Test Log

Date	Day	Time	Technician	Chem. Cart Used	Subsample Fed (✓)	Daily Data Review	Subsample Used	Sample Information
2021/09/30	0	1638	SC	2	✓	EV	Day 0	Initial pH: <u>8.3</u> Initial EC (µS/cm): <u>2990</u> Initial DO (mg/L): <u>7.9</u> Initial Temp (°C): <u>17.8</u>
2021/10/01	1	1500	SS	3	✓	MF	Day 1	Filtered with 60 µm nitex screen Yes/No
2021/10/02	2	0950	DN	3	✓	MAE	Day 2	Sample pre-aerated/hardness/pH adjust: Yes/No
2021/10/03	3	1100	EV	3	✓	MF	Day 3	*if yes, describe procedure, rate and duration
2021/10/04	4	1200	SC	3	✓	MF	Day 4	
2021/10/05	5	1045	SC	3	✓	MF	Day 5	
2021/10/06	6	1500	SS	U	✓	MF	Day 6	
2021/10/07	7	1400	EV	3	✓	-	Day 7	
	8							

### Test Specifics

xuse river water (2122-0052-02) as dilution water

 Food expiration: 10/09 mH

Dilution water vessel and preparation date:

7:10/01, W3:10104
N3 09/23, 09/28, 09/29

Control Validity		
Day <u>7</u>		
Cup	Number of Young	Number of Broods
1	28	3
2	20	3
3	18	2
4	18	2
5	22	3
6	29	3
7	29	3
8	16	2
9	17	2
10	20	3

 Average # of Young: 24

 % with ≥ 3 Broods: 60

 Control Mortality:  
 (must be ≤20%) 0

Reproduction Validity Criteria: the average number of young produced in first three broods is ≥ 15, when 60% of control organisms had 3 or more broods:

Yes/ No

 Reviewed By: W

 Date Reviewed: 2021/11/01



Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0202 (Reactor 2)

**Chemistry**

New Solutions									Old Solutions							
Conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50
Day																

pH (units) (range: 6.5-8.5)

pH (units) (range: 6.5-8.5)

0	8.0	8.0	8.1	8.0	8.1	8.1	8.2	8.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
1	7.7	7.7	7.8	7.8	7.9	7.9	8.0	8.2	7.7	7.8	7.8	7.9	7.9	8.0	8.1	8.1
2	8.0	8.0	8.0	8.1	8.1	8.1	8.3	8.4	7.7	7.8	7.9	7.9	8.0	8.0	8.1	8.2
3	7.7	7.7	7.8	7.8	7.9	7.9	8.1	8.2	7.6	7.7	7.7	7.7	7.8	7.9	8.0	8.2
4	7.9	7.9	7.9	7.9	7.9	8.0	8.1	8.2	7.8	7.8	7.8	7.8	7.9	7.9	8.0	8.2
5	7.7	7.7	7.8	7.8	7.9	7.9	8.1	8.2	7.9	7.8	7.8	7.8	7.9	8.0	8.1	8.2
6	7.8	7.8	7.8	7.8	7.9	7.9	8.1	8.2	7.8	7.9	7.9	7.9	8.0	8.0	8.2	8.3
7									7.8	7.8	7.8	7.8	7.9	8.0	8.2	8.3
8																

Conductance (µS/cm)

0	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
1	192	310	310	310	310	310	310	310	192	310	310	310	310	310	310	310
2	115	310	310	310	310	310	310	310	115	310	310	310	310	310	310	310
3	195	310	310	310	310	310	310	310	195	310	310	310	310	310	310	310
4	115	310	310	310	310	310	310	310	115	310	310	310	310	310	310	310
5	115	310	310	310	310	310	310	310	115	310	310	310	310	310	310	310
6	219	310	310	310	310	310	310	310	219	310	310	310	310	310	310	310
7																
8																

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	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	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8																

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
7																
8																

DO Levels (40-100% saturation)\* -

2.9 to 7.3 mg/L at 24°C

2.9 to 7.2 mg/L at 25°C

2.9 to 7.1 mg/L at 26°C

\*corrected for altitude

Reviewed By W

Date Reviewed: 7/11/10



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0202 (Reactor 2)

## Chemistry

New Solutions										Old Solutions									
Conc. (%)	100									100									
Day																			
pH (units) (range: 6.5-8.5)																			
0	8.4									0									
1	8.3									1	8.3								
2	8.4									2	8.4								
3	8.4									3	8.4								
4	8.4									4	8.5								
5										5	8.6								
6										6									
7										7									
8										8									
Conductance (µS/cm)																			
0	3010									0	3010								
1	3200									1	3010								
2	3170									2	2920								
3	2990									3	2960								
4	2850									4	3210								
5										5	3200								
6										6									
7										7									
8										8									
Dissolved Oxygen (mg/L) (40-100% saturation)																			
0	6.7									0									
1	7.1									1	6.9								
2	7.2									2	6.6								
3	7.3									3	6.5								
4	7.5									4	6.4								
5										5	6.6								
6										6									
7										7									
8										8									
Temperature 24 - 26 (°C)																			
0	26									0									
1	25									1	24								
2	24									2	24								
3	24									3	24								
4	24									4	24								
5										5	24								
6										6									
7										7									
8										8									

**DO Levels (40-100% saturation)\* -**  
 2.9 to 7.3 mg/L at 24°C  
 2.9 to 7.2 mg/L at 25°C  
 2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

Reviewed By: 10

Date Reviewed: 2021/10/01



## Ceriodaphnia Bench Sheet

Method	CDD	Client	Hat/Syn PJ2021-006
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Reference 2122-0202 (Reactor 2)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

brood organisms produced during an organism's 4th or subsequent brood are not included in this count.

Day	1	2	3	4	5	6	7	8
Cup								
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

Lab Ctl	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

Site Ctl	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

1.6	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

3.2	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

6.3	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

12.5	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

25	1	2	3	4	5	6	7	8
1	0	0	0					
2								
3								
4								
5								
6								
7								
8								
9								
10								

Reviewed By: 10

Date Reviewed: 7/21/10



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0202 (Reactor 2)

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				100				
1	0	0	X <sub>0</sub>	—	—	—	—	—
2	—	—	0	X <sub>0</sub>	—	—	—	—
3	—	—	X <sub>0</sub>	—	—	—	—	—
4	—	—	X <sub>0</sub>	—	—	—	—	—
5	—	—	0	0	X <sub>0</sub>	—	—	—
6	—	—	0	X <sub>0</sub>	—	—	—	—
7	—	—	0	X <sub>0</sub>	—	—	—	—
8	—	—	X <sub>0</sub>	X <sub>0</sub>	—	—	—	—
9	—	—	X <sub>0</sub>	—	—	—	—	—
10	—	—	0	X <sub>0</sub>	—	—	—	—

Day	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Day	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Day	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

 Reviewed By: LD

 Date Reviewed: 2021/11/01



# Ceriodaphnia Bench Sheet

## Test Organism Information

 Client: HAT/SHN

 Culture history for adults used in the test for sample reference: PJ 2021-006

 Day Used: 2021/09/30
2122-0202

 Test organisms appeared healthy before use: ☒ Yes ☐ No

Number of young produced per brood adult within first three broods:

Brood	row/replicate	A1	A3	A5	B1	B3	C1	C3	E1	E3			
-------	---------------	----	----	----	----	----	----	----	----	----	--	--	--

Culture(s) Used for Testing:

NES B2

number of young	2	4	4	4	5	5	4	6	4				
-----------------	---	---	---	---	---	---	---	---	---	--	--	--	--

number of young	6	5	6	4	8	8	8	10					
-----------------	---	---	---	---	---	---	---	----	--	--	--	--	--

number of young	9	12	7	6	11	10	9	11					
-----------------	---	----	---	---	----	----	---	----	--	--	--	--	--

number of young	11	13	10	12	12	10	14	10					
-----------------	----	----	----	----	----	----	----	----	--	--	--	--	--

 Number of Adults Alive in Culture
 

7 days prior:	<u>25</u>	day used:	<u>25</u>
---------------	-----------	-----------	-----------

Notes: all cups have 1 adult

 Average No. of young in first 3 broods: 21

 (must be  $\geq 15$ )

 Culture % mortality (7-days prior to testing): 0%

 (must be  $\leq 20\%$ )

 Number of young produced by each brood organism in last complete brood is  $\geq 8$ : Y

Yes (Y) or No (N)

 Reviewed By: W

 Date Reviewed: 2021/11/01



## CETIS Analytical Report

Report Date: 10 Nov-21 15:05 (p 1 of 2)

Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 20-9272-3635	<b>Endpoint:</b> 7d Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 10 Nov-21 15:05	<b>Analysis:</b> Untrimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Batch ID:</b> 06-2122-2431	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 30 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 07 Oct-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24h
<b>Sample ID:</b> 06-7424-7467	<b>Code:</b> Week 4 Reactor 2	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.819	0.02856	65.98	57.84	75.25

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1



# CETIS Analytical Report

Report Date: 10 Nov-21 15:05 (p 2 of 2)  
Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

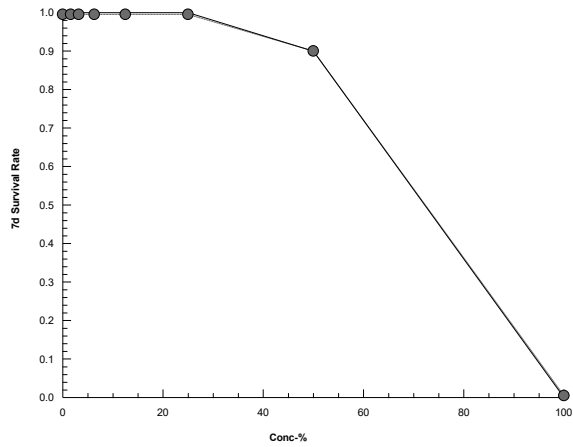
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 20-9272-3635      Endpoint: 7d Survival Rate  
Analyzed: 10 Nov-21 15:05      Analysis: Untrimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 10 Nov-21 15:06 (p 1 of 2)

Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 05-0585-8888	<b>Endpoint:</b> 7d Survival Rate	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 10 Nov-21 15:06	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 06-2122-2431	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 30 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 07 Oct-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24h
<b>Sample ID:</b> 06-7424-7467	<b>Code:</b> Week 4 Reactor 2	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1855110	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	26.81	25.59	50.35	3.73	1.986	3.908
LC5	35.41	28.09	51.77	2.824	1.932	3.56
LC10	50	31.55	53.61	2	1.865	3.17
LC15	51.97	35.41	55.5	1.924	1.802	2.824
LC20	54.02	39.74	57.47	1.851	1.74	2.516
LC25	56.15	44.58	59.5	1.781	1.681	2.243
LC40	63.05	55.23	66.03	1.586	1.514	1.811
LC50	68.1	60.99	70.77	1.468	1.413	1.639

## 7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9	10.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



# CETIS Analytical Report

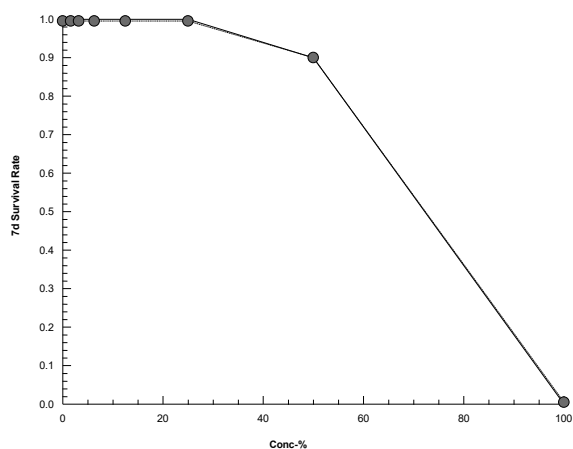
Report Date: 10 Nov-21 15:06 (p 2 of 2)  
Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

## Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental Calgary

Analysis ID: 05-0585-8888      Endpoint: 7d Survival Rate      CETIS Version: CETISv1.9.4  
Analyzed: 10 Nov-21 15:06      Analysis: Linear Interpolation (ICPIN)      Status Level: 1

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

## Graphics





# CETIS Analytical Report

Report Date: 17 Nov-21 13:29 (p 1 of 2)  
Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 12-3563-2436	<b>Endpoint:</b> Reproduction	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 17 Nov-21 13:28	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 06-2122-2431	<b>Test Type:</b> Reproduction-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 30 Sep-21	<b>Protocol:</b> EC/EPS 1/RM/21	<b>Diluent:</b> River Water
<b>Ending Date:</b> 07 Oct-21	<b>Species:</b> Ceriodaphnia dubia	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Branchiopoda	<b>Source:</b> In-House Culture <b>Age:</b> <24h
<b>Sample ID:</b> 06-7424-7467	<b>Code:</b> Week 4 Reactor 2	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 72h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1881802	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.31	3.306	1.0000	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	25.43	0.05607	25.57	3.933	3.91	1784
IC5	27.2	0.3136	28.43	3.676	3.518	318.9
IC10	29.59	0.7255	32.64	3.38	3.064	137.8
IC15	32.18	1.267	37.45	3.108	2.67	78.95
IC20	34.99	3.179	43.31	2.858	2.309	31.46
IC25	38.03	28.35	50.18	2.629	1.993	3.527
IC40	48.81	38.12	57.64	2.049	1.735	2.624
IC50	55.35	43.81	63.2	1.807	1.582	2.283

## Reproduction Summary

			Calculated Variate							Isotonic Variate	
Conc.-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect		Mean	%Effect
0	XC	10	26.6	16	39	7.545	28.37%	0.0%		26.82	0.0%
1.6		10	26	13	40	8.206	31.56%	2.26%		26.82	0.0%
3.2		10	25.6	18	34	6.603	25.79%	3.76%		26.82	0.0%
6.3		10	27.2	16	35	8.203	30.16%	-2.26%		26.82	0.0%
12.5		10	26.9	17	42	8.006	29.76%	-1.13%		26.82	0.0%
25		10	28.6	17	38	7.074	24.73%	-7.52%		26.82	0.0%
50		10	15.7	0	24	7.484	47.67%	40.98%		15.7	41.45%
100		10	0	0	0	0		100.0%		0	100.0%

## Reproduction Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	20	28	33	26	16	18	28	23	39	35
1.6		40	21	30	28	18	13	22	32	34	22
3.2		20	32	20	34	34	19	21	30	28	18
6.3		35	35	34	23	16	35	19	19	35	21
12.5		24	17	32	17	24	35	42	22	31	25
25		38	27	33	22	17	33	19	34	30	33
50		13	22	20	10	24	0	10	16	22	20
100		0	0	0	0	0	0	0	0	0	0



# CETIS Analytical Report

Report Date: 17 Nov-21 13:29 (p 2 of 2)  
Test Code/ID: 2122-0202 CD W4 / 03-4041-5614

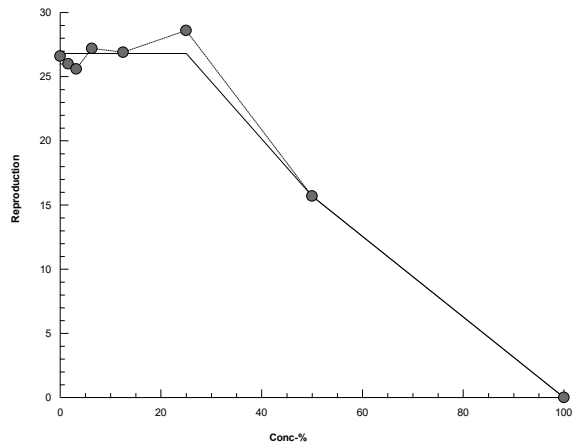
## Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental Calgary

Analysis ID: 12-3563-2436      Endpoint: Reproduction  
Analyzed: 17 Nov-21 13:28      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 5
**Test Log**

Date	Day	Time	Technician	Chem. Cart Used	Subsample Fed (✓)	Daily Data Review	Subsample Used	Sample Information
2021/10/07	0	16:50	SS	4	✓	MF	Day 0	Initial pH: <u>9.0</u> Initial EC (µS/cm): <u>3050</u> Initial DO (mg/L): <u>9.6</u> Initial Temp (°C): <u>18.1</u>
2021/10/08	1	07:45	ST	4	✓	KL	Day 1	Filtered with 60 µm nitex screen
2021/10/09	2	18:35	ST	4	✓	VJL	Day 2	Yes/No <u>Yes</u>
2021/10/10	3	16:20	EV	3	✓	AW	Day 3	Sample pre-aerated/hardness/pH adjust: <u>Yes</u>
2021/10/11	4	14:50	EV	3	✓	MF	Day 4	Yes/No <u>Yes</u>
2021/10/12	5	17:10	SC	7	✓	AW	Day 5	*if yes, describe procedure, rate and duration
2021/10/13	6	14:00	EV	2	✓	MF	Day 6	
2021/10/14	7	10:30	SC	2	—		Day 7	
	8							

**Test Specifics**

 Food expiration: 10109 (in-h), ABS 10/21, 11/07

 Dilution water vessel and preparation date: 210106, 06 10/07, 1: 10/08

Cup	Control Validity	
	Day 7	
	Number of Young	Number of Broods
1	33	3
2	31	1
3	29	1
4	29	1
5	20	
6	31	
7	26	
8	28	
9	31	
10	38	✓

 Average # of Young: 31

 % with ≥ 3 Broods: 100

 Control Mortality: 0  
 (must be ≤ 20%)

Reproduction Validity Criteria: the average number of young produced in first three broods is ≥ 15, when 60% of control organisms had 3 or more broods:

 Yes / No Yes

 Reviewed By: MG

 Date Reviewed: 2021/10/29



Method CDD Client Hat/Syn PJ2021-006

 Reference 2122-0052 Week 5
**Chemistry**

New Solutions									Old Solutions								
Conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	
Day																	

pH (units) (range: 6.5-8.5)

pH (units) (range: 6.5-8.5)

0	7.8	7.9	8.1	8.2	8.3	8.5	8.8	0	7.8	7.9	8.0	8.0	8.0	8.2	8.3	8.6
1	7.8	7.9	8.1	8.0	8.1	8.4	8.6	1	7.8	7.9	8.0	8.0	8.0	8.2	8.4	
2	7.7	7.9	8.1	8.0	8.1	8.3	8.4	2	7.7	7.8	7.9	7.9	7.9	8.0	8.2	8.4
3	7.6	7.7	7.8	7.8	8.0	8.2	8.4	3	7.6	7.8	7.8	7.8	7.9	8.1	8.2	8.4
4	7.5	7.7	7.7	7.8	7.8	8.1	8.3	4	7.5	7.6	7.6	7.7	7.7	7.8	7.9	8.1
5	7.8	7.8	7.8	8.0	8.0	8.4	8.5	5	7.8	7.9	7.9	7.9	7.9	8.0	8.2	8.5
6	7.7	7.8	7.8	7.8	7.9	8.0	8.2	6	7.8	7.7	7.7	7.7	7.7	7.8	8.0	8.2
7								7	7.4	7.6	7.4	7.6	7.6	7.7	7.9	8.1
8								8								

\* 7.9 ev

Conductance (uS/cm)

0	203	335	386	436	525	692	1036	1714	0	208	331	380	423	506	662	972	1623
1	199	324	380	427	514	685	1013	1716	1	223	354	388	429	510	679	1009	1634
2	202	334	385	424	504	671	1046	1717	2	225	341	380	433	521	691	1013	1639
3	205	323	380	423	510	688	1081	1696	3	216	333	386	430	519	690	1025	1682
4	202	341	393	440	527	697	1044	1680	4	217	350	398	440	527	683	1074	1700
5	216	337	392	441	546	718	1068	1706	5	215	342	379	428	517	673	1010	1617
6	212	325	374	420	510	682	1010	1658	6	210	341	367	435	572	701	1038	1667
7									7								
8									8								

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	1	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	2	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	3	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	4	6.7	6.8	6.9	6.9	6.9	6.9	6.9	7.0
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	5	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
8									8								

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	0	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	1	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	2	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	3	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	4	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	5	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	6	24	24	24	24	24	24	24	24
7									7	24	24	24	24	24	24	24	24
8									8								

DO Levels (40-100% saturation)

 2.9 to 7.3 mg/L at 24°C  
 2.9 to 7.2 mg/L at 25°C  
 2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: W/L

 Date Reviewed: 2021/10/29



# Ceriodaphnia Bench Sheet

 Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 5

## Chemistry

New Solutions						Old Solutions					
Conc. (%)	100	100-pH				100	100-pH				
Day											

pH (units) (range: 6.5-8.5)

0	9.0	8.2									
1	8.8	8.2									
2	8.6	8.2									
3	8.6	-									
4	8.6	/									
5	9.0	/									
6											
7											
8											

Conductance (uS/cm)

0	3080	3190									
1	3070	3070									
2	3120	3210									
3	3120	-									
4	3140	/									
5	3150	/									
6											
7											
8											

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	7.3									
1	6.9	6.9									
2	7.3	7.3									
3	7.3	7.3									
4	7.3	/									
5	7.3	/									
6											
7											
8											

Temperature 24 - 26 (°C)

0	24	24									
1	24	24									
2	24	24									
3	24	24									
4	24	/									
5	24	/									
6											
7											
8											

DO Levels (40-100% saturation)\* -

2.9 to 7.3 mg/L at 24°C

2.9 to 7.2 mg/L at 25°C

2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

 Reviewed By: M/G

 Date Reviewed: 2024/10/29



Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 5

## Biology

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup	1	2	3	4	5	6	7	8
1				Lab Ctl				
2	0	0	4	0	12	0	17	—
3	↓	↓	5	0	10	↓	9	—
4	↓	↓	3	0	10	↓	9	—
5	↓	↓	3	0	10	↓	9	—
6	↓	↓	3	0	10	↓	9	—
7	↓	↓	3	0	10	↓	9	—
8	↓	↓	3	0	10	↓	9	—
9	↓	↓	3	0	10	↓	9	—
10	↓	↓	3	0	10	↓	9	—
1				Site Ctl				
2	0	0	0	3	12	0	15	—
3	↓	↓	2	0	10	↓	12	—
4	↓	↓	2	0	10	↓	12	—
5	↓	↓	2	0	10	↓	12	—
6	↓	↓	2	0	10	↓	12	—
7	↓	↓	2	0	10	↓	12	—
8	↓	↓	2	0	10	↓	12	—
9	↓	↓	2	0	10	↓	12	—
10	↓	↓	2	0	10	↓	12	—
1				1.6				
2	0	0	3	0	10	0	15	—
3	↓	↓	3	0	10	↓	15	—
4	↓	↓	3	0	10	↓	15	—
5	↓	↓	3	0	10	↓	15	—
6	↓	↓	3	0	10	↓	15	—
7	↓	↓	3	0	10	↓	15	—
8	↓	↓	3	0	10	↓	15	—
9	↓	↓	3	0	10	↓	15	—
10	↓	↓	3	0	10	↓	15	—
1				3.2				
2	0	0	6	0	10	0	17	—
3	↓	↓	6	0	10	↓	17	—
4	↓	↓	6	0	10	↓	17	—
5	↓	↓	6	0	10	↓	17	—
6	↓	↓	6	0	10	↓	17	—
7	↓	↓	6	0	10	↓	17	—
8	↓	↓	6	0	10	↓	17	—
9	↓	↓	6	0	10	↓	17	—
10	↓	↓	6	0	10	↓	17	—
1				6.3				
2	0	0	4	0	10	0	16	—
3	↓	↓	4	0	10	↓	16	—
4	↓	↓	4	0	10	↓	16	—
5	↓	↓	4	0	10	↓	16	—
6	↓	↓	4	0	10	↓	16	—
7	↓	↓	4	0	10	↓	16	—
8	↓	↓	4	0	10	↓	16	—
9	↓	↓	4	0	10	↓	16	—
10	↓	↓	4	0	10	↓	16	—
1				12.5				
2	0	0	5	0	10	0	10	—
3	↓	↓	5	0	10	↓	10	—
4	↓	↓	5	0	10	↓	10	—
5	↓	↓	5	0	10	↓	10	—
6	↓	↓	5	0	10	↓	10	—
7	↓	↓	5	0	10	↓	10	—
8	↓	↓	5	0	10	↓	10	—
9	↓	↓	5	0	10	↓	10	—
10	↓	↓	5	0	10	↓	10	—
1				25				
2	0	0	0	10	10	0	0	—
3	↓	↓	0	10	10	↓	0	—
4	↓	↓	0	10	10	↓	0	—
5	↓	↓	0	10	10	↓	0	—
6	↓	↓	0	10	10	↓	0	—
7	↓	↓	0	10	10	↓	0	—
8	↓	↓	0	10	10	↓	0	—
9	↓	↓	0	10	10	↓	0	—
10	↓	↓	0	10	10	↓	0	—
1				50				
2	0	0	0	10	10	0	0	—
3	↓	↓	0	10	10	↓	0	—
4	↓	↓	0	10	10	↓	0	—
5	↓	↓	0	10	10	↓	0	—
6	↓	↓	0	10	10	↓	0	—
7	↓	↓	0	10	10	↓	0	—
8	↓	↓	0	10	10	↓	0	—
9	↓	↓	0	10	10	↓	0	—
10	↓	↓	0	10	10	↓	0	—

Reviewed By: W/L

Date Reviewed: 2021/10/29

not dead  
X



Method CDD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 5

**Biology**

(#, young produced; 0, no young; X, dead; X#, young produced-dead; —, young produced after 3rd brood)

Brood organisms produced during an organism's 4th or subsequent brood are not included in brood counts

Day	1	2	3	4	5	6	7	8
Cup				100				
1	0	0	X <sub>0</sub>					
2		0	0	2	X <sub>0</sub>			
3		X <sub>0</sub>						
4		X <sub>0</sub>						
5		0	X <sub>0</sub>					
6		0	X <sub>0</sub>					
7			0	X <sub>0</sub>				
8			0	0	X <sub>0</sub>			
9			0	0	0	X <sub>0</sub>		
10	↓	↓	0	0	X <sub>0</sub>			
				100-pH adj				
1	0	0	X <sub>0</sub>					
2		0	X <sub>0</sub>					
3		X <sub>0</sub>						
4		0	X <sub>0</sub>					
5		0	X <sub>0</sub>					
6		X <sub>0</sub>						
7		X <sub>0</sub>						
8		0	X <sub>0</sub>					
9		0	X <sub>0</sub>					
10	↓	↓	X <sub>0</sub>					
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Reviewed By: ML

Date Reviewed: 2021/10/29



# Ceriodaphnia Bench Sheet

## Test Organism Information

Client: HAF/SUN

Culture history for adults used in the test for sample reference: PJ2021-006 (2122-0052-01)

Day Used: 2021/10/07

Test organisms appeared healthy before use: ☒ Yes / ☐ No

Number of young produced per brood adult within first three broods:

Brood	row/replicate	B3	B4	C3	D2	E1	E2	E3	E4	E2		
-------	---------------	----	----	----	----	----	----	----	----	----	--	--

Culture(s) Used for Testing: Tues A1 Th. B1A

number of young	4	2	7	4	4	5	6	6	3			
-----------------	---	---	---	---	---	---	---	---	---	--	--	--

number of young	12	8	3	8	12	10	11	15	5			
-----------------	----	---	---	---	----	----	----	----	---	--	--	--

number of young	11	15	12	15	16	11	10	13	9			
-----------------	----	----	----	----	----	----	----	----	---	--	--	--

number of young	13	11	15	15	9	12	9	11	16	12		
-----------------	----	----	----	----	---	----	---	----	----	----	--	--

Number of Adults Alive in Culture

7 days prior:	day used:
25 + 25	25 + 25

Notes: all cups have 1 adult

Average No. of young in first 3 broods: 26

(must be  $\geq 15$ )

Culture % mortality (7-days prior to testing): 0%

(must be  $\leq 20\%$ )

Number of young produced by each brood organism in last complete brood is  $\geq 8$ : 4

Yes (Y) or No (N)

Reviewed By: MG

Date Reviewed: 2021/10/29



# CETIS Analytical Report

Report Date: 02 Nov-21 19:40 (p 1 of 2)  
Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	11-7938-7179	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	02 Nov-21 19:39	Analysis:	Untrimmed Spearman-Kärber	Status Level:	1
Batch ID:	11-9916-4899	Test Type:	Reproduction-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	07 Oct-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	14 Oct-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In-House Culture
					Age: <24h
Sample ID:	03-3773-3434	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

Spearman-Kärber Estimates							
Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.789	0.03808	61.56	51.66	73.36

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	0.8000	0.0000	1.0000	0.4216	52.70%	20.0%	8/10	0.8	20.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

7d Survival Rate Detail											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	0.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

7d Survival Rate Binomials											
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	0/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

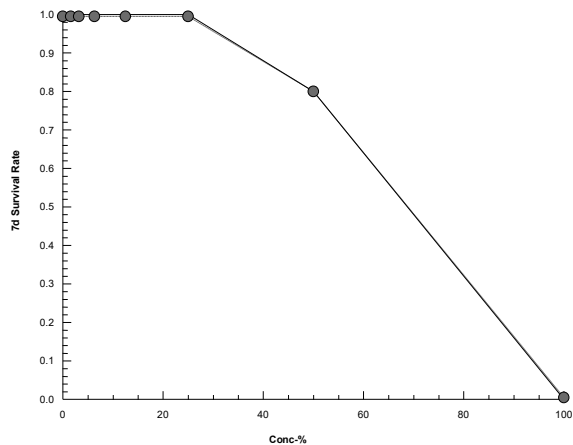


CETIS Analytical Report

Report Date: 02 Nov-21 19:40 (p 2 of 2)  
Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

Ceriodaphnia 7-d Survival and Reproduction Test			Nautilus Environmental Calgary	
Analysis ID:	11-7938-7179	Endpoint:	7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed:	02 Nov-21 19:39	Analysis:	Untrimmed Spearman-Kärber	Status Level: 1

Graphics





## CETIS Analytical Report

Report Date: 02 Nov-21 19:42 (p 1 of 2)  
 Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	19-9259-1103	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	02 Nov-21 19:41	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	11-9916-4899	Test Type:	Reproduction-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	07 Oct-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	14 Oct-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In-House Culture
				Age:	<24h
Sample ID:	03-3773-3434	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1633175	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	25.89	25.35	50.35	3.862	1.986	3.944
LC5	29.77	26.81	51.77	3.359	1.932	3.73
LC10	35.41	28.75	53.61	2.824	1.865	3.478
LC15	42.09	30.82	55.5	2.376	1.802	3.244
LC20	50	33.04	57.47	2	1.74	3.026
LC25	52.23	35.41	59.5	1.915	1.681	2.824
LC40	59.5	43.57	66.03	1.681	1.514	2.295
LC50	64.89	50	70.77	1.541	1.413	2

## 7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
1.6		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
3.2		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.3		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	0.8000	0.0000	1.0000	0.4216	52.70%	20.0%	8/10	0.8	20.0%
100		10	0.0000	0.0000	0.0000	0.0000		100.0%	0/10	0	100.0%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	0.0000
100		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



CETIS Analytical Report

Report Date: 02 Nov-21 19:42 (p 2 of 2)  
Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

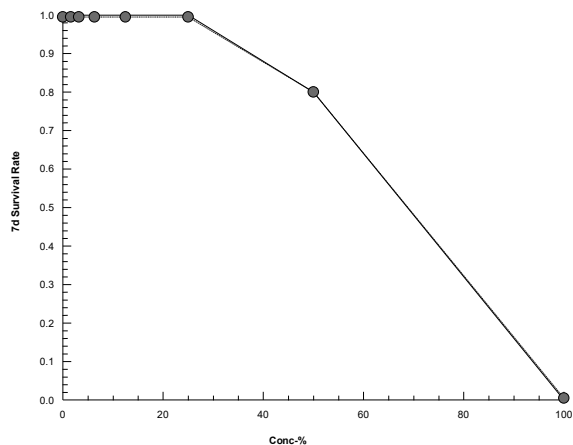
Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental Calgary

Analysis ID: 19-9259-1103      Endpoint: 7d Survival Rate      CETIS Version: CETISv1.9.4  
Analyzed: 02 Nov-21 19:41      Analysis: Linear Interpolation (ICPIN)      Status Level: 1

7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	0/1
100		0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Graphics





## CETIS Analytical Report

Report Date: 02 Nov-21 19:44 (p 1 of 2)  
 Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

Ceriodaphnia 7-d Survival and Reproduction Test				Nautilus Environmental Calgary	
Analysis ID:	00-8354-1652	Endpoint:	Reproduction	CETIS Version:	CETISv1.9.4
Analyzed:	02 Nov-21 19:44	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	11-9916-4899	Test Type:	Reproduction-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	07 Oct-21	Protocol:	EC/EPS 1/RM/21	Diluent:	River Water
Ending Date:	14 Oct-21	Species:	Ceriodaphnia dubia	Brine:	
Test Length:	7d 0h	Taxon:	Branchiopoda	Source:	In-House Culture
					Age: <24h
Sample ID:	03-3773-3434	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	72h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1887858	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.523	3.306	0.0198	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	1.71	0.1239	2.863	58.48	34.93	807.2
IC5	2.198	0.7931	6.913	45.5	14.47	126.1
IC10	2.933	1.757	8.14	34.1	12.29	56.91
IC15	7.085	2.265	10.03	14.11	9.965	44.16
IC20	8.391	2.816	12.32	11.92	8.115	35.51
IC25	9.908	6.483	13.3	10.09	7.516	15.42
IC40	14.22	11.57	16.17	7.032	6.185	8.643
IC50	16.72	14.69	18.58	5.979	5.383	6.808

## Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	10	29.5	14	37	6.98	23.66%	0.0%	30.2	0.0%
1.6		10	30.9	26	38	3.479	11.26%	-4.75%	30.2	0.0%
3.2		10	25.8	10	33	6.647	25.76%	12.54%	26.7	11.59%
6.3		10	27.6	13	33	5.68	20.58%	6.44%	26.7	11.59%
12.5		10	20.5	12	27	5.061	24.69%	30.51%	20.5	32.12%
25		10	7.5	4	13	2.838	37.84%	74.58%	7.5	75.17%
50		10	4.1	0	7	2.283	55.68%	86.1%	4.1	86.42%
100		10	0.2	0	2	0.6325	316.20%	99.32%	0.2	99.34%

## Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	XC	33	25	35	14	24	30	29	37	36	32
1.6		31	32	33	30	26	27	31	33	28	38
3.2		33	27	29	22	25	10	23	28	28	33
6.3		31	31	27	31	13	25	27	28	30	33
12.5		15	27	27	24	18	12	21	20	17	24
25		7	9	4	5	6	8	5	7	13	11
50		2	7	7	4	0	5	6	4	2	4
100		0	2	0	0	0	0	0	0	0	0

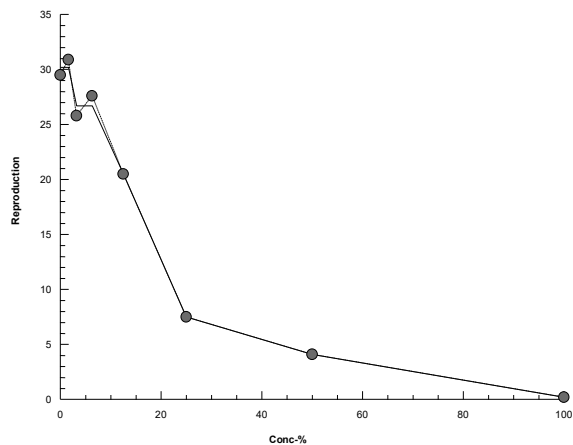


CETIS Analytical Report

Report Date: 02 Nov-21 19:44 (p 2 of 2)  
Test Code/ID: 2122-0052 CD 5 / 05-5935-9081

Ceriodaphnia 7-d Survival and Reproduction Test		Nautilus Environmental Calgary	
Analysis ID:	00-8354-1652	Endpoint:	Reproduction
Analized:	02 Nov-21 19:44	Analysis:	Linear Interpolation (ICPIN)
		CETIS Version:	CETISv1.9.4
		Status Level:	1

Graphics





## **APPENDIX E – 7-d Fathead Minnow (*Pimephales promelas*) Toxicity Test Data**



## Fathead Minnow Extra Concentrations Bench Sheet

 Method FMD

Client

HAT/SYN (PJ2021-006)

Reference

2122 - 2052-01  
 (week 1)

**Test Log**

Date	Day	Time	Technicians	Chem Cart Used	Fed	Daily Data Review	Subsample Used
2021/09/01	0	1430	ST/ME/ST	2	-	✓	Day 0
2021/09/10	1	1530	DJ	2	✓	✓	Day 1
2021/09/11	2	1140	MAE	2	✓	✓	Day 2
2021/09/12	3	1110	JCC	2	✓	✓	Day 3
2021/09/13	4	1400	EV	2	✓	✓	Day 4
2021/09/14	5	1130	EV	2	✓	✓	Day 5
2021/09/15	6	1030	EV	2	✓	✓	Day 6
2021/09/16	7	1500	KL	2	-	✓	Day 7

**Sample Information**

Initial pH: 8.2 9.1  
 Initial EC (µS/cm): 1218 299  
 Initial DO (mg/L): 5.8 5.7  
 Filtered with 60 µm nitex screen  
 Sample pre-aerated/hardness/pH adjust: Yes/No  
 \*if yes, describe procedure, rate and duration

Organisms upon receipt:  
 Mortality: 21  
 Temperature (°C): 21 \*temp. must be between 22 °C - 28 °C  
 Dissolved Oxygen (mg/L): 12.5

**Test Organisms**

 Fish Feeding Normally: Yes/No  
 Inflated Swim Bladders: Yes/No

 Organism Source: AQUARIUM  
 Batch Number: 20210909FM  
 Breeding Stock Mortality: 21
**Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)**

conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
replicate									
a	10	10	10	10	10	10	10	9	10
b	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10
a	10	10	9(1)	8	10	10	9	10	*9
b	10	10	10	10	10	10	10	10	
c	10	10	10	10	10	10	10	10	
d	9	10	10	10	10	10	10	10	
a	9	10	9	9	10	10	9	9	
b	10	10	10	10	10	9(1)	10(1)	9	
c	10	10	9	10	10	10	10	9	
d	9	10	10	10	10	10	10	10	
a	9	10	8	8	9	10	10	8	9(1)
b	10	10	10	10	9	10	8	8	7
c	10	10	9	10	10	10	10	10	6
d	9	10	10	10	10	10	10	10(1)	7

**Atypical Swimming Behaviour:**

 Unless otherwise noted, behavior is considered to be normal  
 Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
8	10	8	8	9	10	10	6*	6*
10	10	10	10	9	10	8	8	6(1)
10	10	9	10	10	10	10(1)	10(1)	5
9	10	10	10	9	10	10	9	5(1)
8	10	8	8	9	10	10	5*	4*
10	10	10	10	9	10	8	6*	2(1)*
10	10	9	10	10	10	9	9*	5*
9	10	10	10	9	10	10(1)	6*	8*
8	9	8*	8	9	10	10	5*	7*
10	10	10	10	9	10	7	7*	1*
10	10	9	10	10	10	9	7*	3*
9	10	10	10	9	10	10(1)	6*	1*

Comments: \* microbial growth observed

**Scoring Convention: # alive (# atypically swimming)**

 e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel  
 No bracketed # indicates no atypical swimming within test vessel

 Reviewed By: SS

 Date Reviewed: 2021/10/28



# Fathead Minnow Extra Concentrations Bench Sheet

 Method FMD

 Client HAT/SYN (PJ2021-006)

 Reference 2122 - (week 1) <sup>0052-01</sup>

## Chemistry

### New Solutions

conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
day									

pH (units) (range: 6.5-8.5)

0	8.7	8.1	8.3	8.4	8.5	8.7	8.9	9.0	9.1
1	8.3	8.5	8.5	8.6	8.7	8.8	8.9	9.1	9.2
2	8.3	8.8	8.8	8.4	8.4	8.6	8.7	8.9	9.0
3	8.1	8.7	8.3	8.3	8.4	8.5	8.7	8.9	9.0
4	8.0	8.1	8.2	8.3	8.4	8.5	8.7	8.8	8.9
5	8.2	8.2	8.3	8.4	8.4	8.6	8.7	8.9	9.0
6	8.2	8.2	8.3	8.4	8.5	8.6	8.7	8.9	9.0
7									
8									

Conductivity (µS/cm)

0	381	381	331	391	481	663	1028	1442	3000
1	388	385	345	396	494	658	1032	1657	3550
2	385	388	348	387	468	620	956	1897	3080
3	396	396	347	404	494	660	980	1612	3390
4	404	396	347	401	490	663	974	1626	3060
5	382	385	347	389	481	648	1000	1638	1946
6	344	392	347	389	478	650	1011	1675	2960
7									
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.7
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.2	6.3
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	5.8
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.1
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.2
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.2
7									
8									

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24
7									
8									

DO Levels (40-100% saturation)\* -

2.9 to 7.3 mg/L at 24°C

\*corrected for altitude

### Old Solutions

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
---------	----------	-----	-----	-----	------	----	----	-----

pH (units) (range: 6.5-8.5)

0	8.3	8.0	8.1	8.1	8.2	8.3	8.4	9.0	
1	8.2	7.9	8.1	8.0	8.1	8.2	8.3	8.6	8.9
2	8.0	7.9	8.0	8.0	8.1	8.1	8.3	8.5	8.8
3	8.0	8.0	8.0	8.0	8.0	8.0	8.2	8.5	8.7
4	8.0	7.9	7.9	8.0	8.0	8.1	8.7	8.5	8.8
5	8.1	7.8	7.8	7.9	8.0	8.0	8.1	8.5	8.8
6	8.0	7.7	7.8	7.8	7.9	8.0	8.2	8.5	8.8
7									
8									

Conductivity (µS/cm)

0	432	448	348	408	492	658	1058	1656	1880
1	430	297	365	409	490	713	1060	1899	3060
2	424	329	361	403	486	667	1045	1630	3010
3	421	299	361	425	517	702	1140	1634	3120
4	430	311	358	416	509	690	1058	1644	3140
5	439	343	358	447	527	706	1077	1692	3030
6	400	297	358	401	499	685	1058	1707	3100
7									
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.0	6.2	6.2	6.2	6.2	6.3	6.3	6.3	6.3
1	6.8	6.8	6.9	6.8	6.7	6.8	6.8	6.8	6.7
2	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
3	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
4	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
5	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
6	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5
7									
8									

Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24	MAF
1	24	24	24	24	24	24	24	24	24	
2	24	24	24	24	24	24	24	24	24	MAF
3	24	24	24	24	24	24	24	24	24	
4	24	24	24	24	24	24	24	24	24	
5	24	24	24	24	24	24	24	24	24	
6	24	24	24	24	24	24	24	24	24	
7										
8										

 Reviewed By: SS

 Date Reviewed: 2021/10/28



# Organism Weights

## Bench Sheet

Client HATSYN Sample 222-0082-01 Organism FM Batch 20210909 PM

Initial Weight (mg):  
Final Weight (mg):

Item Weighed	Date	Initials	Balance*
dried pan	20210916	DL	Mettler
dried pan + organisms	20210919	AL	Mettler

Concentration

Replicate	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	399.32	402.50	399.32	402.50	399.32	402.50	399.32	402.50
b	405.74	402.06	405.74	402.06	405.74	402.06	405.74	402.06
c	407.55	410.98	407.55	410.98	407.55	410.98	407.55	410.98
d	398.62	402.14	398.62	402.14	398.62	402.14	398.62	402.14
e								

Concentration

Replicate	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	394.38	399.56	394.38	399.56	394.38	399.56	394.38	399.56
b	392.86	397.48	392.86	397.48	392.86	397.48	392.86	397.48
c	394.55	403.55	394.55	403.55	394.55	403.55	394.55	403.55
d	396.65	400.68	396.65	400.68	396.65	400.68	396.65	400.68
e	400.00		400.00		400.00		400.00	

Balance Calibration Check:

first pan weighed: 400.00 Initial 400.00 Final 400.00  
weight of first pan: 400.00  
first pan after all other pans weighed: 400.00

% difference <5%: Yes/No

% difference =  $\frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: SS Date Reviewed: 202110128



# CETIS Analytical Report

Report Date: 03 Nov-21 09:11 (p 1 of 2)  
Test Code/ID: Treated OSPW We / 12-4043-7013

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	03-8305-1617	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:11	Analysis:	Trimmed Spearman-Kärber	Status Level:	1
Batch ID:	17-3182-5581	Test Type:	Growth-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	09 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	16 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
Sample ID:	07-7268-3404	Code:	Week 1, Reactor 3	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Trimmed Spearman-Kärber Estimates							
Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.025	17.95%	1.758	0.04109	57.25	47.38	69.18

Residual Analysis						
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)	
Extreme Value	Grubbs Extreme Value Test	2.521	2.938	0.2578	No Outliers Detected	

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.975	0.0%
1.6		4	0.9250	0.8000	1.0000	0.0957	10.35%	5.13%	37/40	0.95	2.56%
3.2		4	0.9500	0.8000	1.0000	0.1000	10.53%	2.56%	38/40	0.95	2.56%
6.3		4	0.9250	0.9000	1.0000	0.0500	5.41%	5.13%	37/40	0.95	2.56%
12.5		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.95	2.56%
25		4	0.9000	0.7000	1.0000	0.1414	15.71%	7.69%	36/40	0.9	7.69%
50		4	0.5750	0.5000	0.7000	0.0957	16.65%	41.03%	23/40	0.575	41.03%
100		4	0.1750	0.1000	0.3000	0.0957	54.71%	82.05%	7/40	0.175	82.05%

7d Survival Rate Detail					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.9000	1.0000	1.0000	1.0000
1.6		0.8000	1.0000	0.9000	1.0000
3.2		0.8000	1.0000	1.0000	1.0000
6.3		0.9000	0.9000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000
25		1.0000	0.7000	0.9000	1.0000
50		0.5000	0.5000	0.7000	0.6000
100		0.2000	0.1000	0.3000	0.1000

7d Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	9/10	10/10	10/10	10/10
1.6		8/10	10/10	9/10	10/10
3.2		8/10	10/10	10/10	10/10
6.3		9/10	9/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10
25		10/10	7/10	9/10	10/10
50		5/10	5/10	7/10	6/10
100		2/10	1/10	3/10	1/10



# CETIS Analytical Report

Report Date: 03 Nov-21 09:11 (p 2 of 2)

Test Code/ID: Treated OSPW We / 12-4043-7013

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

Nautilus Environmental Calgary

Analysis ID: 03-8305-1617

Endpoint: 7d Survival Rate

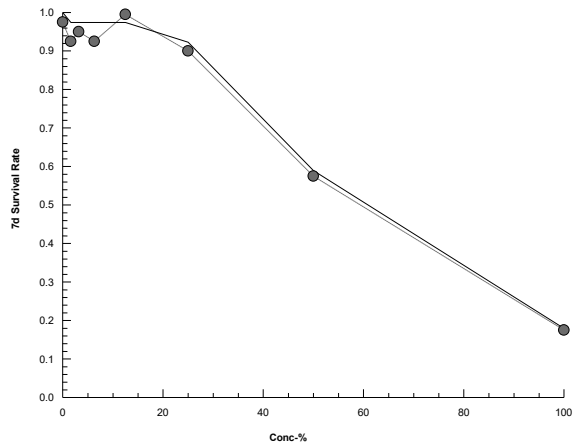
CETIS Version: CETISv1.9.4

Analyzed: 03 Nov-21 9:11

Analysis: Trimmed Spearman-Kärber

Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 03 Nov-21 09:12 (p 1 of 2)

Test Code/ID: Treated OSPW We / 12-4043-7013

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	03-5045-9103	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:12	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	17-3182-5581	Test Type:	Growth-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	09 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	16 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	<24
Sample ID:	07-7268-3404	Code:	Week 1, Reactor 3	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1342700	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.521	2.938	0.2578	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	0.4516	n/a	40.45	221.4	2.472	n/a
LC5	17.43	n/a	33.25	5.737	3.008	n/a
LC10	26.24	10.15	32.37	3.811	3.089	9.848
LC15	29.14	14.68	35.65	3.432	2.805	6.812
LC20	32.34	19.79	39.66	3.092	2.521	5.052
LC25	35.89	24.29	44.86	2.786	2.229	4.117
LC40	48.95	38.88	60.58	2.043	1.651	2.572
LC50	58.22	47.42	69.9	1.718	1.431	2.109

## 7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.975	0.0%
1.6		4	0.9250	0.8000	1.0000	0.0957	10.35%	5.13%	37/40	0.95	2.56%
3.2		4	0.9500	0.8000	1.0000	0.1000	10.53%	2.56%	38/40	0.95	2.56%
6.3		4	0.9250	0.9000	1.0000	0.0500	5.41%	5.13%	37/40	0.95	2.56%
12.5		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.95	2.56%
25		4	0.9000	0.7000	1.0000	0.1414	15.71%	7.69%	36/40	0.9	7.69%
50		4	0.5750	0.5000	0.7000	0.0957	16.65%	41.03%	23/40	0.575	41.03%
100		4	0.1750	0.1000	0.3000	0.0957	54.71%	82.05%	7/40	0.175	82.05%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.9000	1.0000	1.0000	1.0000
1.6		0.8000	1.0000	0.9000	1.0000
3.2		0.8000	1.0000	1.0000	1.0000
6.3		0.9000	0.9000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000
25		1.0000	0.7000	0.9000	1.0000
50		0.5000	0.5000	0.7000	0.6000
100		0.2000	0.1000	0.3000	0.1000

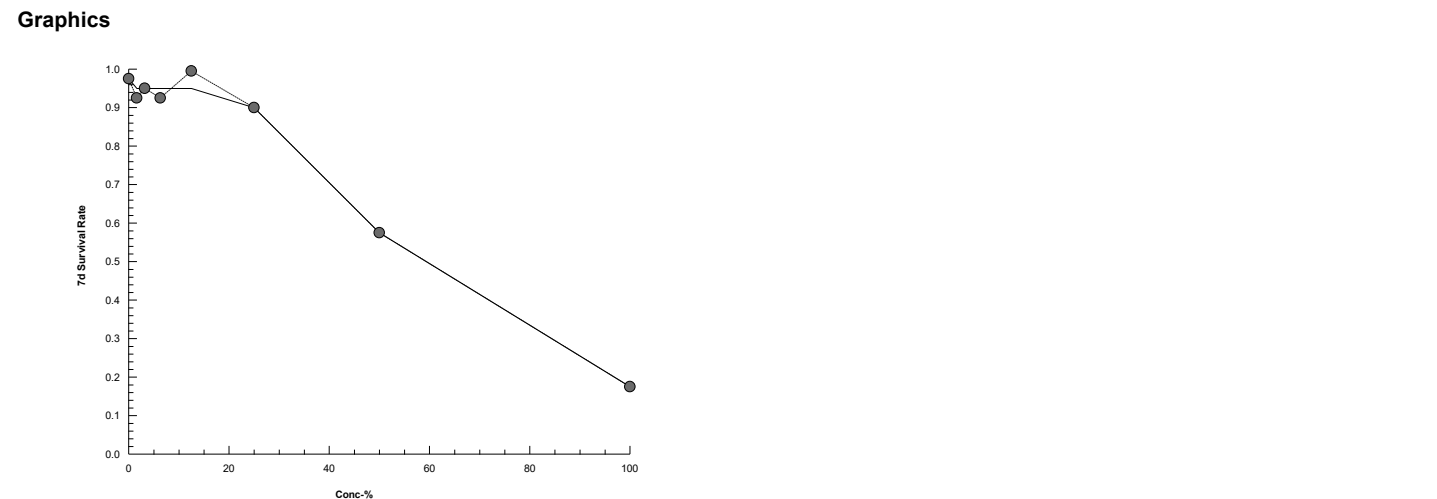


# CETIS Analytical Report

Report Date: 03 Nov-21 09:12 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 12-4043-7013

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary
Analysis ID: 03-5045-9103	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4		
Analyzed: 03 Nov-21 9:12	Analysis: Linear Interpolation (ICPIN)	Status Level: 1		

7d Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	9/10	10/10	10/10	10/10
1.6		8/10	10/10	9/10	10/10
3.2		8/10	10/10	10/10	10/10
6.3		9/10	9/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10
25		10/10	7/10	9/10	10/10
50		5/10	5/10	7/10	6/10
100		2/10	1/10	3/10	1/10





# CETIS Analytical Report

Report Date: 03 Nov-21 09:14 (p 1 of 2)  
Test Code/ID: Treated OSPW We / 12-4043-7013

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	12-9330-1130	Endpoint:	Mean Dry Biomass-mg	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:13	Analysis:	Nonlinear Regression (NLR)	Status Level:	1
Batch ID:	17-3182-5581	Test Type:	Growth-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	09 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	16 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	<24
Sample ID:	07-7268-3404	Code:	Week 1, Reactor 3	Project:	
Sample Date:	07 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	09 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu=\alpha/[1+(x/\delta)^{\gamma}]$	Normal [ $w=1$ ]	Off [ $\mu^*=\mu$ ]	None	None

## Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
10	92.85	-178.8	-175.3	0.8909	Yes	2.359	2.621	0.0709	Non-Significant Lack of Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	20.47	n/a	26.87	4.884	3.721	n/a
IC10	25.28	n/a	31.82	3.955	3.142	n/a
IC15	28.81	17.8	35.46	3.471	2.82	5.619
IC20	31.79	22.8	38.42	3.146	2.603	4.385
IC25	34.48	26.69	41.02	2.9	2.438	3.747
IC40	41.94	36.02	48.09	2.385	2.079	2.776
IC50	47.02	41.4	53.42	2.127	1.872	2.416

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.4918	0.01295	0.4653	0.5183	37.99	<1.0E-37	Significant Parameter
$\gamma$	3.541	0.8309	1.842	5.241	4.262	2.0E-04	Significant Parameter
$\delta$	47.02	3.05	40.79	53.26	15.42	<1.0E-37	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	5.804	1.935	3	599.8	<1.0E-37	Significant
Lack of Fit	0.03082	0.006165	5	2.359	0.0709	Non-Significant
Pure Error	0.06272	0.002614	24			
Residual	0.09355	0.003226	29			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Extreme Value	Grubbs Extreme Value Test	2.998	2.938	0.0382	Outlier Detected
Variances	Bartlett Equality of Variance Test	9.103	14.07	0.2454	Equal Variances
	Mod Levene Equality of Variance	1.283	2.423	0.3004	Equal Variances
	Shapiro-Wilk W Normality Test	0.9655	0.9338	0.3843	Normal Distribution
Distribution	Anderson-Darling A2 Normality Te	0.3866	2.492	0.3941	Normal Distribution



# CETIS Analytical Report

Report Date: 03 Nov-21 09:14 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 12-4043-7013

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

Nautilus Environmental Calgary

Analysis ID: 12-9330-1130  
Analyzed: 03 Nov-21 9:13

Endpoint: Mean Dry Biomass-mg  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Mean Dry Biomass-mg Summary

### Calculated Variate

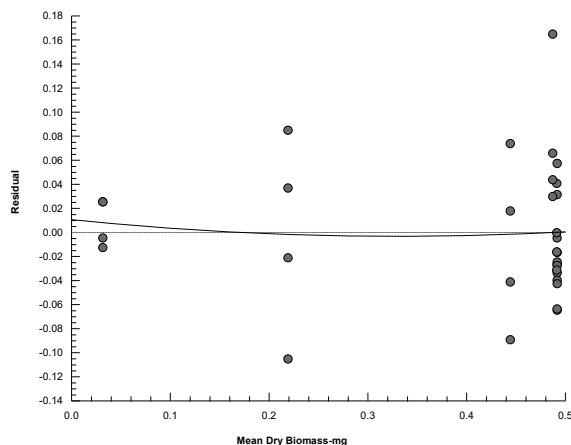
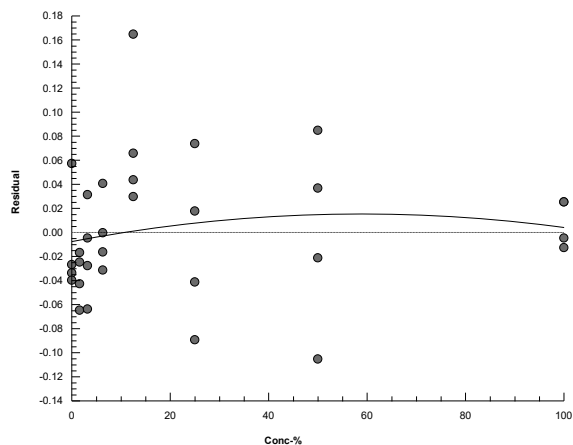
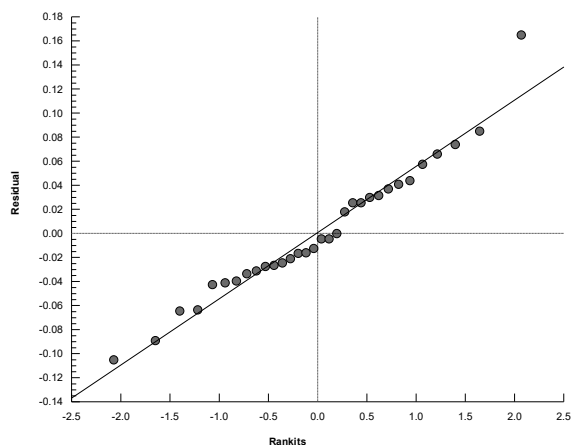
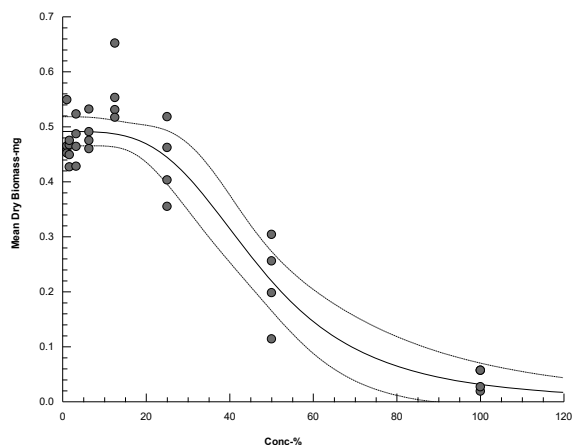
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	4	0.481	0.452	0.549	0.02282	0.04564	9.49%	0.0%
1.6		4	0.4545	0.427	0.475	0.01066	0.02132	4.69%	5.51%
3.2		4	0.4755	0.428	0.523	0.01995	0.0399	8.39%	1.14%
6.3		4	0.4895	0.46	0.532	0.01552	0.03103	6.34%	-1.77%
12.5		4	0.5633	0.517	0.652	0.0305	0.06099	10.83%	-17.1%
25		4	0.4345	0.355	0.518	0.0354	0.07081	16.30%	9.67%
50		4	0.218	0.114	0.304	0.04088	0.08176	37.51%	54.68%
100		4	0.04	0.019	0.057	0.00995	0.0199	49.75%	91.68%

### Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.458	0.465	0.452	0.549
1.6		0.467	0.427	0.475	0.449
3.2		0.428	0.464	0.487	0.523
6.3		0.46	0.532	0.491	0.475
12.5		0.531	0.517	0.553	0.652
25		0.518	0.462	0.355	0.403
50		0.114	0.304	0.256	0.198
100		0.057	0.019	0.057	0.027

### Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [ $\omega=1$ ]





Pans labeled on Sep. 20

# Fathead Minnow Extra Concentrations Bench Sheet

Method FMD Client HAT/SYN (PJ2021-005) Reference 2122-0052-01 (week 2)

## Test Log

Date	Day	Time	Technicians	Chem. Cart Used	Fed	Daily Data Review	Subsample Used	Sample Information
2021/09/15	0	1445	MAE, SPH, HIL	2	-	EV	Day 0	Initial pH: <u>9.0</u> Initial EC (µS/cm): <u>2490</u> Initial DO (mg/L): <u>5.1</u> Filtered with 60 µm nitex screen <u>Yes</u> Sample pre-aerated/hardness/pH adjust: <u>Yes</u> *if yes, describe procedure, rate and duration
2021/09/16	1	1055	MAE	2	✓	AW	Day 1	
2021/09/17	2	1400	MAE	2	✓	AW	Day 2	
2021/09/18	3	1700	MAE	2	✓	MAE	Day 3	
2021/09/19	4	1500	MAE	2	✓	MAE	Day 4	
2021/09/20	5	1340	MAE	2	✓	AW	Day 5	
2021/09/21	6	1340	JCC	2	-	KL	Day 6	
2021/09/22	7	1200	MAE	2	-	AW		

## Test Organisms

Fish Feeding Normally: Yes/No  
Inflated Swim Bladders: Yes/No

Organism Source: Aquarox  
Batch Number: 20210915 PM  
Breeding Stock Mortality: 10/0

## Organisms upon receipt:

Mortality: 21/0  
Temperature (°C): 26 \*temp. must be between 22 °C - 28 °C  
Dissolved Oxygen (mg/L): 10.9

## Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)

conc. (%)	Lab Ctl	Site Ctl	16	32	63	125	25	50	100
replicate									
a	10	10	10	10	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10
a	10	10	10	10	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10
a	10	10	10	10	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10
a	10	10	10	10	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10

Lab Ctl	Site Ctl	16	32	63	125	25	50	100
a	10	9	10	10	10	10	9	8
b	10	10	9	10	10	10	10	9
c	10	10	10	10	10	10	10	9
d	10	10	10	10	10	10	9	7
a	10	9	10	10	10	10	9	8
b	10	10	9	10	10	10	10	9
c	10	10	10	10	10	10	10	9
d	10	10	10	10	10	10	9	5
a	10	9	10	10	10	10	9	8
b	10	10	9	10	10	10	10	9
c	10	10	10	10	10	10	10	9
d	10	10	10	10	10	10	9	5

## Comments:

\* microbial clouds.

## Atypical Swimming Behaviour:

Unless otherwise noted, behavior is considered to be normal  
Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour

## Scoring Convention: # alive (# atypically swimming)

e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel  
No bracketed # indicates no atypical swimming within test vessel

Reviewed By: SS

Date Reviewed: 2021/11/02





Reference 2122-0052-01 (week 2)

## Old Solutions

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
---------	----------	-----	-----	-----	------	----	----	-----

pH (units) (range: 6.5-8.5)

8	2	8	1	8	1	8	2	8	2
8	3	8	4	8	7	8	9		
8	2	8	1	8	0	8	1	8	1
8	7	8	1	8	1	8	1	8	7
8	3	8	0	7	9	8	0	8	0
8	7	8	3	8	3	8	5	8	8
8	4	8	7	8	7	8	3	8	3
8	4	8	3	8	0	8	0	8	3
8	4	8	3	8	0	8	3	8	3
9	1	9	0	9	0	9	0	9	1
8	0	7	7	8	7	9	8	0	8

Conductivity ( $\mu\text{S}/\text{cm}$ )

Conductivity ( $\mu\text{S}/\text{cm}$ )											
412	305	348	412	535	678	1025	1639	3200			
437	320	365	455	557	703	1060	1757	3160			
412	328	355	398	456	665	993	1585	3610			
404	300	344	388	480	616	853	1191	3170			
46	330	361	401	509	685	1066	1834	3330			
401	311	361	393	496	662	1030	1763	3160			
432	304	343	382	472	620	1034	1778	3140			

Dissolved Oxygen (mg/L) (40-100% saturation)

Dissolved Oxygen (mg/L) (40-100% saturation)										
7.5	7.1	7.0	7.0	7.0	6.9	6.8	6.8	6.8		
7.7	7.2	7.0	7.0	6.9	6.8	6.7	6.7	6.7		
7.1	6.9	6.7	6.7	6.1	6.2	6.2	6.2	6.1		
7.1	6.9	6.8	6.6	6.6	6.7	6.6	6.6	6.5		
7.4	7.4	7.7	7.1	7.0	7.0	6.9	6.9	6.9		
6.8	6.7	6.7	6.7	6.7	6.6	6.5	6.5	6.4		
6.1	6.0	5.8	5.8	6.0	5.7	5.6	5.5	5.5		

Temperature 24 - 26 (°C)

24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24
24	—	—	—	—	—	—	—	3
24	—	—	—	—	—	—	—	3
24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24

2.8 to 7.1 mg/L at 26°C

\*corrected for altitude

Reviewed By:

Date Reviewed: 2021/1/02



# Organism Weights Bench Sheet

Client HAT/SYN Sample 2122-0052-01 Organism FM Batch 20210915PM

Item Weighed Date Initials Balance\*

dried pan	202109122	mmf	Mettler #1
dried pan + organisms	202109122	AW	Mettler 1

Initial Weight (mg):  
Final Weight (mg):

\* same balance must be used for initial and final weights  
\* for FM/HA/CT, must use scale with 0.01 mg accuracy

Concentration

Replicate	Initial	Final
a	399.71	403.11
b	401.93	408.01
c	401.28	404.21
d	397.05	401.30
e		

Initial	Final
405.21	409.45
402.67	407.18
405.12	409.75
396.70	400.56

Initial	Final
396.44	401.25
405.53	409.87
409.71	415.60
399.98	403.98

Initial	Final
398.71	402.86
405.94	410.52
400.29	404.55
399.07	404.06

Initial	Final
405.64	410.41
405.25	408.92
396.55	401.06
397.08	402.28

Initial	Final
404.79	409.19
395.07	399.79
395.38	399.76
404.08	407.95

Concentration

Initial	Final
397.01	403.36
396.76	402.61
397.66	402.84
403.45	408.34
e	

Initial	Final
393.90	397.66
401.34	406.03
397.35	402.01
403.04	405.43

Initial	Final
394.68	395.15
398.92	399.05
399.44	400.07
398.48	399.08

Initial	Final

Initial	Final

Initial	Final

Balance Calibration Check:

first pan weighed: Initial 188.71A Final 188.71A  
weight of first pan: 399.71  
first pan after all other pans weighed: 399.73

% difference <5%: Yes/No

% difference =  $\frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: SS Date Reviewed: 20211110Z



## CETIS Analytical Report

Report Date: 03 Nov-21 09:40 (p 1 of 2)

Test Code/ID: Treated OSPW We / 13-1595-2288

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	08-6533-9286	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:40	Analysis:	Trimmed Spearman-Kärber	Status Level:	1
Batch ID:	09-2203-6870	Test Type:	Growth-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	15 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	22 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
Sample ID:	13-3663-0190	Code:	Week 2, Reactor 3	Project:	
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.025	20.20%	1.837	0.04794	68.74	55.13	85.73

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.321	2.938	0.0076	Outlier Detected

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.99	0.0%
1.6		4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.99	0.0%
3.2		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.99	0.0%
6.3		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.99	0.0%
12.5		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.99	0.0%
25		4	0.9500	0.9000	1.0000	0.0577	6.08%	2.56%	38/40	0.95	4.04%
50		4	0.7500	0.5000	0.9000	0.1732	23.09%	23.08%	30/40	0.75	24.24%
100		4	0.2000	0.1000	0.3000	0.0817	40.82%	79.49%	8/40	0.2	79.8%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.9000	1.0000	1.0000	1.0000
1.6		1.0000	0.9000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000
25		0.9000	1.0000	1.0000	0.9000
50		0.8000	0.8000	0.9000	0.5000
100		0.2000	0.2000	0.3000	0.1000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	9/10	10/10	10/10	10/10
1.6		10/10	9/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
6.3		10/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	10/10
25		9/10	10/10	10/10	9/10
50		8/10	8/10	9/10	5/10
100		2/10	2/10	3/10	1/10



# CETIS Analytical Report

Report Date: 03 Nov-21 09:40 (p 2 of 2)

Test Code/ID: Treated OSPW We / 13-1595-2288

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

Nautilus Environmental Calgary

Analysis ID: 08-6533-9286

Endpoint: 7d Survival Rate

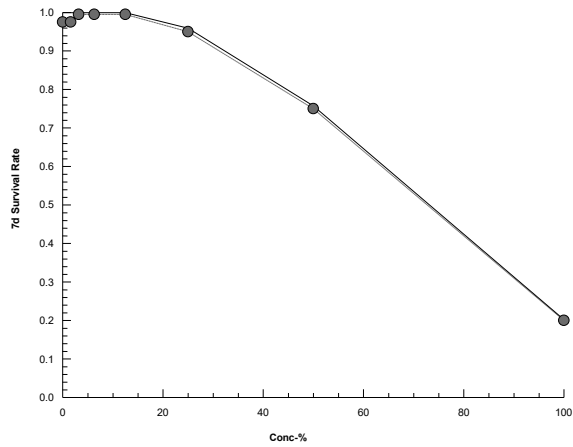
CETIS Version: CETISv1.9.4

Analyzed: 03 Nov-21 9:40

Analysis: Trimmed Spearman-Kärber

Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 06 Sep-22 11:53 (p 1 of 2)  
 Test Code/ID: 2122-0052 / 17-0875-5156

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	04-9217-2290	Endpoint:	7d Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	06 Sep-22 11:52	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	06 Sep-22 11:51	MD5 Hash:	3BD4002275830CACB5414D06B37A856F	Editor ID:	003-581-756-9
Batch ID:	03-7363-3149	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	15 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	22 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
Sample ID:	06-2463-7869	Code:	Week 2	Project:	PJ2021-006
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1980654	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	30.72	22.42	47.77	3.256	2.093	4.46
LC15	36.47	26.51	60.29	2.742	1.659	3.772
LC20	43.27	28.9	60.73	2.311	1.647	3.461
LC25	50.48	29.74	61.15	1.981	1.635	3.362
LC40	60.91	41.29	70.31	1.642	1.422	2.422
LC50	69.01	52.53	78.02	1.449	1.282	1.904

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	4	0.9750	1.0000	0.9000	1.0000	5.13%	0.00%	39/40	0.9900	0.00%
1.6		4	0.9750	1.0000	0.9000	1.0000	5.13%	0.00%	39/40	0.9900	0.00%
3.2		4	1.0000	1.0000	1.0000	1.0000	0.00%	-2.56%	40/40	0.9900	0.00%
6.3		4	1.0000	1.0000	1.0000	1.0000	0.00%	-2.56%	40/40	0.9900	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	0.00%	-2.56%	40/40	0.9900	0.00%
25		4	0.9500	0.9500	0.9000	1.0000	6.08%	2.56%	38/40	0.9500	4.04%
50		4	0.7500	0.8000	0.5000	0.9000	23.09%	23.08%	30/40	0.7500	24.24%
100		4	0.2000	0.2000	0.1000	0.3000	40.82%	79.49%	8/40	0.2000	79.80%

## 7d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	0.9000	1.0000	1.0000	1.0000
1.6		1.0000	0.9000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
6.3		1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
25		0.9000	1.0000	1.0000	0.9000
50		0.8000	0.8000	0.9000	0.5000
100		0.2000	0.2000	0.3000	0.1000



# CETIS Analytical Report

Report Date: 06 Sep-22 11:53 (p 2 of 2)  
Test Code/ID: 2122-0052 / 17-0875-5156

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

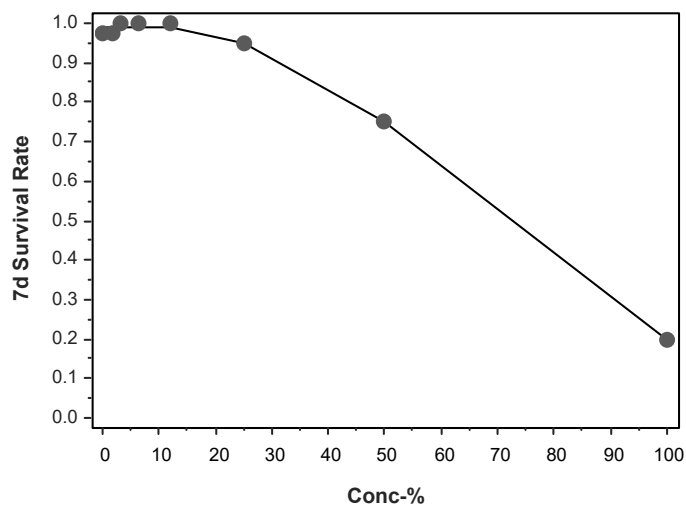
Nautilus Environmental Calgary

Analysis ID: 04-9217-2290      Endpoint: 7d Survival Rate      CETIS Version: CETISv2.1.0  
Analyzed: 06 Sep-22 11:52      Analysis: Linear Interpolation (ICPIN)      Status Level: 1  
Edit Date: 06 Sep-22 11:51      MD5 Hash: 3BD4002275830CACB5414D06B37A856F      Editor ID: 003-581-756-9

### 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	9/10	10/10	10/10	10/10
1.6		10/10	9/10	10/10	10/10
3.2		10/10	10/10	10/10	10/10
6.3		10/10	10/10	10/10	10/10
12		10/10	10/10	10/10	10/10
25		9/10	10/10	10/10	9/10
50		8/10	8/10	9/10	5/10
100		2/10	2/10	3/10	1/10

### Graphics





# CETIS Analytical Report

Report Date: 03 Nov-21 09:41 (p 1 of 2)  
Test Code/ID: Treated OSPW We / 13-1595-2288

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	11-2576-8767	Endpoint:	Mean Dry Biomass-mg	CETIS Version:	CETISv1.9.4
Analyzed:	03 Nov-21 9:41	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	09-2203-6870	Test Type:	Growth-Survival (7d)	Analyst:	Sara Thiessen
Start Date:	15 Sep-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	22 Sep-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	<24
Sample ID:	13-3663-0190	Code:	Week 2, Reactor 3	Project:	
Sample Date:	13 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	15 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	48h	Client:	Syncrude Canada Ltd		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1616823	200	Yes	Two-Point Interpolation

Residual Analysis					
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.938	2.938	0.0501	No Outliers Detected

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	26.33	n/a	64.82	3.798	1.543	n/a
IC5	32.38	23.38	63.74	3.088	1.569	4.277
IC10	41.86	22.11	61.35	2.389	1.63	4.524
IC15	50.69	20.87	59.47	1.973	1.682	4.792
IC20	53.04	23.86	61.67	1.885	1.622	4.191
IC25	55.5	27.37	63.95	1.802	1.564	3.653
IC40	63.56	42.91	71.2	1.573	1.405	2.33
IC50	69.56	51.41	76.45	1.438	1.308	1.945

Mean Dry Biomass-mg Summary			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	4	0.431	0.386	0.463	0.03415	7.92%	0.0%	0.471	0.0%
1.6		4	0.476	0.4	0.589	0.08233	17.30%	-10.44%	0.471	0.0%
3.2		4	0.4495	0.415	0.499	0.0377	8.39%	-4.29%	0.471	0.0%
6.3		4	0.4788	0.451	0.52	0.02951	6.16%	-11.08%	0.471	0.0%
12.5		4	0.434	0.386	0.472	0.03559	8.20%	-0.7%	0.471	0.0%
25		4	0.5567	0.489	0.635	0.06586	11.83%	-29.18%	0.471	0.0%
50		4	0.4075	0.239	0.549	0.1327	32.56%	5.45%	0.4075	13.48%
100		4	0.0455	0.012	0.063	0.02339	51.40%	89.44%	0.0455	90.34%

Mean Dry Biomass-mg Detail					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.424	0.451	0.463	0.386
1.6		0.481	0.434	0.589	0.4
3.2		0.415	0.458	0.426	0.499
6.3		0.477	0.467	0.451	0.52
12.5		0.44	0.472	0.438	0.386
25		0.635	0.585	0.518	0.489
50		0.376	0.549	0.466	0.239
100		0.047	0.012	0.063	0.06



# CETIS Analytical Report

Report Date: 03 Nov-21 09:41 (p 2 of 2)  
Test Code/ID: Treated OSPW We / 13-1595-2288

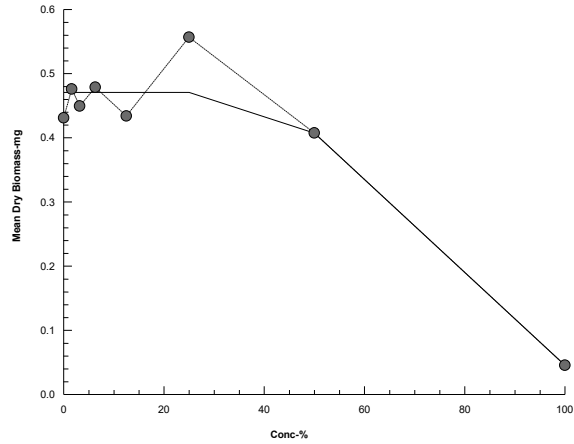
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 11-2576-8767      Endpoint: Mean Dry Biomass-mg  
Analyzed: 03 Nov-21 9:41      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# Fathead Minnow Test Summary Sheet

(7-d *Pimephales promelas* Survival and Growth Test)

Client: Hatfield  
Work Order No.: 211937

Start Date/Time: September 23, 2021 / 14:30  
Test Species: *Pimephales promelas*

## Sample Information:

Sample ID: Treated OSPW  
Sample Date: September 19, 2021  
Date Received: September 23, 2021  
Sample Volume: 2x20L, 5x20L  
\* River water for dilutions

## Dilution Water (initial water quality):

Type: River water (site control)  
Temperature (°C): 25.5  
pH: 8.0  
Dissolved Oxygen (mg/L): 7.7  
Hardness (mg/L CaCO<sub>3</sub>): 146  
Alkalinity (mg/L CaCO<sub>3</sub>): 124

## Test Validity Criteria:

The test is invalid if:

- 1) for the control solutions, the combined and cumulative incidence of any mortalities, or fish showing loss of equilibrium or other signs of atypical swimming behavior, is >20%
- 2) the average dry weight of the surviving control fish does not attain 250 ug when the fish are dried and weighed.

## WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4; pH = 6.5 to 8.5

## Test Organism Information:

(organisms acclimated to moderately hard water)

Batch No.: 092321  
Source: Aquatic Biosystems  
Age: 2 wks  
Receipt temperature: 21.0  
Acclimation rate: ±3°C / day

Mortality prior to test initiation: 0.15  
Swim bladder inflated at test initiation? (Y/N): Y  
Breeding stock mortality during the week prior to test initiation (%): 22%  
Breeding stock mortality on weekly basis: <1%  
Incidence of disease: None

## NaCl Reference Toxicant Results:

Reference Toxicant ID: PP195  
Stock Solution ID: N/A  
Date Initiated: September 23, 2021  
7-d EC50 (95% CL): 4.1 (3.3 - 4.9) g/L NaCl  
7-d IC50 (95% CL): 3.5 (2.2 - 4.6) g/L NaCl  
8 mos

## Survival:

Reference Toxicant Mean and Historical Range: 5.0 (3.3 - 6.5) CV (%): 14  
(g/L NaCl)

## Biomass:

Reference Toxicant Mean and Historical Range: 4.3 (3.3 - 5.6) CV (%): 14  
(g/L NaCl)

## Test Results:

	Survival	Biomass
LC25 % (v/v) (95% CL)	—	
LC50 % (v/v) (95% CL)	<u>83.9 (72.5 - 97.1)</u>	
IC25 % (v/v) (95% CL)		<u>55.1 (46.7 - 65.3)</u>
IC50 % (v/v) (95% CL)		<u>72.4 (60.0 - 102.4) #v</u>
		100

Reviewed by: JGU

Date reviewed: Dec. 17/21



# **7-d Chronic Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client: Synerude Hatfield Consultants  
 Sample ID: ~ OSPW Treated OSPW  
 Work Order #: 211937

Start Date & Time: Sep 23/21 6 14:30  
 Stop Date & Time: Sep 30/21 6 14:30  
 CER #: 11  
 Test Species: Pimephales promelas

% (v/v) Concentration Lab Control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	26.0	24.0	26.0	25.0	25.0	24.0	25.0	24.0	26.0	24.0	26.0	24.0	24.0	24.0
DO (mg/L)	7.8	6.8	7.8	6.4	7.9	5.7	7.7	5.5	7.8	6.1	7.5	6.4	7.5	6.0
pH	7.8	7.6	8.0	7.4	8.0	7.4	8.2	7.5	8.0	7.5	8.1	7.5	8.7	7.5
Cond. (µS/cm)	327	326		327		327		331		332		333		342
Initials	PM	JW		JW		SA		PM		PM		PM		PM

Concentration Site Control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.5	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.0	24.0	24.5	24.0	25.0	24.0
DO (mg/L)	7.7	7.0	8.0	6.6	8.0	5.6	7.7	6.0	8.1	6.2	8.2	5.9	7.8	6.1
pH	8.0	7.9	8.0	7.8	8.0	7.7	8.1	7.4	7.9	7.5	7.9	7.6	8.1	7.6
Cond. (µS/cm)	312	308		315		320		303		310		315		321
Initials	PM	JW		JW		SA		PM		PM		PM		PM

Concentration 1.56	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.0	24.0	24.5	24.0	25.0	24.0
DO (mg/L)	8.0	7.0	8.0	6.5	8.0	5.5	7.8	5.8	8.0	6.2	8.1	6.0	7.8	6.0
pH	8.2	8.0	8.1	7.8	8.1	7.8	8.3	7.6	8.1	7.7	8.2	7.7	8.2	7.7
Cond. (µS/cm)	359	359		357		361		355		355		360		363
Initials	PM	JW		JW		SA		PM		PM		PM		PM

Concentration 12.5	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.0	24.0	24.5	24.0	24.5	24.0
DO (mg/L)	7.9	7.0	8.0	6.6	8.2	5.2	7.8	5.6	8.0	6.1	8.0	6.0	7.9	6.3
pH	8.5	8.3	8.4	8.0	8.4	7.9	8.4	7.8	8.3	8.0	8.4	7.9	8.4	7.9
Cond. (µS/cm)	668	680		700		683		613		670		671		682
Initials	PM	JW		JW		SA		PM		PM		PM		PM

Thermometer: CER11 DO meter/probe: DO4/4 pH meter/probe: 4/4 Conductivity meter/probe: 4/4

	Control	Site Control	Treated OSPW
Hardness*	98	146	90
Alkalinity*	74	124	402

Analysts: PM, JW, DA

Reviewed by: JG

Date reviewed: Nov-10/21

\* mg/L as CaCO3

Sample Description: Yellow-green, slightly turbid odourless liquid with some particulates

Comments:



# **7-d Chronic Freshwater Toxicity Test** **Initial and Final Water Quality Measurements**

Client: Synchrone Habitat Consulting  
 Sample ID: M-05PW Treated OSPW  
 Work Order #: 211937

Start Date & Time: Sep 23/21 @ 1430  
 Stop Date & Time: Sep 30/21 @ 1430  
 CER #: 11  
 Test Species: Pimephales promelas

Concentration 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.0	24.0	24.05	24.0	24.5	24.0
DO (mg/L)	8.3	7.0	8.0	6.6	8.0	5.7	7.7	5.6	8.1	6.1	7.4	6.2	8.0	6.1
pH	9.2	9.0	9.1	8.7	9.0	8.8	9.0	8.7	9.0	8.8	8.9	8.8	8.9	8.6
Cond. (µS/cm)	3080	3120		3100		3120		3010		3100		3120		3120
Initials	PM	JW		JW		DK		PM		PM		PM		

Concentration Site Control + 20µg/L	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	26.0	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.05	24.0	24.5	24.0	24.5	24.0
DO (mg/L)	8.0	7.1	7.9	6.7	8.0	5.6	7.8	6.0	8.0	5.9	8.0	6.1	7.6	6.1
pH	8.1	8.2	8.3	8.0	8.0	7.8	8.1	7.6	7.9	7.7	8.0	7.7	8.1	7.8
Cond. (µS/cm)	315	311		333		336		316		311		323		330
Initials	PM	JW		JW		DK		PM		PM		PM		PM

Concentration 50 100 + 20µg/L Cu	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.5	24.0	24.5	24.0	24.5	24.0
DO (mg/L)	8.0	7.0	7.9	6.6	8.0	5.8	7.8	5.8	8.1	6.1	8.0	6.1	7.7	6.1
pH	9.0	8.8	8.9	8.4	8.7	8.5	8.9	8.2	8.7	8.4	8.8	8.4	8.8	8.2
Cond. (µS/cm)	1746	1767		1716		1737		1732		1738		1708		1732
Initials	PM	JW		JW		DK		PM		PM		PM		PM

Concentration 100 + 20µg/L Cu	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.5	24.0	24.5	25.0	25.0	24.0	24.5	24.0	24.5	24.0	24.5	24.0	25.0	24.0
DO (mg/L)	8.2	7.1	7.9	6.6	8.0	6.1	7.8	5.6	8.0	6.2	7.6	6.1	7.8	6.4
pH	9.2	9.0	9.1	8.8	9.0	9.0	9.0	8.7	9.0	8.8	9.0	8.7	8.9	8.7
Cond. (µS/cm)	3060	3110		3070		3110		3060		3080		3080		3110
Initials	PM	JW		JW		DK		PM		PM		PM		PM

Thermometer: CERN DO meter/probe: 4 / 4 pH meter/probe: 4 / 4 Conductivity meter/probe: 4 / 4

	Control	Site Control	Treated OSPW
Hardness*	98	146	90
Alkalinity*	74	124	402

Analysts: PM, JW, DK

Reviewed by: JG

Date reviewed: Nov-10/21

\* mg/L as CaCO3

Sample Description: Yellow green, slightly turbid odourless liquid w/ some particulates

Comments:



# 7-d Fathead Minnow Toxicity Test Daily Survival

Client: Hatfield Consultants  
Sample ID: Treated OSPW  
Work Order #: 211937

Start Date & Time: Sep 23/21 @ 14:30  
Stop Date & Time: Sep 30/21 @ 14:30  
Test Species: Pimephales promelas

Concentration % (v/v)	Rep	Day of Test - Percent Survival							Comments
		1	2	3	4	5	6	7	
Lab Control	A	100	100	100	100	100	100	100	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	90	90	90	90	
Site Control	A	↓	↓	↓	100	100	90	80	
	B	↓	↓	↓	80	80	80	↓	
	C	↓	↓	90	70	70	70	70	
1.56	A	↓	80 <sup>④</sup>	80	80	70 <sup>④</sup> 70	70	↓	
	B	↓	90	↓	↓	80	80	80	
	C	90	↓	90	↓	↓	↓	↓	
3.12	A	100	100	↓	90	90	90	90	
	B	90	80	80	80	70	70	70	
	C	100	90	90	↓	80	80	80	
6.25	A	90	↓	↓	90	90	90	90	
	B	↓	↓	↓	80	80	80	80	
	C	100	100	80	60	30 <sup>④</sup>	30	30	
12.5	A	↓	↓	100	90	80	80	80	
	B	↓	↓	↓	70	60	60	60	
	C	↓	↓	↓	↓	70	70	70	
25	A	↓	↓	100	90	90	90	80	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	80	70	70	70	70	70	
50	A	↓	100	100	100	100	100	80	
	B	90	90	90	90	90	90	90	
	C	100	100	100	100	↓	↓	↓	
Tech Initials		JW	JW	PK	PK	PK	PK	PK	

Legend: 1- Fish dying  
2- Fish showing loss of equilibrium  
3- Fish showing atypical swimming

Test solution depth: ~6.5cm Remaining fish appear normal at test termination  
Comments: ④ Fungal growth on dead fish

Reviewed by: JG

Date reviewed: Nov-10/21



# 7-d Fathead Minnow Toxicity Test Daily Survival

Client: Hatfield Consultants <sup>PMH</sup>  
 Sample ID: Treated OSPW  
 Work Order #: 211937

Start Date & Time: Sep 23/21 @ 14:30  
 Stop Date & Time: Sep 30/21 @ 1430  
 Test Species: Pimephales promelas

SY Purple

Concentration % (v/v)	Rep	Day of Test - Percent Survival							Comments
		1	2	3	4	5	6	7	
100	A	100	100	100	90	70	40	40	
	B	↓	↓	90	60	30	30	20	
	C	90	90	↓	50	40	20	↓	
Site control +	A	100	100	100	100	100	100	100	
20µg/L Cu	B	↓	↓	↓	↓	↓	↓	↓	
	C			90	90	90	90	90	
50% + 20µg/L	A			100	100	100	100	100	
Cu	B			↓	↓	90	90	90	
	C			↓	↓	100	100	PMH 100	
100% + 20	A				90	30	20	20	
20µg/L Cu	B	↓	↓	↓	80	50	40	↓	
	C	90	90	90	↓	↓	30	10	
	A								
	B								
	C								
	A								
	B								
	C								
	A								
	B								
	C								
	A								
	B								
	C								
Tech Initials		JW	JW	PMH	PMH	PMH	PMH	PMH	

Legend:  
 1- Fish dying  
 2- Fish showing loss of equilibrium  
 3- Fish showing atypical swimming

Test solution depth: ~6.5cm; Remaining fish appear normal at test termination  
 Comments: \_\_\_\_\_

Reviewed by: How

Date reviewed: Nov - 15/21



# Fathead Minnow Toxicity Test Data Sheet

## Dry Weight Data

Client: Synchrone Hatfield

Sample ID: OSPW

Work Order No.: 211937

Start Date & Time: Sep 23/21 @ 1430

Termination Date & Time: Sep 30/21 @ 1430

Balance ID: Bal -1

(5x purple)

Concentration	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	1	10	pm	1011.78	1017.56	10	TH / RB
	B	2	10		1013.03	1019.04	10	RB
	C	3	9		1002.98	1008.24	9	RB
1.56	A	4	7		1004.92	1009.79	7	RB
	B	5	8		1001.09	1005.92	8	↓
	C	6	9		1002.02	1006.66	8	↓
3.12	A	7	7		1000.25	1005.23	9	RB
	B	8	7		1002.39	1006.70	7	↓
	C	9	8		1002.94	1007.01	8	↓
6.25	A	10	7		1001.40	1006.20	9	RB
	B	11	7		1008.14	1012.19	8	↓
	C	12	8		1004.82	1006.76	3	↓
12.5	A	13	8		1001.58	1005.85	8	RB
	B	14	8		1010.97	1014.25	6	↓
	C	15	7		995.26	999.23	7	↓
25	A	16	8		997.90	1002.40	8	RB
	B	17	8		1008.02	1012.30	8	↓
	C	18	7		1002.26	1006.59	7	↓
50	A	19	8		998.15	1003.67	8	RB
	B	20	9		1000.80	1006.79	9	↓
	C	21	9		1008.36	1013.44	9	↓
100	A	22	4		1005.38	1007.56	4	RB
	B	23	2		1006.66	1007.25	2	↓
	C	24	2		1019.72	1020.10	2	↓

Date/time pan placed in oven:

Sept 21/21 @ 1400

Date/time pan + organisms placed in oven:

Sep 30/21 @ 1630

Date/time pan removed from oven:

Sept 22/21 @ 1500

Date/time pan + organisms removed from oven:

Oct 12/21 @ 1530

Comments:

10% Re-weigh: Pan # 4: 1009.84 mg Pan # 12: 1006.84 Pan # 26: 1019.01  
Pan # 32: 1010.05

Reviewed by:

JGh

Date Reviewed:

Nov-15/21



# Fathead Minnow Toxicity Test Data Sheet

## Dry Weight Data

Client: SynGene OSPW  
 Sample ID: OSPW  
 Work Order No.: 211937

Start Date & Time: Sep 23/21 @ 1430  
 Termination Date & Time: Sep 30/21 @ 1430  
 Balance ID: Bal - 1

(5 purple)

Concentration	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
<del>Pin</del> control 50 + 20 µg/L Cu	A	25	10	PM	998.70	1004.72	10	TH/PB
	B	26	9		1013.95	1019.08	9	PB
	C	27	10		1008.98	1015.60	10	PB
100 + 20 µg/L Cu	A	28	2		1009.03	1010.06	2	PB
	B	29	2		1001.20 <sup>31</sup>	1003.17	2	↓
	C	30	1		1003.58	1003.82	1	↓
Site control	A	31	8		1004.04	1009.45	8	PB
	B	32	8		1004.98	1010.17	8	↓
	C	33	7		1013.36	1018.27	7	↓
Site control + 20 µg/L Cu	A	34	10		1013.04	1019.09	10	PB
	B	35	10		1007.69	1013.98	10	↓
	C	36	9		998.98	1005.62	9	↓
	A							
	B							
	C							
	A							
	B							
	C							
	A							
	B							
	C							
	A							
	B							
	C							

Date/time pan placed in oven: Sep 21/21 @ 1400

Date/time pan + organisms placed in oven: Sep 30/21 @ 1630

Date/time pan removed from oven: Sep 22/21 @ 1500

Date/time pan + organisms removed from oven: Oct 12/21 @ 1530

Comments:

Reviewed by: JGh

Date Reviewed: Nov. 15/21



# CETIS Summary Report

Report Date: 17 Dec-21 14:38 (p 1 of 4)  
Test Code/ID: 211937 / 10-0002-4710

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

Nautilus Environmental

Batch ID: 20-3761-7877	Test Type: Growth-Survival (7d)	Analyst: Pierre Koelich
Start Date: 23 Sep-21 14:30	Protocol: EC/EPS 1/RM/22	Diluent: Mod-Hard Synthetic Water
Ending Date: 30 Sep-21 14:30	Species: Pimephales promelas	Brine:
Test Length: 7d 0h	Taxon: Actinopterygii	Source: Aquatic Biosystems, CO Age: <24
Sample ID: 10-1296-2811	Code: 3C6095FB	Project:
Sample Date: 19 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 2h (15.8 °C)	Client: Hatfield	

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
07-5172-6422	7d Survival Rate	Trimmed Spearman-Kärber	EC50	83.92	72.54	97.09	1.192	1
07-5763-0185	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	0.8645	0.09613	5.737	115.7	1
			IC10	2.08	0.3281	104.4	48.08	
			IC15	4.445	n/a	107.6	22.5	
			IC20	52.15	n/a	61.41	1.918	
			IC25	55.08	46.66	65.26	1.815	
			IC40	64.9	54.36	82.72	1.541	
06-4241-3456	Mean Dry Weight-mg	NLR: 3P Log-Gompertz	IC50	72.39	60.05	103.1	1.381	
			IC5	95.45	n/a	98.4	1.048	1
			IC10	96.8	n/a	99.42	1.033	
			IC15	97.63	n/a	100	1.024	
			IC20	98.24	n/a	100.4	1.018	
			IC25	98.72	n/a	100.6	1.013	
			IC40	99.84	98.31	100.9	1.002	
			IC50	100.4	99.89	100.9	0.9956	

LC = Lab Control  
N = Site Control  
XC = Site Control + 20 mg/L Cu  
S = 50% + 20 mg/L Cu  
SS = 100% + 20 mg/L Cu



# CETIS Summary Report

Report Date:

17 Dec-21 14:38 (p 2 of 4)

Test Code/ID:

211937 / 10-0002-4710

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

Nautilus Environmental

### 7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
0	N	3	0.7667	0.6232	0.9101	0.7000	0.8000	0.0333	0.0577	7.53%	20.69%
0	XC	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
1.56		3	0.7667	0.6232	0.9101	0.7000	0.8000	0.0333	0.0577	7.53%	20.69%
3.12		3	0.8000	0.5516	1.0000	0.7000	0.9000	0.0577	0.1000	12.50%	17.24%
6.25		3	0.6667	0.0000	1.0000	0.3000	0.9000	0.1856	0.3215	48.22%	31.03%
12.5		3	0.7000	0.4516	0.9484	0.6000	0.8000	0.0577	0.1000	14.29%	27.59%
25		3	0.7667	0.6232	0.9101	0.7000	0.8000	0.0333	0.0577	7.53%	20.69%
50		3	0.8667	0.7232	1.0000	0.8000	0.9000	0.0333	0.0577	6.66%	10.34%
51	Σ	3	0.9667	0.8232	1.0000	0.9000	1.0000	0.0333	0.0577	5.97%	0.00%
100		3	0.2667	0.0000	0.5535	0.2000	0.4000	0.0667	0.1155	43.30%	72.41%
101	ΣΣ	3	0.1667	0.0232	0.3101	0.1000	0.2000	0.0333	0.0577	34.64%	82.76%

### Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	0.5683	0.4729	0.6638	0.526	0.601	0.02218	0.03842	6.76%	0.00%
0	N	3	0.517	0.4548	0.5793	0.491	0.541	0.01447	0.02506	4.85%	9.03%
0	XC	3	0.6327	0.559	0.7064	0.605	0.664	0.01713	0.02967	4.69%	-11.32%
1.56		3	0.478	0.4475	0.5085	0.464	0.487	0.007096	0.01229	2.57%	15.89%
3.12		3	0.4453	0.3282	0.5625	0.407	0.498	0.02723	0.04716	10.59%	21.64%
6.25		3	0.3597	-0.008708	0.728	0.194	0.48	0.08562	0.1483	41.23%	36.72%
12.5		3	0.384	0.2579	0.5101	0.328	0.427	0.02931	0.05076	13.22%	32.43%
25		3	0.437	0.4083	0.4657	0.428	0.45	0.006659	0.01153	2.64%	23.11%
50		3	0.553	0.44	0.666	0.508	0.599	0.02627	0.04551	8.23%	2.70%
51		3	0.5923	0.4061	0.7786	0.513	0.662	0.04328	0.07497	12.66%	-4.22%
100		3	0.105	-0.1395	0.3495	0.038	0.218	0.05682	0.09842	93.73%	81.52%
101		3	0.1043	-0.0969	0.3056	0.024	0.186	0.04677	0.08101	77.64%	81.64%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	0.5878	0.5583	0.6173	0.578	0.601	0.006849	0.01186	2.02%	0.00%
0	N	3	0.6755	0.61	0.7409	0.6488	0.7014	0.01521	0.02635	3.90%	-14.91%
0	XC	3	0.6573	0.4815	0.833	0.605	0.7378	0.04085	0.07076	10.77%	-11.81%
1.56		3	0.6265	0.4747	0.7783	0.58	0.6957	0.03529	0.06112	9.76%	-6.58%
3.12		3	0.5593	0.4258	0.6927	0.5088	0.6157	0.03102	0.05373	9.61%	4.86%
6.25		3	0.5621	0.377	0.7471	0.5062	0.6467	0.04301	0.07449	13.25%	4.38%
12.5		3	0.5492	0.5074	0.591	0.5337	0.5671	0.009722	0.01684	3.07%	6.57%
25		3	0.572	0.4662	0.6778	0.535	0.6186	0.02459	0.04259	7.45%	2.69%
50		3	0.64	0.4747	0.8053	0.5644	0.69	0.03843	0.06656	10.40%	-8.88%
51	Σ	3	0.6113	0.4953	0.7274	0.57	0.662	0.02696	0.0467	7.64%	-4.00%
100		3	0.3433	-0.1097	0.7964	0.19	0.545	0.1053	0.1824	53.12%	41.59%
101	ΣΣ	3	0.5617	-0.3012	1.425	0.24	0.93	0.2005	0.3474	61.85%	4.45%



## CETIS Summary Report

 Report Date: 17 Dec-21 14:38 (p 3 of 4)  
 Test Code/ID: 211937 / 10-0002-4710

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

Nautilus Environmental

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	1.0000	1.0000	0.9000
0	N	0.8000	0.8000	0.7000
0	XC	1.0000	1.0000	0.9000
1.56		0.7000	0.8000	0.8000
3.12		0.9000	0.7000	0.8000
6.25		0.9000	0.8000	0.3000
12.5		0.8000	0.6000	0.7000
25		0.8000	0.8000	0.7000
50		0.8000	0.9000	0.9000
51		1.0000	0.9000	1.0000
100		0.4000	0.2000	0.2000
101		0.2000	0.2000	0.1000

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	0.578	0.601	0.526
0	N	0.541	0.519	0.491
0	XC	0.605	0.629	0.664
1.56		0.487	0.483	0.464
3.12		0.498	0.431	0.407
6.25		0.48	0.405	0.194
12.5		0.427	0.328	0.397
25		0.45	0.428	0.433
50		0.552	0.599	0.508
51		0.602	0.513	0.662
100		0.218	0.059	0.038
101		0.103	0.186	0.024

## Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	0.578	0.601	0.5844
0	N	0.6763	0.6488	0.7014
0	XC	0.605	0.629	0.7378
1.56		0.6957	0.6037	0.58
3.12		0.5533	0.6157	0.5088
6.25		0.5333	0.5062	0.6467
12.5		0.5337	0.5467	0.5671
25		0.5625	0.535	0.6186
50		0.69	0.6656	0.5644
51		0.602	0.57	0.662
100		0.545	0.295	0.19
101		0.515	0.93	0.24



# CETIS Summary Report

Report Date: 17 Dec-21 14:38 (p 4 of 4)  
Test Code/ID: 211937 / 10-0002-4710

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

Nautilus Environmental

### 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	10/10	10/10	9/10
0	N	8/10	8/10	7/10
0	XC	10/10	10/10	9/10
1.56		7/10	8/10	8/10
3.12		9/10	7/10	8/10
6.25		9/10	8/10	3/10
12.5		8/10	6/10	7/10
25		8/10	8/10	7/10
50		8/10	9/10	9/10
51		10/10	9/10	10/10
100		4/10	2/10	2/10
101		2/10	2/10	1/10



## CETIS Analytical Report

 Report Date: 14 Dec-21 15:34 (p 1 of 2)  
 Test Code/ID: 211937 / 10-0002-4710

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

Nautilus Environmental

Analysis ID: 07-5172-6422	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 25 Oct-21 14:19	Analysis: Trimmed Spearman-Kärber	Status Level: 1
Batch ID: 20-3761-7877	Test Type: Growth-Survival (7d)	Analyst: Pierre Koelich
Start Date: 23 Sep-21 14:30	Protocol: EC/EPS 1/RM/22	Diluent: Mod-Hard Synthetic Water
Ending Date: 30 Sep-21 14:30	Species: Pimephales promelas	Brine:
Test Length: 7d 0h	Taxon: Actinopterygii	Source: Aquatic Biosystems, CO Age: <24
Sample ID: 10-1296-2811	Code: 3C6095FB	Project:
Sample Date: 19 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 2h (15.8 °C)	Client: Hatfield	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	0.2333	34.29%	1.924	0.03164	83.92	72.54	97.09

## 7d Survival Rate Summary

## Calculated Variate(A/B)

## Isotonic Variate

Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	N	3	0.7667	0.7000	0.8000	0.0577	7.53%	0.0%	23/30	0.7778	0.0%
1.56		3	0.7667	0.7000	0.8000	0.0577	7.53%	0.0%	23/30	0.7778	0.0%
3.12		3	0.8000	0.7000	0.9000	0.1000	12.50%	-4.35%	24/30	0.7778	0.0%
6.25		3	0.6667	0.3000	0.9000	0.3215	48.22%	13.04%	20/30	0.75	3.57%
12.5		3	0.7000	0.6000	0.8000	0.1000	14.29%	8.7%	21/30	0.75	3.57%
25		3	0.7667	0.7000	0.8000	0.0577	7.53%	0.0%	23/30	0.75	3.57%
50		3	0.8667	0.8000	0.9000	0.0577	6.66%	-13.04%	26/30	0.75	3.57%
100		3	0.2667	0.2000	0.4000	0.1155	43.30%	65.22%	8/30	0.2667	65.71%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	0.8000	0.8000	0.7000
1.56		0.7000	0.8000	0.8000
3.12		0.9000	0.7000	0.8000
6.25		0.9000	0.8000	0.3000
12.5		0.8000	0.6000	0.7000
25		0.8000	0.8000	0.7000
50		0.8000	0.9000	0.9000
100		0.4000	0.2000	0.2000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	8/10	8/10	7/10
1.56		7/10	8/10	8/10
3.12		9/10	7/10	8/10
6.25		9/10	8/10	3/10
12.5		8/10	6/10	7/10
25		8/10	8/10	7/10
50		8/10	9/10	9/10
100		4/10	2/10	2/10

Site Control (N) failure  
JGU

JGU  
Dec-17/21



# CETIS Analytical Report

Report Date: 14 Dec-21 15:34 (p 2 of 2)  
Test Code/ID: 211937 / 10-0002-4710

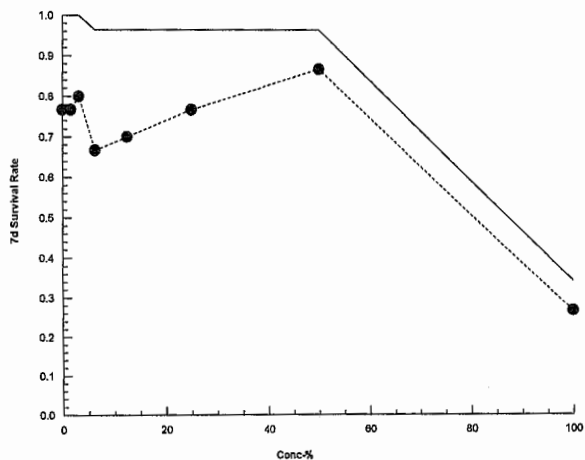
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

Analysis ID: 07-5172-6422      Endpoint: 7d Survival Rate  
Analyzed: 25 Oct-21 14:19      Analysis: Trimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## CETIS Analytical Report

 Report Date: 14 Dec-21 15:34 (p 1 of 2)  
 Test Code/ID: 211937 / 10-0002-4710

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

Nautilus Environmental

Analysis ID: 07-5763-0185	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.9.4
Analyzed: 25 Oct-21 14:20	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 20-3761-7877	Test Type: Growth-Survival (7d)	Analyst: Pierre Koelich
Start Date: 23 Sep-21 14:30	Protocol: EC/EPS 1/RM/22	Diluent: Mod-Hard Synthetic Water
Ending Date: 30 Sep-21 14:30	Species: Pimephales promelas	Brine:
Test Length: 7d 0h	Taxon: Actinopterygii	Source: Aquatic Biosystems, CO Age: <24
Sample ID: 10-1296-2811	Code: 3C6095FB	Project:
Sample Date: 19 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 2h (15.8 °C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	211607	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.8645	0.09613	5.737	115.7	17.43	1040
IC10	2.08	0.3281	104.4	48.08	0.9574	304.8
IC15	4.445	n/a	107.6	22.5	0.9296	n/a
IC20	52.15	n/a	61.41	1.918	1.628	n/a
IC25	55.08	46.66	65.26	1.815	1.532	2.143
IC40	64.9	54.36	82.72	1.541	1.209	1.839
IC50	72.39	60.05	103.1	1.381	0.9703	1.665

## Mean Dry Biomass-mg Summary

## Calculated Variate

## Isotonic Variate

Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	N	3	0.517	0.491	0.541	0.02506	4.85%	0.0%	0.517	0.0%
1.56		3	0.478	0.464	0.487	0.01229	2.57%	7.55%	0.478	7.55%
3.12		3	0.4453	0.407	0.498	0.04716	10.59%	13.86%	0.4453	13.86%
6.25		3	0.3597	0.194	0.48	0.1483	41.23%	30.43%	0.4334	16.17%
12.5		3	0.384	0.328	0.427	0.05076	13.22%	25.73%	0.4334	16.17%
25		3	0.437	0.428	0.45	0.01153	2.64%	15.47%	0.4334	16.17%
50		3	0.553	0.508	0.599	0.04551	8.23%	-6.96%	0.4334	16.17%
100		3	0.105	0.038	0.218	0.09842	93.73%	79.69%	0.105	79.69%

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	N	0.541	0.519	0.491
1.56		0.487	0.483	0.464
3.12		0.498	0.431	0.407
6.25		0.48	0.405	0.194
12.5		0.427	0.328	0.397
25		0.45	0.428	0.433
50		0.552	0.599	0.508
100		0.218	0.059	0.038



# CETIS Analytical Report

Report Date: 14 Dec-21 15:34 (p 2 of 2)  
Test Code/ID: 211937 / 10-0002-4710

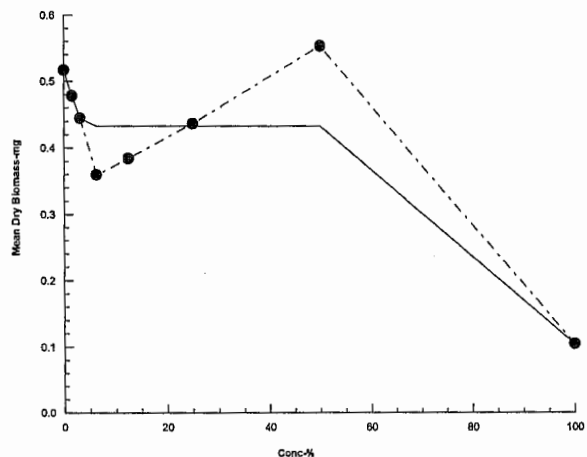
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

Analysis ID: 07-5763-0185      Endpoint: Mean Dry Biomass-mg  
Analyzed: 25 Oct-21 14:20      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





Pans labelled  
2021/10/05 km

## Fathead Minnow Extra Concentrations Bench Sheet

Method	FMD	Client	Hat/Syn PJ2021-006	Reference	2122-0052-01 Week 4
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### Test Log

Date	Day	Time	Technicians	Chem. Cart Used	Fed		Daily Data Review	Subsample Used		Initial pH:	Initial EC (µS/cm):	Initial DO (mg/L):	Sample Information
					AM	PM							
21/10/01	0	1400	MAF/JP/JCL	MAF	-	✓	AW	Day 0	✓				9.1 2950 9.3
21/10/01	1	1500	AW	MAF	✓	✓		Day 1	✓				Yes/No
21/10/01	2	1500	EV	MAF	✓	✓	MF	Day 2	✓				Sample pre-aerated/hardness/pH adjust:
21/10/01	3	1600	EV/SS	MAF	✓	✓	MF	Day 3	✓				Yes/No
21/10/01	4	1700	AW	MAF	✓	✓		Day 4	✓				*if yes, describe procedure, rate and duration
21/10/01	5	1800	AW	MAF	✓	✓	AW	Day 5	✓				
21/10/01	6	1930	AW	MAF	✓	✓	MF	Day 6	✓				
21/10/01	7	1100	MAF	MAF	-	-	KL						

**Test Organisms**

Fish Feeding Normally: ☒ Yes/No

Inflated Swim Bladders: ☒ Yes/No

**Organisms upon receipt:**

Mortality: ☒ Yes/No

Temperature (°C): 25

Dissolved Oxygen (mg/L): 9.8

Organism Source: Aquatox

Batch Number: 20211001FM

Breeding Stock Mortality: CS1

\*temp. must be between 22 °C- 28 °C

**Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)**

conc. (%)		Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100	
replicate		Day 1									
a		5	10	10	10	10	10	10	10	10	
b		5	10	10	10	10	10	10	10	10	
c		5	10	10	10	10	10	10	10	10	
d		5	10	10	10	10	10	10	10	10	
		Day 2									
a		9	10	10	10	10	10	10	10	10	
b		10	9	10	10	10	10	10	10	10	
c		10	10	10	10	10	10	10	10	10	
d		10	10	10	10	10	10	9	10	10	
		Day 3									
a		9	8	10	10	10	10	10	10		
b		9	9	10	10	10	10	10	9		
c		10	10	9	9	10	10	10	9		
d		8	9	10	9	10	10	10	9(1)		
		Day 4									
a		9	8	10	10	10	10	10	9(1)		
b		9	8	8	10	10	10	10	9		
c		10	9	8	10	10	10	10	9(2)		
d		8	9	10	9	10	10	10	8	9(1)	

### Atypical Swimming Behaviour:

Unless otherwise noted, behavior is considered to be normal. Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour.

**Scoring Convention:** # alive (# atypically swimming)

e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel  
No bracketed # indicates no atypical swimming within test vessel

Reviewed By: LD

Date Reviewed: 10/21/04



# Fathead Minnow Extra Concentrations Bench Sheet

Method FMD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Chemistry

### New Solutions

conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
day									
0	7.8	7.8	7.9	7.9	8.0	8.0	8.4	8.6	8.8
1	8.1	8.1	8.2	8.2	8.3	8.5	8.7	8.8	9.0
2	8.1	8.1	8.2	8.2	8.3	8.5	8.7	8.8	9.0
3	8.2	8.2	8.3	8.4	8.4	8.6	8.7	8.9	9.1
4	7.9	8.0	8.1	8.1	8.3	8.4	8.6	8.8	9.0
5	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.8	9.0
6									
7									
8									

pH (units) (range: 6.5-8.5)

Conductivity (µS/cm)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
0	367	382	355	416	507	676	1020	1649	2940
1	409	519	602	673	836	1144	1521	2391	5810
2	845	811	880	940	1054	1149	1105	1415	3040
3	311	311	387	445	503	788	1179	1910	3150
4	311	311	389	450	556	773	1190	1882	3210
5	335	321	378	442	531	752	1100	1790	3120
6	409	371	407	462	581	755	1097	1705	3100
7	432	385	421	487	591	779	1085	1704	3050
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

Temperature 24 - 26 (°C)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
0	7.3	7.3	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	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8									

### Old Solutions

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100

pH (units) (range: 6.5-8.5)

Conductivity (µS/cm)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
0	375	383	478	409	616	784	1144	1848	3830
1	451	357	408	465	568	772	1140	1889	3170
2	373	337	399	464	580	812	1192	1930	3300
3	361	345	400	451	567	778	1154	1970	3200
4	385	383	485	546	640	741	1108	1763	3140
5	451	387	409	491	581	815	1140	1773	3010
6	499	344	517	471	611	817	1163	1763	3140
7									
8									

Dissolved Oxygen (mg/L) (40-100% saturation)

Temperature 24 - 26 (°C)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
0	6.3	6.1	6.2	6.3	6.3	6.2	6.6	6.0	5.8
1	6.5	6.7	6.9	6.6	6.7	6.7	6.7	6.6	6.6
2	6.9	6.8	6.8	6.7	6.6	6.6	6.6	6.5	6.4
3	6.9	6.7	6.7	6.6	6.5	6.6	6.6	6.4	6.4
4	6.7	6.8	6.3	6.3	6.2	6.1	6.2	6.2	6.1
5	6.8	6.7	6.6	6.6	6.4	6.4	6.3	6.8	6.5
6	6.9	6.8	6.5	6.4	6.2	6.3	6.3	6.4	6.2
7									
8									

DO Levels (40-100% saturation)\* - 2.9 to 7.3 mg/L at 24°C 2.9 to 7.2 mg/L at 25°C 2.8 to 7.1 mg/L at 26°C  
 \*corrected for altitude

Reviewed By: W

Date Reviewed: 2021/11/01

\*Day 5 old pH: 7.7, 7.6, 7.5, 7.5, 7.5  
 EC: 408, 335, 387, 439, 540



# Organism Weights Bench Sheet

 Client HAT Sample CO52-01 Organism FMD Batch 20211001FM

	Item Weighed	Date	Initials	Balance*
Initial Weight (mg):	dried pan	10/20/21	DM	Mettler 1
Final Weight (mg):	dried pan + organisms	10/21/21	DM	Mettler 1

\* same balance must be used for initial and final weights  
 \* for FM/HA/CT, must use scale with 0.01 mg accuracy

## Concentration

Replicate	LAB CTL		SITE CTL		1.6		3.2		6.3		12.5	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	402.68	405.67	404.16	406.04	397.38	400.90	405.34	408.73	404.78	408.93	402.01	406.58
b	405.28	408.54	402.71	405.81	399.59	403.50	410.86	414.29	402.60	406.87	405.80	410.70
c	396.31	399.16	401.89	405.62	400.49	403.94	411.50	415.69	404.61	408.29	403.49	408.08
d	399.34	402.29	396.96	400.37	405.46	408.89	403.11	407.45	403.18	407.75	397.29	401.77
e												

## Concentration

Replicate	25		50		100							
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	402.69	405.57	396.54	401.05	398.83	400.30						
b	400.03	403.06	398.04	402.05	395.69	396.43						
c	406.51	410.70	394.67	398.55	398.51	399.64						
d	403.06	408.24	410.15	413.44	401.20	402.79						
e												

## Balance Calibration Check:

	Initial	Final
first pan weighed:	LAB CTL A	LAB CTL A
weight of first pan:	402.65	405.67
first pan after all		
other pans weighed:	402.64	405.66

% difference <5%: Yes/No Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: W Date Reviewed: 2021/11/04



## CETIS Analytical Report

Report Date: 10 Nov-21 14:54 (p 1 of 2)  
 Test Code/ID: 2122-0052 FM W4 / 06-6778-9415

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	15-6006-8842	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	10 Nov-21 14:53	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	16-1219-2585	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	06-7424-7467	Code:	Week 4, Reactor 3	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	254102	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.772	2.938	1.0000	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	29.77	24.54	63.41	3.359	1.577	4.075
LC5	50.82	23.95	56.08	1.968	1.783	4.176
LC10	55.14	40.81	60.66	1.813	1.649	2.45
LC15	59.82	50.78	65.69	1.672	1.522	1.969
LC20	64.89	55.71	71.71	1.541	1.395	1.795
LC25	70.39	60.48	78.42	1.421	1.275	1.653
LC40	89.77	76.75	105.3	1.114	0.9498	1.303
LC50	>100	n/a	n/a	<1	n/a	n/a

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.8250	0.7000	0.9000	0.0957	11.61%	0.0%	33/40	0.9375	0.0%
1.6		4	0.9000	0.8000	1.0000	0.1155	12.83%	-9.09%	36/40	0.9375	0.0%
3.2		4	0.9250	0.9000	1.0000	0.0500	5.41%	-12.12%	37/40	0.9375	0.0%
6.3		4	1.0000	1.0000	1.0000	0.0000	0.00%	-21.21%	40/40	0.9375	0.0%
12.5		4	1.0000	1.0000	1.0000	0.0000	0.00%	-21.21%	40/40	0.9375	0.0%
25		4	0.9750	0.9000	1.0000	0.0500	5.13%	-18.18%	39/40	0.9375	0.0%
50		4	0.9000	0.8000	1.0000	0.0817	9.07%	-9.09%	36/40	0.9	4.0%
100		4	0.5000	0.4000	0.6000	0.0817	16.33%	39.39%	20/40	0.5	46.67%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.7000	0.9000	0.9000
1.6		1.0000	0.8000	0.8000	1.0000
3.2		0.9000	1.0000	0.9000	0.9000
6.3		1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000
25		1.0000	0.9000	1.0000	1.0000
50		1.0000	0.9000	0.9000	0.8000
100		0.6000	0.5000	0.4000	0.5000

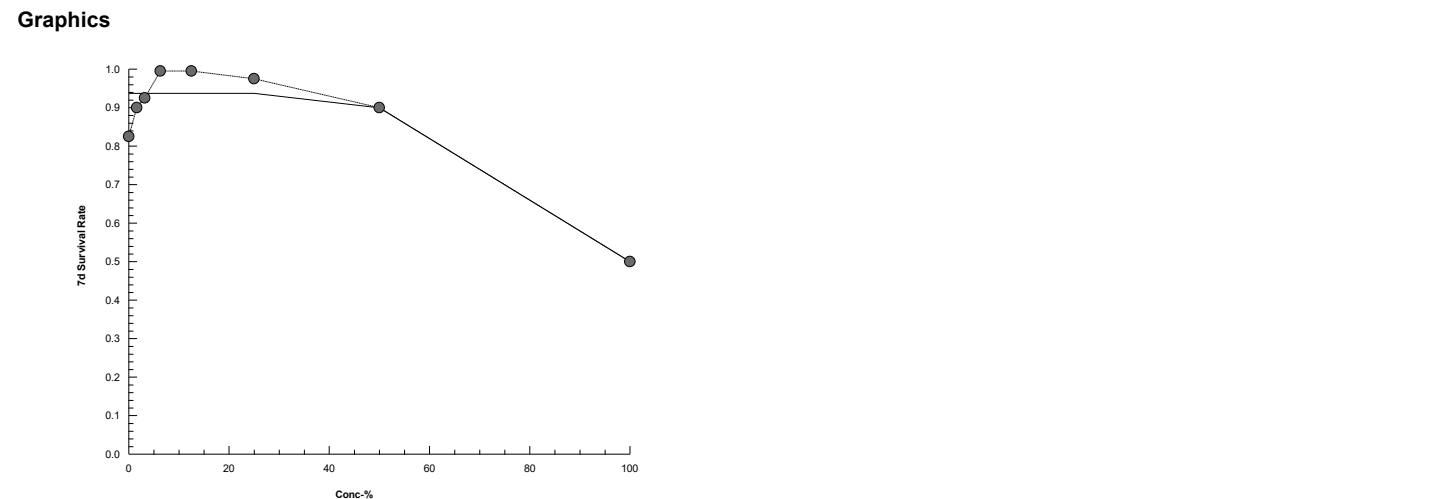


# CETIS Analytical Report

Report Date: 10 Nov-21 14:54 (p 2 of 2)  
Test Code/ID: 2122-0052 FM W4 / 06-6778-9415

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary
Analysis ID: 15-6006-8842	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4		
Analyzed: 10 Nov-21 14:53	Analysis: Linear Interpolation (ICPIN)	Status Level: 1		

7d Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	8/10	7/10	9/10	9/10
1.6		10/10	8/10	8/10	10/10
3.2		9/10	10/10	9/10	9/10
6.3		10/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	10/10
25		10/10	9/10	10/10	10/10
50		10/10	9/10	9/10	8/10
100		6/10	5/10	4/10	5/10





# CETIS Analytical Report

Report Date: 10 Nov-21 14:54 (p 1 of 2)  
Test Code/ID: 2122-0052 FM W4 / 06-6778-9415

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

Nautilus Environmental Calgary

<b>Analysis ID:</b> 12-5000-7448	<b>Endpoint:</b> Mean Dry Biomass-mg	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 10 Nov-21 14:54	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 16-1219-2585	<b>Test Type:</b> Growth-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 01 Oct-21	<b>Protocol:</b> EC/EPS 1/RM/22	<b>Diluent:</b> River Water
<b>Ending Date:</b> 08 Oct-21	<b>Species:</b> Pimephales promelas	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Actinopterygii	<b>Source:</b> Aquatox, AR <b>Age:</b>
<b>Sample ID:</b> 06-7424-7467	<b>Code:</b> Week 4, Reactor 3	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 96h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	314912	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.908	2.938	0.0571	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	50.38	n/a	50.6	1.985	1.976	n/a
IC5	52.36	n/a	52.82	1.91	1.893	n/a
IC10	54.94	3.4	55.73	1.82	1.794	29.41
IC15	57.65	48.33	58.79	1.735	1.701	2.069
IC20	60.49	51.13	62.02	1.653	1.612	1.956
IC25	63.47	54.09	65.42	1.576	1.529	1.849
IC40	73.29	64.32	76.86	1.364	1.301	1.555
IC50	80.66	71.64	85.64	1.24	1.168	1.396

## Mean Dry Biomass-mg Summary

			Calculated Variate							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect		Mean	%Effect
0	XC	4	0.318	0.248	0.373	0.05329	16.76%	0.0%		0.388	0.0%
1.6		4	0.3577	0.343	0.391	0.0225	6.29%	-12.5%		0.388	0.0%
3.2		4	0.3838	0.339	0.434	0.04977	12.97%	-20.68%		0.388	0.0%
6.3		4	0.4168	0.368	0.457	0.03699	8.88%	-31.05%		0.388	0.0%
12.5		4	0.4635	0.448	0.49	0.0183	3.95%	-45.75%		0.388	0.0%
25		4	0.382	0.288	0.518	0.1079	28.25%	-20.13%		0.3871	0.21%
50		4	0.3923	0.329	0.451	0.05016	12.79%	-23.35%		0.3871	0.21%
100		4	0.1068	0.074	0.147	0.03029	28.38%	66.43%		0.1068	72.48%

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.248	0.31	0.373	0.341
1.6		0.352	0.391	0.345	0.343
3.2		0.339	0.343	0.419	0.434
6.3		0.415	0.427	0.368	0.457
12.5		0.457	0.49	0.459	0.448
25		0.288	0.303	0.419	0.518
50		0.451	0.401	0.388	0.329
100		0.147	0.074	0.107	0.099



# CETIS Analytical Report

Report Date: 10 Nov-21 14:54 (p 2 of 2)  
Test Code/ID: 2122-0052 FM W4 / 06-6778-9415

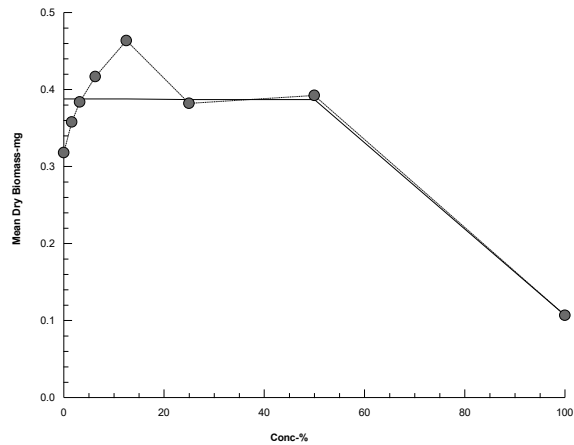
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 12-5000-7448      Endpoint: Mean Dry Biomass-mg  
Analyzed: 10 Nov-21 14:54      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





Pgns labelled  
 2021/10/05 KM  
**Fathead Minnow Extra  
 Concentrations Bench Sheet**

Method FMD Client Hat/Syn PJ2021-006 Reference 2122-0202 Week 4 (Reactor 2)

**Test Log**

Date	Day	Time	Technicians	Chem. Cart Used	Fed	Daily Data Review	Subsample Used
21/10/01	0	1430	MAF/JP/JCC	3	AM PM		Day 0
22/10/01	1	1450	MAF	3	✓	✓	Day 1
23/10/01	2	1515	EV	4	✓	✓	Day 2
24/10/01	3	1450	EV	4	✓	✓	Day 3
25/10/01	4	1100	AW	4	✓	✓	Day 4
26/10/01	5	0930	EV	4	✓	✓	Day 5
27/10/01	6	1100	AW	4	✓	✓	Day 6
28/10/01	7	1100	SC	4	✓	✓	Day 7

**Sample Information**

Initial pH:	8.3
Initial EC (µS/cm):	2990
Initial DO (mg/L):	7.9
Filtered with 60 µm nitex screen	
Sample pre-aerated/hardness/pH adjust:	Yes/No
*If yes, describe procedure, rate and duration	

**Test Organisms**

Fish Feeding normally: Yes/No  
 Inflated Swim Badders: Yes/No

Organism Source: Aquatox  
 Batch Number: 20211001FM  
 Breeding Stock Mortality: 281

**Organisms upon receipt:**

Mortality: 281  
 Temperature (°C): 25 \*temp. must be between 22 °C - 28 °C  
 Dissolved Oxygen (mg/L): 9.8

**Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)**

conc. (%) replicate	Lab Ctl	Site Ctl	1.1	2.2	6.3	12.5	25	50	100
Day 1									
a	10	10	10	10	10	10	10	10	
b	10	10	10	10	10	10	10	10	
c	10	10	10	10	10	10	10	10	
d	10	10	10	10	10	10	10	10	
Day 2									
a	10	10	10	10	10(1)	10	10	10	
b	9	10	10	10	10	10	10	10	
c	10	10	9	10	10	10	10	10	
d	9	10(1)	10	10	10	9	10	10	
Day 3									
a	9	10	10	10	10(1)	10	10	9	
b	9	8*	10	10	10	10	9	10	
c	10	10	9	10	9	10	10	10	
d	8	10(1)	10	10	10	8	10	10	
Day 4									
a	9	10	10	10	10(1)	10	10	9	
b	9	8	10	10	10	9	9	10	
c	10	10	9	10	9	10	10	10	
d	8	10(1)	10	10	10	8	10	10	
Day 5									
a	9	10	10	10	10(1)	10	10	9	
b	9	8	10	10	10	9	9	10	
c	10	10	9	10	9	10	10	10	
d	8	10(1)	10	10	10	8	10	10	
Day 6									
a	9	10	10	10	10(1)	10	10	9	
b	9	8	10	10	10	9	9	10	
c	10	10	9	10	9	10	10	10	
d	8	10(1)	10	10	10	8	10	10	
Day 7									
a	9	10	10	10	10(1)	10	10	9	
b	9	8	10	10	10	9	9	10	
c	10	10	9	10	9	10	10	10	
d	8	10(1)	10	10	10	8	10	10	

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
Day 5								
9	10	10	10	10	10	9	8(2)	
9	8	10	10	10	9	9	10	
10(1)	10	9	9	8*	10	10	10	
8(1)	7*	9	9(1)	10*	7	10	10	
Day 6								
9	8	10	10	9	10	8	7	
9	8	10	10	10	9	8	9	
10	9	10	9	8	10	9	8	
7	6*	9	8	9	6	9	9	
Day 7								
9	8	10	10	9	10	8	7	
9	8	10	10	10	9	8	9	
9	10	9	9	8	10	9	8	
7	6	9	8	9	6	9	9	

**Comments:**

\* 1 killed by tech exclude from 5 tests at microbial growth

**Scoring Convention: # alive (# atypically swimming)**

e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel  
 No bracketed # indicates no atypical swimming within test vessel

**Atypical Swimming Behaviour:**

Unless otherwise noted, behavior is considered to be normal  
 Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour

Reviewed By: 10

Date Reviewed: 2021/11/01



# Fathead Minnow Extra Concentrations Bench Sheet

 Method FMD Client                      Hat/Syn PJ2021-006 Reference 2122-0202 Week 4

## Chemistry

New Solutions									
conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100
day									
0	7.8	7.9	7.9	8.0	8.0	8.0	8.1	8.2	8.3
1	8.1	8.0	8.0	8.1	8.1	8.1	8.2	8.3	8.4
2	7.9	8.0	8.0	8.1	8.1	8.1	8.2	8.3	8.4
3	8.2	8.1	8.1	8.2	8.2	8.2	8.3	8.4	8.5
4	8.1	8.2	8.3	8.3	8.3	8.3	8.4	8.5	8.6
5	8.2	8.2	8.1	8.2	8.2	8.3	8.4	8.5	8.6
6	8.1	8.2	8.2	8.2	8.2	8.3	8.4	8.5	8.6
7									
8									
Conductivity (µS/cm)									
0	367	321	371	408	408	408	1009	1647	2940
1	409	329	446	476	476	476	1052	1648	3170
2	396	375	395	476	476	476	1052	1648	3170
3	368	370	376	476	476	476	1052	1648	3170
4	375	328	382	476	476	476	1052	1648	3170
5	394	418	420	476	476	476	1052	1648	3170
6	409	345	399	476	476	476	1052	1648	3170
7	409	345	399	476	476	476	1052	1648	3170
8									
Dissolved Oxygen (mg/L) (40-100% saturation)									
0	7.3	7.3	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	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
7									
8									
Temperature 24 - 26 (°C)									
0	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24
7									
8									

Old Solutions									
Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100	
pH (units) (range: 6.5-8.5)									
0	8.1	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
1	8.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
2	7.8	7.7	7.9	7.9	7.9	7.9	7.9	7.9	7.9
3	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
4	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
5	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
6	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
7									
8									
Conductivity (µS/cm)									
0	402	401	470	470	470	470	470	470	470
1	440	403	481	532	667	864	1190	1730	3280
2	423	351	400	443	549	754	1098	1702	3150
3	401	335	394	437	540	757	1103	1691	3100
4	408	332	392	436	529	710	1103	1691	3100
5	461	351	430	501	590	750	1102	1724	3100
6	494	351	494	601	690	794	1101	1712	3100
7									
8									
Dissolved Oxygen (mg/L) (40-100% saturation)									
0	6.4	6.4	6.3	6.2	6.2	6.1	6.0	6.8	6.5
1	6.1	6.8	6.6	6.5	6.4	6.3	6.4	6.1	5.9
2	6.9	6.9	6.6	6.4	6.4	6.4	6.4	6.4	6.3
3	6.8	6.7	6.7	6.5	6.4	6.4	6.3	6.3	6.2
4	6.9	6.8	6.8	6.8	6.4	6.3	6.3	6.3	6.3
5	6.9	6.8	6.7	6.6	6.5	6.5	6.5	6.5	6.5
6	6.9	6.9	6.7	6.7	6.7	6.7	6.7	6.7	6.7
7									
8									
Temperature 24 - 26 (°C)									
0	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24
7									
8									

DO Levels (40-100% saturation)\* - 2.9 to 7.3 mg/L at 24°C      2.9 to 7.2 mg/L at 25°C      2.8 to 7.1 mg/L at 26°C  
 \*corrected for altitude

 Reviewed By: W

 Date Reviewed: 2021/11/01



# Organism Weights Bench Sheet

 Client HAT Sample 07202 Organism FM Batch 20211001FM

	Item Weighed	Date	Initials	Balance*
Initial Weight (mg):	dried pan	2021/10/07	AC/DM	Mettler 1
Final Weight (mg):	dried pan + organisms	2021/10/14	DM	Mettler 1

\* same balance must be used for initial and final weights  
 \* for FM/HA/CT, must use scale with 0.01 mg accuracy

		Concentration									
		LAB CTL		SITE CTL		1.6		3.2		6.3	
Replicate		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a		398.31	401.65	401.57	404.69	402.17	405.30	398.19	401.42	399.08	402.37
b		401.96	405.23	393.12	396.30	400.97	404.22	398.54	401.58	397.54	400.53
c		401.33	404.41	399.17	401.90	404.95	407.72	409.30	411.66	399.64	402.12
d		397.94	400.55	403.87	406.20	404.97	408.12	398.70	400.90	393.29	396.08
e											

		Concentration									
		50		25		100					
Replicate		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a		395.87	398.31	392.48	394.83	401.20	402.81				
b		399.43	401.59	398.73	400.64	402.08	402.32				
c		398.15	400.11	403.37	406.32	401.48	402.58				
d		397.33	399.41	398.21	400.39	408.31	409.99				
e											

Balance Calibration Check:

	Initial	Final
first pan weighed:	LAB CTL A	LAB CTL A
weight of first pan:	398.31	401.65
first pan after all		
other pans weighed:	398.28	401.59

 Test Validity Met: Yes/No/NA

 Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

 % difference <5%: Yes/No Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

 Reviewed By: NO Date Reviewed: 2021/11/10



## CETIS Analytical Report

Report Date: 18 Nov-21 08:23 (p 1 of 2)

Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	01-8151-9377	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-21 8:23	Analysis:	Trimmed Spearman-Kärber	Status Level:	1
Batch ID:	07-1718-5747	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
Sample ID:	16-2401-0783	Code:	Week 4 Reactor 2	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL
Control Threshold	0.1795	47.61%	1.984	0.05024	96.37	76.47	121.5

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.349	2.938	0.4602	No Outliers Detected

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.8222	0.6000	1.0000	0.1692	20.58%	0.0%	32/39	0.8931	0.0%
1.6		4	0.9500	0.9000	1.0000	0.0577	6.08%	-15.54%	38/40	0.8931	0.0%
3.2		4	0.9000	0.7000	1.0000	0.1414	15.71%	-9.46%	36/40	0.8931	0.0%
6.3		4	0.9000	0.8000	1.0000	0.0817	9.07%	-9.46%	36/40	0.8931	0.0%
12.5		4	0.8750	0.6000	1.0000	0.1893	21.63%	-6.42%	35/40	0.875	2.02%
25		4	0.8500	0.8000	0.9000	0.0577	6.79%	-3.38%	34/40	0.85	4.82%
50		4	0.8250	0.7000	0.9000	0.0957	11.61%	-0.34%	33/40	0.825	7.62%
100		4	0.4250	0.3000	0.7000	0.1893	44.54%	48.31%	17/40	0.425	52.41%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.8889	1.0000	0.6000
1.6		1.0000	1.0000	0.9000	0.9000
3.2		1.0000	1.0000	0.9000	0.7000
6.3		0.9000	1.0000	0.8000	0.9000
12.5		1.0000	0.9000	1.0000	0.6000
25		0.8000	0.8000	0.9000	0.9000
50		0.7000	0.9000	0.8000	0.9000
100		0.4000	0.3000	0.3000	0.7000

## 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	8/10	8/9	10/10	6/10
1.6		10/10	10/10	9/10	9/10
3.2		10/10	10/10	9/10	7/10
6.3		9/10	10/10	8/10	9/10
12.5		10/10	9/10	10/10	6/10
25		8/10	8/10	9/10	9/10
50		7/10	9/10	8/10	9/10
100		4/10	3/10	3/10	7/10



# CETIS Analytical Report

Report Date: 18 Nov-21 08:23 (p 2 of 2)  
Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

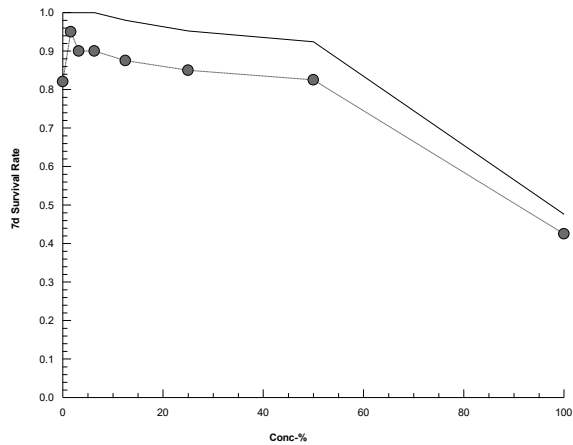
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 01-8151-9377      Endpoint: 7d Survival Rate  
Analyzed: 18 Nov-21 8:23      Analysis: Trimmed Spearman-Kärber

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# CETIS Analytical Report

Report Date: 18 Nov-21 08:24 (p 1 of 2)  
 Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	11-4576-9279	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	18 Nov-21 8:24	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	07-1718-5747	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	01 Oct-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	08 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
					Age:
Sample ID:	16-2401-0783	Code:	Week 4 Reactor 2	Project:	PJ2021-006
Sample Date:	27 Sep-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	29 Sep-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	793433	200	Yes	Two-Point Interpolation

Residual Analysis					
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.349	2.938	0.4602	No Outliers Detected

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	8.966	n/a	75.49	11.15	1.325	n/a
LC5	26.44	n/a	69.09	3.782	1.447	n/a
LC10	51.92	n/a	61.02	1.926	1.639	n/a
LC15	56.11	n/a	69.91	1.782	1.43	n/a
LC20	60.64	43.94	83.9	1.649	1.192	2.276
LC25	65.52	48.05	98.76	1.526	1.013	2.081
LC40	82.62	61.08	n/a	1.21	n/a	1.637
LC50	96.39	70.07	n/a	1.037	n/a	1.427

7d Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.8222	0.6000	1.0000	0.1692	20.58%	0.0%	32/39	0.8931	0.0%
1.6		4	0.9500	0.9000	1.0000	0.0577	6.08%	-15.54%	38/40	0.8931	0.0%
3.2		4	0.9000	0.7000	1.0000	0.1414	15.71%	-9.46%	36/40	0.8931	0.0%
6.3		4	0.9000	0.8000	1.0000	0.0817	9.07%	-9.46%	36/40	0.8931	0.0%
12.5		4	0.8750	0.6000	1.0000	0.1893	21.63%	-6.42%	35/40	0.875	2.02%
25		4	0.8500	0.8000	0.9000	0.0577	6.79%	-3.38%	34/40	0.85	4.82%
50		4	0.8250	0.7000	0.9000	0.0957	11.61%	-0.34%	33/40	0.825	7.62%
100		4	0.4250	0.3000	0.7000	0.1893	44.54%	48.31%	17/40	0.425	52.41%

7d Survival Rate Detail					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.8000	0.8889	1.0000	0.6000
1.6		1.0000	1.0000	0.9000	0.9000
3.2		1.0000	1.0000	0.9000	0.7000
6.3		0.9000	1.0000	0.8000	0.9000
12.5		1.0000	0.9000	1.0000	0.6000
25		0.8000	0.8000	0.9000	0.9000
50		0.7000	0.9000	0.8000	0.9000
100		0.4000	0.3000	0.3000	0.7000



# CETIS Analytical Report

Report Date: 18 Nov-21 08:24 (p 2 of 2)  
Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

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

Nautilus Environmental Calgary

Analysis ID: 11-4576-9279  
Analyzed: 18 Nov-21 8:24

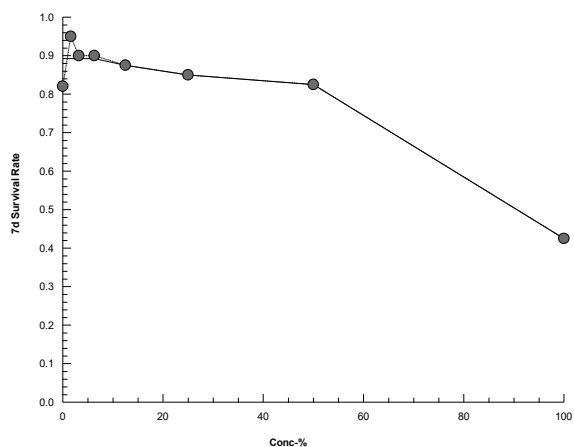
Endpoint: 7d Survival Rate  
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### 7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	8/10	8/9	10/10	6/10
1.6		10/10	10/10	9/10	9/10
3.2		10/10	10/10	9/10	7/10
6.3		9/10	10/10	8/10	9/10
12.5		10/10	9/10	10/10	6/10
25		8/10	8/10	9/10	9/10
50		7/10	9/10	8/10	9/10
100		4/10	3/10	3/10	7/10

### Graphics





# CETIS Analytical Report

Report Date: 18 Nov-21 08:24 (p 1 of 2)  
 Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

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

Nautilus Environmental Calgary

<b>Analysis ID:</b> 04-3374-8649	<b>Endpoint:</b> Mean Dry Biomass-mg	<b>CETIS Version:</b> CETISv1.9.4
<b>Analyzed:</b> 18 Nov-21 8:24	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Batch ID:</b> 07-1718-5747	<b>Test Type:</b> Growth-Survival (7d)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 01 Oct-21	<b>Protocol:</b> EC/EPS 1/RM/22	<b>Diluent:</b> River Water
<b>Ending Date:</b> 08 Oct-21	<b>Species:</b> Pimephales promelas	<b>Brine:</b>
<b>Test Length:</b> 7d 0h	<b>Taxon:</b> Actinopterygii	<b>Source:</b> Aquatox, AR <b>Age:</b>
<b>Sample ID:</b> 16-2401-0783	<b>Code:</b> Week 4 Reactor 2	<b>Project:</b> PJ2021-006
<b>Sample Date:</b> 27 Sep-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd.
<b>Receipt Date:</b> 29 Sep-21	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 96h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2104462	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.506	2.938	0.2722	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	1.81	n/a	20.4	55.25	4.902	n/a
IC5	2.834	0.1219	39.8	35.28	2.513	820.6
IC10	15.93	n/a	40.43	6.277	2.474	n/a
IC15	21.76	n/a	49.72	4.595	2.011	n/a
IC20	30.28	5.845	62.58	3.303	1.598	17.11
IC25	42.74	6.433	65.64	2.339	1.523	15.55
IC40	64.86	49.75	96.49	1.542	1.036	2.01
IC50	79.53	57.8	n/a	1.257	n/a	1.73

## Mean Dry Biomass-mg Summary

			Calculated Variate							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect		Mean	%Effect
0	XC	4	0.2901	0.233	0.3422	0.04743	16.35%	0.0%		0.2988	0.0%
1.6		4	0.3075	0.277	0.325	0.021	6.83%	-6.01%		0.2988	0.0%
3.2		4	0.2707	0.22	0.323	0.05039	18.61%	6.66%		0.2803	6.17%
6.3		4	0.2887	0.248	0.329	0.03406	11.80%	0.45%		0.2803	6.17%
12.5		4	0.2815	0.243	0.3	0.02624	9.32%	2.95%		0.2803	6.17%
25		4	0.2473	0.191	0.295	0.04481	18.12%	14.76%		0.2473	17.25%
50		4	0.2173	0.201	0.244	0.01886	8.68%	25.1%		0.2173	27.29%
100		4	0.1157	0.024	0.168	0.0664	57.37%	60.09%		0.1157	61.26%

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.312	0.3422	0.273	0.233
1.6		0.313	0.325	0.277	0.315
3.2		0.323	0.304	0.236	0.22
6.3		0.329	0.299	0.248	0.279
12.5		0.3	0.296	0.287	0.243
25		0.235	0.191	0.295	0.268
50		0.244	0.216	0.201	0.208
100		0.161	0.024	0.11	0.168



# CETIS Analytical Report

Report Date: 18 Nov-21 08:24 (p 2 of 2)  
Test Code/ID: 2122-0202 FM-W4 / 13-7090-9576

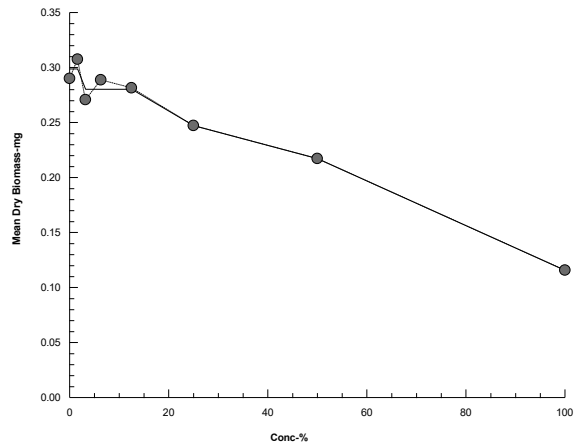
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 04-3374-8649      Endpoint: Mean Dry Biomass-mg  
Analyzed: 18 Nov-21 8:24      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





pans labeled 2021/10/11  
bpm

# Fathead Minnow Extra Concentrations Bench Sheet

Method FMD

Client

Hat/Syn PJ2021-006

Reference

2122-0052-01 Week 4

## Test Log

Date	Day	Time	Technicians	Chem. Cart Used	Fed AM	Fed PM	Daily Data Review	Subsample Used	Sample Information
2021/10/09	0	1515	JCC/TP/LO	LM 3	-	✓	KL	Day 0	Initial pH: <u>9.0</u> Initial EC (µS/cm): <u>3050</u> Initial DO (mg/L): <u>9.6</u> Filtered with 60 µm nitex screen
2021/10/10	1	1340	ST	4	✓	✓	KL	Day 1	Yes/No <u>10</u>
2021/10/10	2	1345	JCC	3	✓	✓	AW	Day 2	Sample pre-aerated/hardness/pH adjust: Yes/No <u>10</u>
2021/10/11	3	1410	JCC/NA	4	✓	✓	EV	Day 3	*if yes, describe procedure, rate and duration
2021/10/11	4	1420	EV	3	✓	✓	AW	Day 4	
2021/10/13	5	1630	ETM	3	✓	✓	AW	Day 5	
2021/10/14	6	1420	ETM	2	✓	✓	KL	Day 6	
2021/10/15	7	0914	KL	2	-	-	KL		

## Test Organisms

Fish Feeding Normally: Yes/No Yes

Inflated Swim Bladders: Yes/No Yes

Organism Source: Aquatox

Batch Number: 20211008PM

Breeding Stock Mortality: 217

## Organisms upon receipt:

Mortality: 217

Temperature (°C): 24.9

Dissolved Oxygen (mg/L): 10.6

\*temp. must be between 22 °C - 28 °C

## Biology (# of organisms alive and # of live organisms displaying atypical swimming behaviour per vessel)

conc. (%)	Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100	100-pH
replicate	JCC									
a	10	10	10	10	10	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	10	10
a	10	10	10	10	9	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10	10
c	10	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	9	10	10
a	10	10	10	10	9	10	10	10	10	10
b	10	10	10	10	10	10	10	10	10	9
c	10	10	10	10	10	10	10	10	10	10
d	10	10	10	10	10	10	10	10	9	10
a	10	10	10	10	9	10	10	10	9(2)	9(1)
b	10	10	10	10	10	10	10	10	10	9
c	10	10	10	9	10	10	10	10	7	10
d	10	10	10	10	10	10	10	10	8(1)	9

Lab Ctl	Site Ctl	1.6	3.2	6.3	12.5	25	50	100	100-pH
10	10	10	10	9	10	10	10(1)	6	7
10	10	10	10	10	10	10(1)	9	7	9
10	10	10	9	10	10	10	10	7	10
10	10	10	10	10	10	10	10	5	8
10	10	10	10	9	10	10	10(1)	6	4
10	10	10	10	10	10	10(1)	9	6	6
10	10	10	9	10	10	10	10(1)	6	7
10	10	10	10	10	10	10	10	5	6
10	10	10	10	7	10	10	9	5	3
10	10	10	10	10	10	10	8	6	6
10	9	10	8	10	10	10	9	5	6
10	10	10	10	10	10	10	10	4	6

Comments:

2021/10/12  
not fed PM

## Atypical Swimming Behaviour:

Unless otherwise noted, behavior is considered to be normal  
Any fish that appear moribund (lethargic), display a loss of equilibrium or show atypical swimming behaviour

Scoring Convention: # alive (in atypically swimming)

e.g. 10 (4) indicates 10 alive but 4 swimming atypically in vessel

No bracketed # indicates no atypical swimming within test vessel

Reviewed By: ML

Date Reviewed: 2021/10/29



# Fathead Minnow Extra Concentrations Bench Sheet

Method FMD Client Hat/Syn PJ2021-006 Reference 2122-0052 Week 4

## Chemistry

### New Solutions

conc. (%)	Lab Ctl	Site Ctl	16	32	63	125	25	50	100	100-pH
day										

### pH (units) (range: 6.5-8.5)

0	8.0	8.0	8.1	8.2	8.3	8.4	8.5	8.7	8.9	8.2
1	7.7	7.9	7.9	8.0	8.1	8.3	8.6	8.8	9.0	8.5
2	8.2	8.2	8.1	8.2	8.2	8.4	8.5	8.7	8.7	8.4
3	7.9	7.9	8.0	8.0	8.1	8.2	8.4	8.6	8.7	8.6
4	8.1	8.0	8.1	8.1	8.2	8.3	8.5	8.6	8.8	8.4
5	7.9	7.9	7.9	8.0	8.1	8.1	8.3	8.5	8.6	8.3
6	8.0	8.0	8.0	8.1	8.1	8.2	8.4	8.6	8.8	8.3
7										
8										

### Conductivity (µS/cm)

0	435	339	403	414	569	773	1103	1742	3050	3220
1	467	354	401	453	545	753	1077	1345	3110	3280
2	440	292	393	439	542	715	1051	1737	3090	3280
3	431	349	397	448	552	742	1095	1757	3160	3240
4	445	350	407	456	565	769	1109	1820	3150	3240
5	439	348	391	443	532	718	1048	1721	3210	3290
6	405	329	375	414	506	660	969	1615	3100	3070
7	438									
8										

### Dissolved Oxygen (mg/L) (40-100% saturation)

0	7.3	8.1	8.3	8.2	8.2	8.1	8.1	7.9	7.6	
1	7.3	7.3	8.1	8.1	8.2	8.2	8.0	8.1	7.3	
2	7.3	8.1	8.4	8.2	8.3	8.5	8.3	8.2	7.1	
3	7.6	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.3	8.0
4	7.3	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8.0
5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
7										
8										

### Temperature 24 - 26 (°C)

0	24	24	24	24	24	24	24	24	24	24
1	24	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24	24
6	24	24	24	24	24	24	24	24	24	24
7										
8										

DO Levels (40-100% saturation)\* -  
\*corrected for altitude

2.9 to 7.3 mg/L at 24°C

2.9 to 7.2 mg/L at 25°C

2.8 to 7.1 mg/L at 26°C

### Old Solutions

Lab Ctl	Site Ctl	16	32	63	125	25	50	100	100-pH
---------	----------	----	----	----	-----	----	----	-----	--------

### pH (units) (range: 6.5-8.5)

8.4	8.4	8.5	8.2	8.2	8.2	8.3	8.4	8.7	8.6
7.9	8.0	7.8	7.9	7.9	8.0	8.2	8.4	8.7	8.5
7.7	7.7	7.7	7.8	7.8	7.9	8.0	8.4	8.5	8.4
7.9	7.7	7.7	7.8	7.8	7.9	8.0	8.2	8.5	8.5
7.9	7.8	7.8	7.8	7.8	7.9	8.0	8.1	8.3	8.5
8.0	7.8	7.8	7.9	7.9	8.0	8.2	8.5	8.7	8.4
7.3	7.6	7.6	7.7	7.8	7.8	7.9	8.2	8.5	8.3

### Conductivity (µS/cm)

463	369	424	487	592	791	1128	1791	3080	3310
502	378	417	463	558	732	1065	1750	3050	3300
449	372	409	458	577	754	1110	1766	3190	3360
461	371	477	483	604	785	1141	1807	3270	3300
497	373	433	488	619	812	1186	1890	3390	3400
420	358	402	425	550	731	1044	1707	3280	3320
432	347	396	442	539	705	1009	1646	3210	3240

### Dissolved Oxygen (mg/L) (40-100% saturation)

7.1	7.0	7.0	7.0	6.6	6.7	6.7	6.9	7.0	7.0
7.1	7.2	7.0	7.0	6.7	6.8	6.8	6.9	7.0	7.0
6.3	6.4	6.5	6.5	6.7	6.7	6.8	7.0	7.0	7.1
6.7	6.0	5.9	5.9	5.9	5.9	5.8	5.9	6.0	6.1
7.1	6.7	6.7	6.6	6.9	6.4	6.4	6.4	6.8	6.6
7.5	6.7	6.7	6.8	6.7	6.6	6.6	6.5	6.5	6.5
7.0	6.6	6.5	6.3	6.3	6.3	6.3	6.2	6.1	6.3

### Temperature 24 - 26 (°C)

24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24
24	24	24	24	24	24	24	24	24	24

Reviewed By: ML

Date Reviewed: 2021/10/29



# Organism Weights

## Bench Sheet

Client HAT/SYN Sample 0052-01 Organism FM Batch 20211008 FM

g AC

Initial Weight (mg):  
Final Weight (mg):

Item Weighed	Date	Initials	Balance*
dried pan	20211015	AC	Mettler 3
dried pan + organisms	20211012	AC	Mettler 3

\* same balance must be used for initial and final weights  
\* for FM/HA/CT, must use scale with 0.01 mg accuracy

mg AC

Concentration

Replicate	LAB CTL	Initial	Final
a	1.0208	1025.68	
b	1.0200	1025.11	
c	1.0285	1054.18	
d	1.0280	1038.16	
e			

Initial	Final
1.0263	1030.61
1.0354	1039.39
1.0227	1036.56
1.0393	1043.60

Initial	Final
1.0203	1024.56
1.0228	1027.40
1.0237	1028.59
1.0193	1025.00
	1024.54

Initial	Final
1.0383	1043.47
1.0387	1043.80
1.0254	1024.81
1.0233	1024.69

Initial	Final
1.0219	1026.67
1.0290	1034.41
1.0077	1012.19
1.0137	1019.29

Initial	Final
1.0165	1020.91
1.0015	1007.00
1.0072	1004.47
1.0003	1005.47
	1011.70

Concentration

Replicate	Initial	Final
a	1.0042	1009.47
b	1.0092	1014.00
c	1.0044	1014.53
d	1.0040	1012.29
e		

Initial	Final
0.9453	1000.24
1.0018	1005.87
1.0099	1009.38
0.9480	1003.42

Initial	Final
1.0015	1003.66
1.0003	1003.14
0.9999	1001.07
1.0087	1010.98

Initial	Final
1.0135	1014.19
1.0107	1013.81
1.0114	1014.88
1.0140	1015.30

Initial	Final

Initial	Final

Balance Calibration Check:

first pan weighed: LAB CTL A Initial 1.0208 Final 1025.63  
weight of first pan: 1.0208  
first pan after all other pans weighed: 1.0209

% difference <5%: ☒ Yes/No

% difference =  $\frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: ☒ Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: MG Date Reviewed: 2021/10/29



## CETIS Analytical Report

Report Date: 04 Nov-21 16:38 (p 1 of 2)  
 Test Code/ID: 2122-0052 FM W5 / 10-5525-9758

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	19-4776-4800	Endpoint:	7d Survival Rate	CETIS Version:	CETISv1.9.4
Analyzed:	04 Nov-21 16:38	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	14-0255-2502	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	08 Oct-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	15 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
					Age:
Sample ID:	21-4039-1101	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1118030	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.29	2.938	0.0090	Outlier Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC1	26.15	n/a	44.2	3.824	2.263	n/a
LC5	42.58	22.84	58.67	2.348	1.704	4.378
LC10	53.06	48.16	58.61	1.885	1.706	2.076
LC15	57.53	52.31	63.65	1.738	1.571	1.912
LC20	62.36	56.82	69.05	1.604	1.448	1.76
LC25	67.6	61.29	75.01	1.479	1.333	1.632
LC40	86.04	75.46	98.39	1.162	1.016	1.325
LC50	>100	n/a	n/a	<1	n/a	n/a

## 7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.9875	0.0%
1.6		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.9875	0.0%
3.2		4	0.9500	0.8000	1.0000	0.1000	10.53%	2.56%	38/40	0.9812	0.63%
6.3		4	0.9750	0.9000	1.0000	0.0500	5.13%	0.0%	39/40	0.9812	0.63%
12.5		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.9812	0.63%
25		4	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%	40/40	0.9812	0.63%
50		4	0.9250	0.9000	1.0000	0.0500	5.41%	5.13%	37/40	0.925	6.33%
100		4	0.5000	0.4000	0.6000	0.0817	16.33%	48.72%	20/40	0.5	49.37%

## 7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	1.0000	1.0000	0.9000	1.0000
1.6		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	0.8000	1.0000
6.3		0.9000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000
50		0.9000	0.9000	0.9000	1.0000
100		0.5000	0.6000	0.5000	0.4000

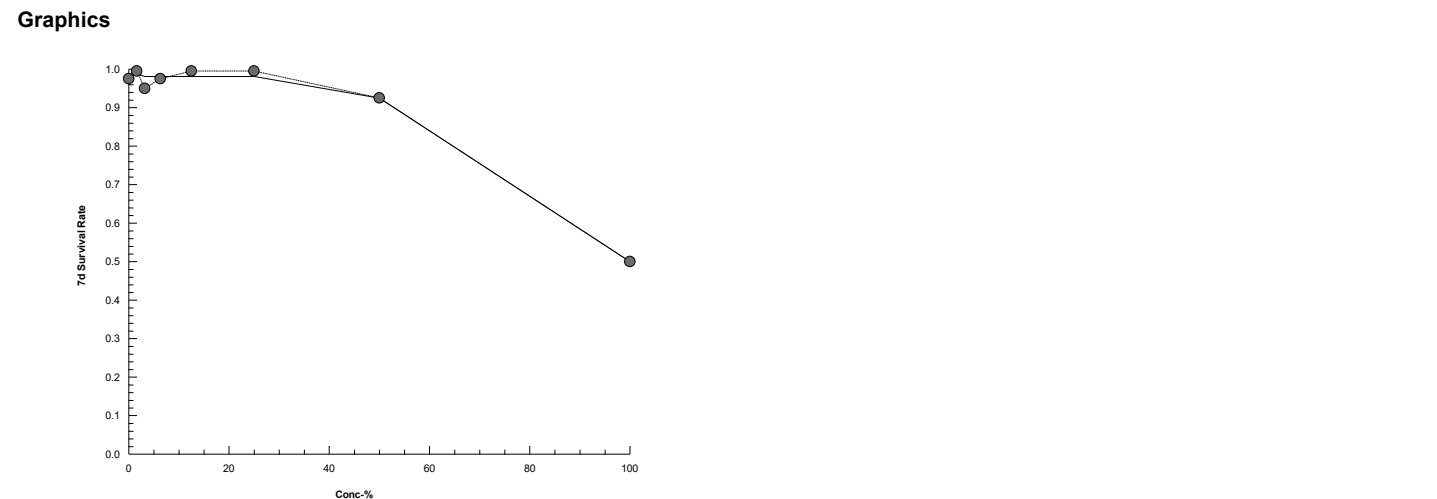


# CETIS Analytical Report

Report Date: 04 Nov-21 16:38 (p 2 of 2)  
Test Code/ID: 2122-0052 FM W5 / 10-5525-9758

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary
Analysis ID: 19-4776-4800	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4		
Analyzed: 04 Nov-21 16:38	Analysis: Linear Interpolation (ICPIN)	Status Level: 1		

7d Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	10/10	10/10	9/10	10/10
1.6		10/10	10/10	10/10	10/10
3.2		10/10	10/10	8/10	10/10
6.3		9/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10
50		9/10	9/10	9/10	10/10
100		5/10	6/10	5/10	4/10





## CETIS Analytical Report

Report Date: 04 Nov-21 16:35 (p 1 of 2)  
 Test Code/ID: 2122-0052 FM W5 / 10-5525-9758

Fathead Minnow 7-d Larval Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	02-0822-2166	Endpoint:	Mean Dry Biomass-mg	CETIS Version:	CETISv1.9.4
Analyzed:	04 Nov-21 16:35	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	14-0255-2502	Test Type:	Growth-Survival (7d)	Analyst:	Stephanie Schiffer
Start Date:	08 Oct-21	Protocol:	EC/EPS 1/RM/22	Diluent:	River Water
Ending Date:	15 Oct-21	Species:	Pimephales promelas	Brine:	
Test Length:	7d 0h	Taxon:	Actinopterygii	Source:	Aquatox, AR
				Age:	
Sample ID:	21-4039-1101	Code:	Week 5, Reactor 3	Project:	PJ2021-006
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd.
Receipt Date:	06 Oct-21	CAS (PC):		Station:	Treated OSPW
Sample Age:	96h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	128502	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.983	2.938	1.0000	No Outliers Detected

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC1	50.62	n/a	50.83	1.976	1.967	n/a
IC5	53.16	28.63	54.29	1.881	1.842	3.493
IC10	56.51	48	58.92	1.769	1.697	2.083
IC15	60.08	51.66	63.94	1.665	1.564	1.936
IC20	63.86	55.27	69.36	1.566	1.442	1.809
IC25	67.88	59.02	75.23	1.473	1.329	1.694
IC40	81.49	69.07	95.85	1.227	1.043	1.448
IC50	92.03	75.35	n/a	1.087	n/a	1.327

## Mean Dry Biomass-mg Summary

			Calculated Variate							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect		Mean	%Effect
0	XC	4	0.409	0.386	0.431	0.02486	6.08%	0.0%		0.4836	0.0%
1.6		4	0.4982	0.424	0.57	0.06023	12.09%	-21.82%		0.4836	0.0%
3.2		4	0.4767	0.439	0.517	0.04254	8.92%	-16.56%		0.4836	0.0%
6.3		4	0.5122	0.449	0.571	0.05852	11.42%	-25.24%		0.4836	0.0%
12.5		4	0.4895	0.441	0.55	0.05269	10.76%	-19.68%		0.4836	0.0%
25		4	0.502	0.473	0.528	0.02959	5.89%	-22.74%		0.4836	0.0%
50		4	0.4977	0.407	0.548	0.06515	13.09%	-21.7%		0.4836	0.0%
100		4	0.2087	0.117	0.284	0.06884	32.98%	48.96%		0.2087	56.84%

## Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	XC	0.431	0.389	0.386	0.43
1.6		0.424	0.51	0.489	0.57
3.2		0.517	0.51	0.441	0.439
6.3		0.477	0.571	0.449	0.552
12.5		0.441	0.55	0.45	0.517
25		0.527	0.48	0.473	0.528
50		0.494	0.407	0.548	0.542
100		0.216	0.284	0.117	0.218



# CETIS Analytical Report

Report Date: 04 Nov-21 16:35 (p 2 of 2)  
Test Code/ID: 2122-0052 FM W5 / 10-5525-9758

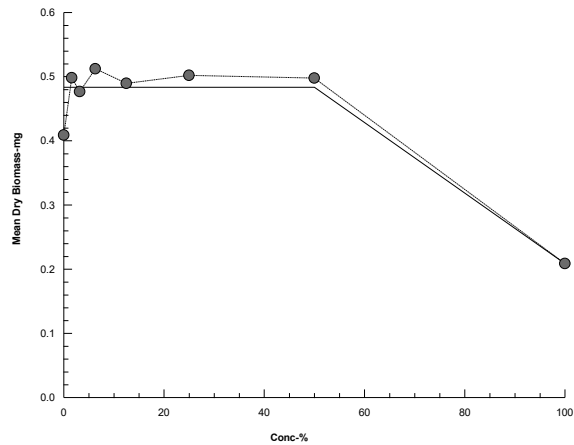
## Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental Calgary

Analysis ID: 02-0822-2166      Endpoint: Mean Dry Biomass-mg  
Analyzed: 04 Nov-21 16:35      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





## **APPENDIX F – Algae (*Psuedokirchneriella subcapitata*) Toxicity Test Data**



### *Pseudokirchneriella subcapitata* Summary Sheet

Client: Synchrude  
Work Order No.: 211808

Start Date: Sept. 10/21  
Set up by: SAN

#### Sample Information:

Sample ID: Treated DSPW  
Sample Date: Sept. 6/21  
Date Received: Sept. 10/21  
Sample Volume: 1 x 20L

#### Test Organism Information:

Culture Date: Sept. 3/21  
Age of culture (Day 0): 7d

#### Zinc Reference Toxicant Results:

Reference Toxicant ID: Sc219  
Stock Solution ID: 21M ZnO  
Date Initiated: Sept. 1/21

72-h IC50 (95% CL): 32.5 (29.0 - 35.6) µg/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4) µg/L Zn CV (%): 9

#### Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	11.0 (8.6 - 13.8)
IC50 %(v/v) (95% CL)	33.5 (28.1 - 40.1)

Reviewed by: 

Date reviewed: Oct 29, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client: Synchrude Setup by: SAK  
 Sample ID: Treated OSPW Test Date/Time: Sept. 10/21 @ 1600h  
 Work Order No.: 211808 CER #: 4  
 Test Species: Pseudokirchneriella subcapitata  
 Culture Date: Sept. 3/21 Age of Culture: 7d Culture Health: Good  
 Culture Count: 1 208 2 204 Average: 206 Culture Cell Density (c1): 206 x 10<sup>4</sup> cells/mL  

$$v1 = \frac{220,000 \text{ cells/mL} \times 60 \text{ mL}}{(c1) \quad 206 \times 10^4 \text{ cells/mL}} = 6.4 \text{ mL}$$
  
 Time Zero Counts: 1 21 2 20 Average: 20.5 x 10<sup>4</sup> cells/mL  
 No. of Cells/mL: 20.5 x 10<sup>4</sup> cells/mL Initial Density: # cells/mL + 220 µL x 10 µL = 9318 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	25.0	26.0	26.0	26.0	26.0	✓	✓	✓	✓
Site Control (site water)	8.2	24.0	↓	↓	↓	↓	↓	↓	↓	↓
1.5	8.2	↓	↓	↓	↓	↓	↓	↓	↓	↓
3	8.3	↓	↓	↓	↓	↓	↓	↓	↓	↓
6	8.4	↓	↓	↓	↓	↓	↓	↓	↓	↓
11.9	8.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
23.8	8.7	↓	↓	↓	↓	↓	↓	↓	↓	↓
47.6	8.9	↓	↓	↓	↓	↓	↓	↓	↓	↓
95.2	9.1	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SAK	SAK	SAK	JBL	RZS	SAK	SAK	JBL	RZS	SAK

Initial control pH: Well 1: 6.9 Well 2: 6.9  
 Final control pH: Well 1: 6.9 Well 2: 6.9  
 Light intensity (lux): 4400 Date measured: Sept. 10/21  
 Thermometer: 1 Light meter: 1 pH meter/probe: 1/1  
 Sample Description: Clear, yellowish, odourless, w/ some particulates  
 Comments: Dilutions done with site control water (4:100)  
 Reviewed: [Signature] Date reviewed: Oct 29, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: SynGene Start Date/Time: Sept. 10/21 @ 1600h  
 Work Order #: 211808 Termination Date: Sept. 13/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SAU  
 % (v/v): \_\_\_\_\_

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	26					SAU
	B	22					
	C	24					
	D	29					
	E	22					
	F	24					
	G	24					
	H	29					
1.5	A	89					
	B	90					
	C	107					
	D	97					
3	A	83					
	B	77					
	C	90					
	D	95					
6	A	71					
	B	87					
	C	97					
	D	89					
11.9	A	62					
	B	61					
	C	74					
	D	80					
23.8	A	59					
	B	57					
	C	52					
	D	51					
47.6	A	42					
	B	39					
	C	45					
	D	37					
95.2	A	23					
	B	25					
	C	31					
	D	30					↓

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Synovide Start Date/Time: Sept. 10/21 @ 1600h  
 Work Order #: 211808 Termination Date: Sept. 13/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SAK  
 % (v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control <sup>sm</sup>  Site control  (Site Water)	A	89					SAK
	B	103					
	C	84					
	D	102					
	E	103					
	F	83					
	G	97					
	H	102					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Syncrude  
WO#: 211808  
Sample ID: Treated OSPW

Start Date/Time: 10-Sept-21 @1600h  
Termination Date/Time: 13-Sept-21 @1600h

pg.1

Initial Cell Density: 9318 cell/mL  
205000  
0.22  
0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		9318.182
% (v/v) Control	A	26				26	25.1	mean	24.1
	B	22				22	21.1	SD	2.77746
	C	24				24	23.1	CV	11.53997
	D	29				29	28.1		
	E	22				22	21.1		
	F	24				24	23.1		
	G	24				24	23.1		
	H	29				29	28.1		
1.5	A	89				89	88.1		
	B	90				90	89.1		
	C	107				107	106.1		
	D	97				97	96.1		
3	A	83				83	82.1		
	B	77				77	76.1		
	C	90				90	89.1		
	D	95				95	94.1		
6	A	71				71	70.1		
	B	87				87	86.1		
	C	97				97	96.1		
	D	89				89	88.1		
11.9	A	62				62	61.1		
	B	61				61	60.1		
	C	74				74	73.1		
	D	80				80	79.1		
23.8	A	59				59	58.1		
	B	57				57	56.1		
	C	52				52	51.1		
	D	51				51	50.1		
47.6	A	42				42	41.1		
	B	39				39	38.1		
	C	45				45	44.1		
	D	37				37	36.1		
95.2	A	23				23	22.1		
	B	25				25	24.1		
	C	31				31	30.1		
	D	30				30	29.1		

Reviewed by: \_\_\_\_\_

Date reviewed: \_\_\_\_\_

*Dec 29, 2021*



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Syncrude  
 WO#: 211808  
 Sample ID: Treated OSPW

Start Date/Time: 10-Sept-21 @1600h  
 Termination Date/Time 13-Sept-21 @1600h

pg.2

Initial Cell Density: 9318 cell/mL  
 205000  
 0.22  
 0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		9318.182
% (v/v)									
Site Control (Site Water)	A	89				89	88.1	mean	94.4
	B	103				103	102.1	SD	8.700369
	C	84				84	83.1	CV	9.212279
	D	102				102	101.1		
	E	103				103	102.1		
	F	83				83	82.1		
	G	97				97	96.1		
	H	102				102	101.1		
1.5	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
3	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
11.9	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
23.8	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
47.6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
95.2	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: 

Date reviewed: Oct 29, 2021



# CETIS Analytical Report

Report Date: 22 Oct-21 15:37 (p 1 of 4)  
Test Code/ID: 211808 / 21-2492-0315

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 04-1545-7896	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-21 15:34	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 15-6508-8048	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 10 Sep-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: Site Water
Ending Date: 13 Sep-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 7d
Sample ID: 21-0551-7823	Code: Treated OSPW	Project:
Sample Date: 06 Sep-21 15:00	Material: Water Sample	Source: Syncrude
Receipt Date: 10 Sep-21 12:52	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 1h (19.7 °C)	Client: Syncrude	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C < T	95.2	>95.2	n/a	1.05	12.64%

## Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	0.07943	2.526	11.93	10	CDF	0.9109	Non-Significant Effect
		3	-1.933	2.526	11.93	10	CDF	1.0000	Non-Significant Effect
		6	-1.986	2.526	11.93	10	CDF	1.0000	Non-Significant Effect
		11.9	-5.533	2.526	11.93	10	CDF	1.0000	Non-Significant Effect
		23.8	-8.605	2.526	11.93	10	CDF	1.0000	Non-Significant Effect
		47.6	-11.57	2.526	11.93	10	CDF	1.0000	Non-Significant Effect
		95.2	-14.43	2.526	11.93	10	CDF	1.0000	Non-Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.175	2.991	0.9036	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.175		0.9061	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	21357.3	3051.04	7	51.33	<1.0E-37	Significant Effect
Error	1664.38	59.442	28			
Total	23021.6		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	6.781	18.48	0.4521	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9733	0.9166	0.5223	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	94.38	87.1	101.6	98.5	82	102	3.076	9.22%	0.00%
1.5		4	94.75	81.54	108	92.5	88	106	4.151	8.76%	-0.40%
3		4	85.25	72.7	97.8	85.5	76	94	3.945	9.25%	9.67%
6		4	85	67.67	102.3	87	70	96	5.447	12.82%	9.93%
11.9		4	68.25	53.47	83.03	67	60	79	4.644	13.61%	27.68%
23.8		4	53.75	47.6	59.9	53.5	50	58	1.931	7.19%	43.05%
47.6		4	39.75	34.18	45.32	39.5	36	44	1.75	8.81%	57.88%
95.2		4	26.25	20.1	32.4	26.5	22	30	1.931	14.71%	72.19%



# CETIS Analytical Report

Report Date: 22 Oct-21 15:38 (p 2 of 4)  
Test Code/ID: 211808 / 21-2492-0315

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 04-1545-7896  
Analyzed: 22 Oct-21 15:34

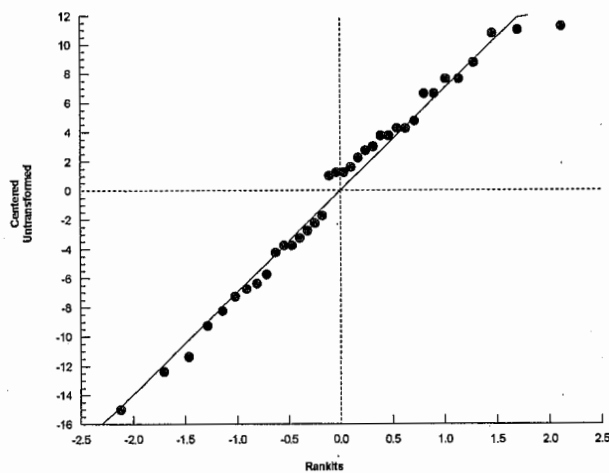
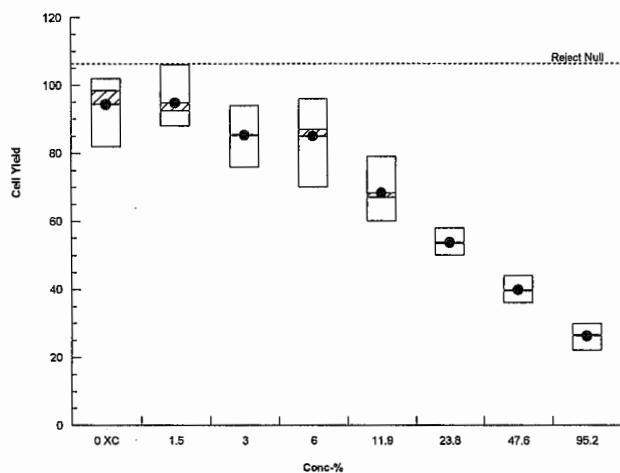
Endpoint: Cell Yield  
Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	88	102	83	101	102	82	96	101
1.5		88	89	106	96				
3		82	76	89	94				
6		70	86	96	88				
11.9		61	60	73	79				
23.8		58	56	51	50				
47.6		41	38	44	36				
95.2		22	24	30	29				

### Graphics





## CETIS Analytical Report

 Report Date: 22 Oct-21 15:38 (p 1 of 2)  
 Test Code/ID: 211808 / 21-2492-0315

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 02-1568-0261	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-21 15:37	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 15-6508-8048	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 10 Sep-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: Site Water
Ending Date: 13 Sep-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 7d
Sample ID: 21-0551-7823	Code: Treated OSPW	Project:
Sample Date: 06 Sep-21 15:00	Material: Water Sample	Source: Syncrude
Receipt Date: 10 Sep-21 12:52	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 1h (19.7 °C)	Client: Syncrude	

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu = \alpha \cdot [1 - \Phi[\log(x/\delta)/\gamma]]$	Normal [ $\omega=1$ ]	Off [ $\mu^*=\mu$ ]	None	None

## Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
4	-71.14	149	153	0.9161	Yes	0.5299	2.558	0.7517	Non-Significant Lack of Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	2.211	0.9	3.496	45.22	28.6	111.1
IC10	4.032	2.564	5.627	24.8	17.77	39.01
IC15	6.046	4.265	8.046	16.54	12.43	23.45
IC20	8.344	6.24	10.74	11.98	9.307	16.03
IC25	11	8.574	13.79	9.092	7.253	11.66
IC40	22.07	18.41	26.31	4.532	3.8	5.431
IC50	33.54	28.08	40.07	2.981	2.496	3.561

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	95.08	2.327	90.35	99.82	40.87	<1.0E-37	Significant Parameter
$\gamma$	1.653	0.1718	1.304	2.003	9.624	<1.0E-37	Significant Parameter
$\delta$	33.54	3.551	26.32	40.77	9.447	<1.0E-37	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	204200	68080	3	1233	<1.0E-37	Significant
Lack of Fit	157.5	31.5	5	0.5299	0.7517	Non-Significant
Pure Error	1664	59.44	28			
Residual	1822	55.21	33			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Extreme Value	Grubbs Extreme Value Test	2.09	2.991	1.0000	No Outliers Detected
Variances	Bartlett Equality of Variance Test	6.781	14.07	0.4521	Equal Variances
	Mod Levene Equality of Variance	0.87	2.359	0.5418	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9709	0.9398	0.4493	Normal Distribution
	Anderson-Darling A2 Normality Test	0.3849	2.492	0.3976	Normal Distribution
Control Trend	Mann-Kendall Trend Test	2		0.9061	Non-Significant Trend in Controls



# CETIS Analytical Report

Report Date: 22 Oct-21 15:38 (p 2 of 2)  
Test Code/ID: 211808 / 21-2492-0315

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 02-1568-0261  
Analyzed: 22 Oct-21 15:37

Endpoint: Cell Yield  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Summary

### Calculated Variate

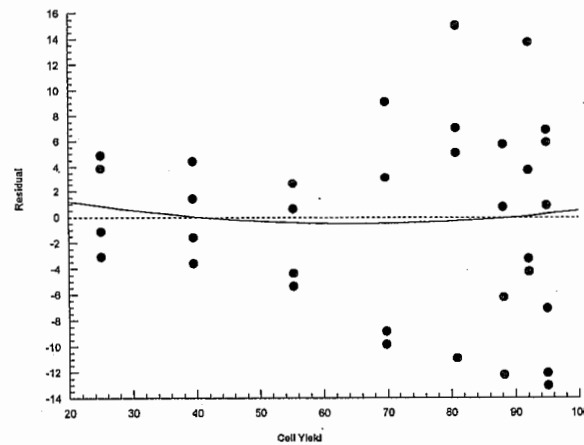
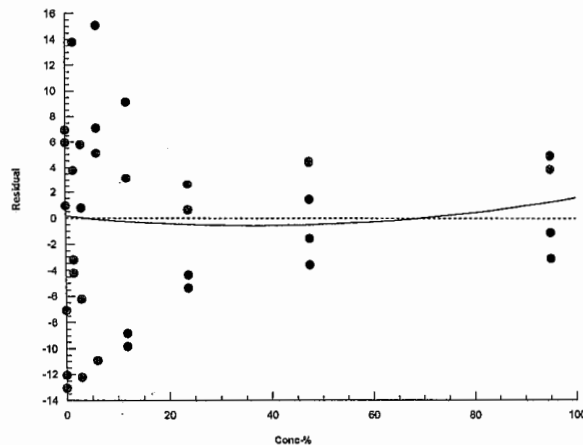
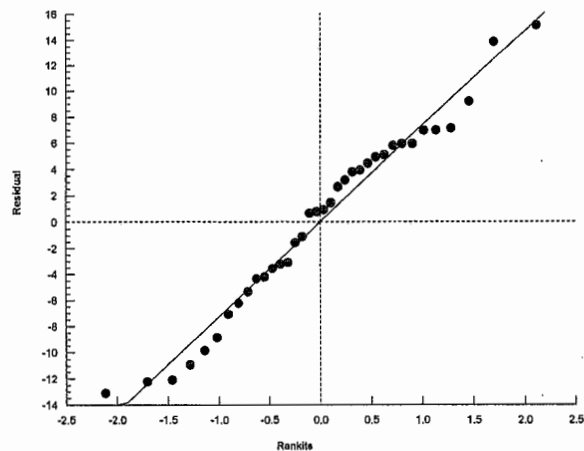
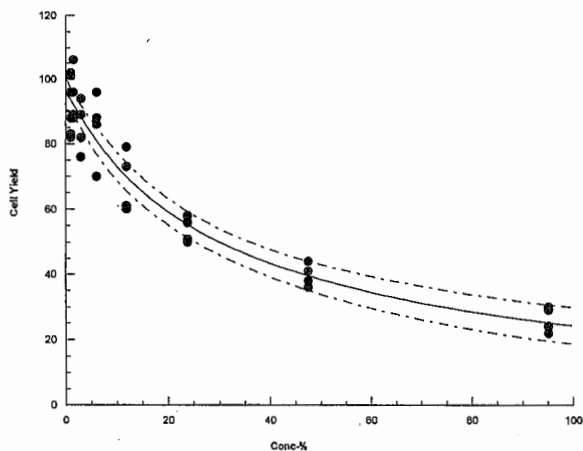
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	8	94.38	82	102	3.076	8.7	9.22%	0.0%
1.5		4	94.75	88	106	4.151	8.302	8.76%	-0.4%
3		4	85.25	76	94	3.945	7.89	9.26%	9.67%
6		4	85	70	96	5.447	10.89	12.82%	9.93%
11.9		4	68.25	60	79	4.644	9.287	13.61%	27.68%
23.8		4	53.75	50	58	1.931	3.862	7.19%	43.05%
47.6		4	39.75	36	44	1.75	3.5	8.81%	57.88%
95.2		4	26.25	22	30	1.931	3.862	14.71%	72.19%

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	88	102	83	101	102	82	96	101
1.5		88	89	106	96				
3		82	76	89	94				
6		70	86	96	88				
11.9		61	60	73	79				
23.8		58	56	51	50				
47.6		41	38	44	36				
95.2		22	24	30	29				

### Graphics

Model: 3P Cum Log-Normal (Probit):  $\mu = \alpha \cdot [1 - \Phi[\log(x/\delta)/\gamma]]$  Distribution: Normal [ $\omega=1$ ]





## *Pseudokirchneriella subcapitata* Summary Sheet

Client: Highfield  
Work Order No.: 211864

Start Date: Sept. 16/21  
Set up by: SAN

### Sample Information:

Sample ID: Treated OSPW  
Sample Date: Sept. 12/21  
Date Received: Sept. 16/21  
Sample Volume: 1 x 20L

### Test Organism Information:

Culture Date: Sept. 10/21  
Age of culture (Day 0): 6d

### Zinc Reference Toxicant Results:

Reference Toxicant ID: SC220  
Stock Solution ID: 21ZnO  
Date Initiated: Sept. 30/21

72-h IC50 (95% CL): 30.2 (26.5 - 34.2)  $\mu$ g/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4)  $\mu$ g/L Zn CV (%): 9

### Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	5.6 (3.5 - 16.0)
IC50 %(v/v) (95% CL)	30.0 (27.9 - 31.7)

Reviewed by: 

Date reviewed: Oct. 29, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client: Hatfield (Synchro) Setup by: SMU  
 Sample ID: Treated OSPW Test Date/Time: Sept. 16/21 @ 1600h  
 Work Order No.: 211864 CER #: 4  
 Test Species: Pseudokirchneriella subcapitata  
 Culture Date: 04/02/21 Age of Culture: 6d Culture Health: Good  
 Culture Count: 1 240 2 220 Average: 230 Culture Cell Density (c1):  $230 \times 10^4$  cells/mL

$$v1 = \frac{220,000 \text{ cells/mL} \times 60 \text{ mL}}{(c1) \times 10^4} = \frac{220 \times 10^4 \times 60}{230 \times 10^4} = 5.7 \text{ mL}$$

Time Zero Counts: 1 23 2 21 Average: 22

No. of Cells/mL:  $22 \times 10^4$  cells/mL Initial Density: # cells/mL + 220  $\mu$ L x 10  $\mu$ L = 10000 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.9	24.0	25.0	25.0	24.0	25.0	✓	✓	✓	✓
(River Water) Site Control	8.0	24.0	↓	↓	↓	↓	↓	↓	↓	↓
1.5	8.1	24.0	↓	↓	↓	↓	↓	↓	↓	↓
3	8.1	24.0	↓	↓	↓	↓	↓	↓	↓	↓
6	8.2	23.0	↓	↓	↓	↓	↓	↓	↓	↓
11.9	8.4	↓	↓	↓	↓	↓	↓	↓	↓	↓
23.8	8.6	↓	↓	↓	↓	↓	↓	↓	↓	↓
47.6	8.9	↓	↓	↓	↓	↓	↓	↓	↓	↓
95.2	9.1	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SMU	SMU	SMU	SMU	SMU	SMU	SMU	SMU	SMU	SMU

Initial control pH: Well 1: 6.9 Well 2: 6.9

Final control pH: Well 1: 7.0 Well 2: 7.0

Light intensity (lux): 3770 Date measured: Sept. 16/21

Thermometer: 1 Light meter: 1 pH meter/probe: 1, 1

Sample Description: Clear, yellowish, odourless, w/ some particulates

Comments: Sample 'River Water' (Site Control) was used as dilution water

Reviewed: [Signature] Date reviewed: Oct. 29, 2021



## Pseudokirchneriella subcapitata Toxicity Test Data Sheet

### 72-h Algal Cell Counts

Client: Synovate/Hatfield Start Date/Time: Sept. 16/21 @ 1600h  
 Work Order #: 211864 Termination Date: Sept. 19/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SAU

Concentration %(v/v)	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	28					SAU
	B	25					
	C	24					
	D	34					
	E	24					
	F	28					
	G	34					
	H	28					
1.5	A	85					
	B	92					
	C	98					
	D	113					
3	A	84					
	B	77					
	C	82					
	D	96					
6	A	75					
	B	76					
	C	77					
	D	72					
11.9	A	74					
	B	65					
	C	87					
	D	79					
23.8	A	61					
	B	64					
	C	89					
	D	59					
47.6	A	32					
	B	31					
	C	26					
	D	33					
95.2	A	14					
	B	13					
	C	15					
	D	14					

Comments:

Reviewed by:

Date Reviewed:



## Pseudokirchneriella subcapitata Toxicity Test Data Sheet

### 72-h Algal Cell Counts

Client: Haltold (Synode) Start Date/Time: Sept 16/21 @ 1600h  
 Work Order #: 211864 Termination Date: Sept. 19/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SRV  
 % (v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control Site control (River water)	A	100					SRV
	B	105					
	C	99					
	D	100					
	E	97					
	F	100					
	G	101					
	H	105					✓
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 211864  
 Sample ID: Treated OSPW

Start Date/Time: 16-Sept-21 @1600h  
 Termination Date/Time 19-Sept-21 @1600h

pg.1

Initial Cell Density: 10000 cell/mL  
 220000  
 0.22  
 0.01  
 10000

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> )	
% (v/v)							cell/mL	
Control	A	28				28	27.0	mean 27.8
	B	25				25	24.0	SD 3.654743
	C	29				29	28.0	CV 13.17024
	D	34				34	33.0	
	E	24				24	23.0	
	F	28				28	27.0	
	G	34				34	33.0	
	H	28				28	27.0	
1.5	A	85				85	84.0	
	B	92				92	91.0	
	C	98				98	97.0	
	D	113				113	112.0	
3	A	84				84	83.0	
	B	77				77	76.0	
	C	82				82	81.0	
	D	96				96	95.0	
6	A	75				75	74.0	
	B	76				76	75.0	
	C	77				77	76.0	
	D	72				72	71.0	
11.9	A	74				74	73.0	
	B	65				65	64.0	
	C	69				69	68.0	
	D	79				79	78.0	
23.8	A	61				61	60.0	
	B	64				64	63.0	
	C	60				60	59.0	
	D	59				59	58.0	
47.6	A	32				32	31.0	
	B	31				31	30.0	
	C	26				26	25.0	
	D	33				33	32.0	
95.2	A	14				14	13.0	
	B	13				13	12.0	
	C	15				15	14.0	
	D	14				14	13.0	

Reviewed by: 

Date reviewed: OCT - 29, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 211864  
 Sample ID: Treated OSPW

Start Date/Time: 16-Sept-21 @1600h  
 Termination Date/Time: 19-Sept-21 @1600h

pg.2

Initial Cell Density: 10000 cell/mL  
 220000  
 0.22  
 0.01  
 10000

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		
% (v/v)									
Site Control (River Water)	A	100				100	99.0	mean	99.9
	B	105				105	104.0	SD	2.799872
	C	99				99	98.0	CV	2.803377
	D	100				100	99.0		
	E	97				97	96.0		
	F	100				100	99.0		
	G	101				101	100.0		
	H	105				105	104.0		
1.5	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
3	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
11.9	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
23.8	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
47.6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
95.2	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: 

Date reviewed: Oct. 29, 2021



# CETIS Analytical Report

Report Date: 26 Oct-21 17:15 (p 1 of 2)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 06-5457-7658	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 16:55	Analysis: Nonparametric-Multiple Comparison	Status Level: 1
Batch ID: 03-0159-9883	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 16 Sep-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 19 Sep-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 17-6220-4146	Code: Treated OSPW	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 3h (14.2 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C < T	95.2	>95.2	n/a	1.05	8.80%

## Wilcoxon/Bonferroni Adj Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	33	n/a	0	10	Exact	1.0000	Non-Significant Effect
		3	42	n/a	0	10	Exact	1.0000	Non-Significant Effect
		6	42	n/a	0	10	Exact	1.0000	Non-Significant Effect
		11.9	42	n/a	0	10	Exact	1.0000	Non-Significant Effect
		23.8	42	n/a	0	10	Exact	1.0000	Non-Significant Effect
		47.6	42	n/a	0	10	Exact	1.0000	Non-Significant Effect
		95.2	42	n/a	0	10	Exact	1.0000	Non-Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.256	2.991	0.0146	Outlier Detected
Control Trend	Mann-Kendall Trend Test	3.256		0.9122	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	30618.9	4374.13	7	144.9	<1.0E-37	Significant Effect
Error	845.375	30.192	28			
Total	31464.3		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	25.04	18.48	7.5E-04	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9159	0.9166	0.0096	Non-Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	99.88	97.53	102.2	99	96	104	0.9899	2.80%	0.00%
1.5		4	96	77.04	115	94	84	112	5.958	12.41%	3.88%
3		4	83.75	70.93	96.57	82	76	95	4.029	9.62%	16.15%
6		4	74	70.56	77.44	74.5	71	76	1.08	2.92%	25.91%
11.9		4	70.75	61.08	80.42	70.5	64	78	3.038	8.59%	29.16%
23.8		4	60	56.56	63.44	59.5	58	63	1.08	3.60%	39.92%
47.6		4	29.5	24.55	34.45	30.5	25	32	1.555	10.54%	70.46%
95.2		4	13	11.7	14.3	13	12	14	0.4082	6.28%	86.98%



# CETIS Analytical Report

Report Date: 26 Oct-21 17:15 (p 2 of 2)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 06-5457-7658  
Analyzed: 26 Oct-21 16:55

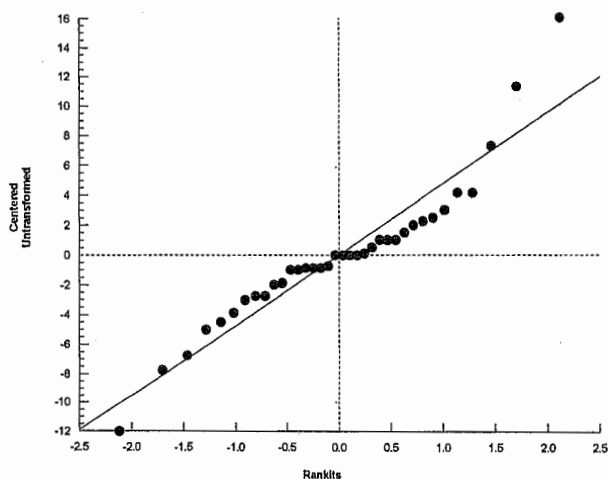
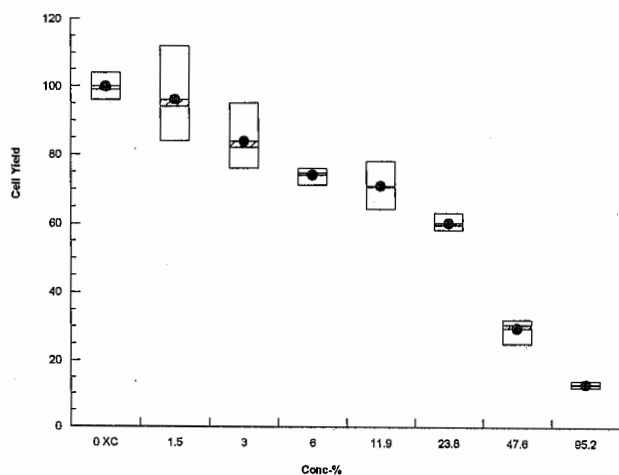
Endpoint: Cell Yield  
Analysis: Nonparametric-Multiple Comparison

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	99	104	98	99	96	99	100	104
1.5		84	91	97	112				
3		83	76	81	95				
6		74	75	76	71				
11.9		73	64	68	78				
23.8		60	63	59	58				
47.6		31	30	25	32				
95.2		13	12	14	13				

### Graphics





# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 5 of 6)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 21-2269-5939	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 16:56	Analysis: Nonparametric-Multiple Comparison	Status Level: 1
Batch ID: 03-0159-9883	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 16 Sep-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 19 Sep-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 17-6220-4146	Code: Treated OSPW	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 3h (14.2 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	1.5	3	2.121	66.67	8.80%

## Wilcoxon/Bonferroni Adj Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	19	n/a	0	10	Exact	0.9616	Non-Significant Effect
		3*	10	n/a	0	10	Exact	0.0141	Significant Effect
		6*	10	n/a	0	10	Exact	0.0141	Significant Effect
		11.9*	10	n/a	0	10	Exact	0.0141	Significant Effect
		23.8*	10	n/a	0	10	Exact	0.0141	Significant Effect
		47.6*	10	n/a	0	10	Exact	0.0141	Significant Effect
		95.2*	10	n/a	0	10	Exact	0.0141	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.256	2.991	0.0146	Outlier Detected
Control Trend	Mann-Kendall Trend Test	3.256		0.9122	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	30618.9	4374.13	7	144.9	<1.0E-37	Significant Effect
Error	845.375	30.192	28			
Total	31464.3		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	25.04	18.48	7.5E-04	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9159	0.9166	0.0096	Non-Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	99.88	97.53	102.2	99	96	104	0.9899	2.80%	0.00%
1.5		4	96	77.04	115	94	84	112	5.958	12.41%	3.88%
3		4	83.75	70.93	96.57	82	76	95	4.029	9.62%	16.15%
6		4	74	70.56	77.44	74.5	71	76	1.08	2.92%	25.91%
11.9		4	70.75	61.08	80.42	70.5	64	78	3.038	8.59%	29.16%
23.8		4	60	56.56	63.44	59.5	58	63	1.08	3.60%	39.92%
47.6		4	29.5	24.55	34.45	30.5	25	32	1.555	10.54%	70.46%
95.2		4	13	11.7	14.3	13	12	14	0.4082	6.28%	86.98%



# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 6 of 6)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 21-2269-5939  
Analyzed: 26 Oct-21 16:56

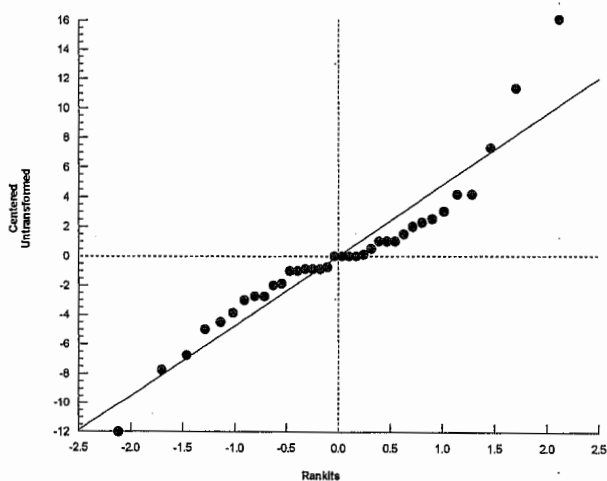
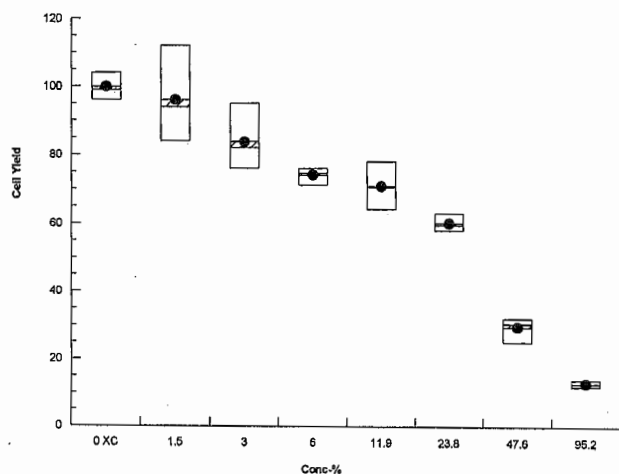
Endpoint: Cell Yield  
Analysis: Nonparametric-Multiple Comparison

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	99	104	98	99	96	99	100	104
1.5		84	91	97	112				
3		83	76	81	95				
6		74	75	76	71				
11.9		73	64	68	78				
23.8		60	63	59	58				
47.6		31	30	25	32				
95.2		13	12	14	13				

### Graphics





# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 1 of 4)  
Test Code/ID: 211864 / 20-5534-0548

EC Alga Growth Inhibition Test				Nautilus Environmental	
Analysis ID:	17-8437-6662	Endpoint:	Cell Yield	CETIS Version:	CETISv1.9.4
Analyzed:	26 Oct-21 16:56	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Batch ID:	03-0159-9883	Test Type:	Cell Growth	Analyst:	Sierra Klueppel
Start Date:	16 Sep-21 16:00	Protocol:	EC/EPS 1/RM/25	Diluent:	River Water
Ending Date:	19 Sep-21 16:00	Species:	Pseudokirchneriella subcapitata	Brine:	
Test Length:	72h	Taxon:	Chlorophyta	Source:	In-House Culture
					Age: 6d
Sample ID:	17-6220-4146	Code:	Treated OSPW	Project:	Special Studies
Sample Date:	12 Sep-21 13:00	Material:	Water Sample	Source:	Hatfield
Receipt Date:	16 Sep-21 08:50	CAS (PC):		Station:	Treated OSPW
Sample Age:	4d 3h (14.2 °C)	Client:	Hatfield		

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	666327	200	Yes	Two-Point Interpolation

Residual Analysis					
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.256	2.991	0.0146	Outlier Detected
Control Trend	Mann-Kendall Trend Test	3.256		0.9122	Non-Significant Trend in Controls

Point Estimates						
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	1.61	n/a	2.317	62.13	43.17	n/a
IC10	2.161	0.4277	3.697	46.28	27.05	233.8
IC15	2.828	1.422	4.535	35.36	22.05	70.31
IC20	3.989	2.061	5.479	25.07	18.25	48.51
IC25	5.645	3.455	16.05	17.71	6.231	28.95
IC40	23.84	16.63	25.47	4.194	3.926	6.013
IC50	29.96	27.89	31.67	3.337	3.158	3.585

Cell Yield Summary			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	8	99.88	96	104	2.8	2.80%	0.0%	99.88	0.0%
1.5		4	96	84	112	11.92	12.41%	3.88%	96	3.88%
3		4	83.75	76	95	8.057	9.62%	16.15%	83.75	16.15%
6		4	74	71	76	2.16	2.92%	25.91%	74	25.91%
11.9		4	70.75	64	78	6.076	8.59%	29.16%	70.75	29.16%
23.8		4	60	58	63	2.16	3.60%	39.92%	60	39.92%
47.6		4	29.5	25	32	3.109	10.54%	70.46%	29.5	70.46%
95.2		4	13	12	14	0.8165	6.28%	86.98%	13	86.98%

Cell Yield Detail									
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	99	104	98	99	96	99	100	104
1.5		84	91	97	112				
3		83	76	81	95				
6		74	75	76	71				
11.9		73	64	68	78				
23.8		60	63	59	58				
47.6		31	30	25	32				
95.2		13	12	14	13				



# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 2 of 4)  
Test Code/ID: 211864 / 20-5534-0548

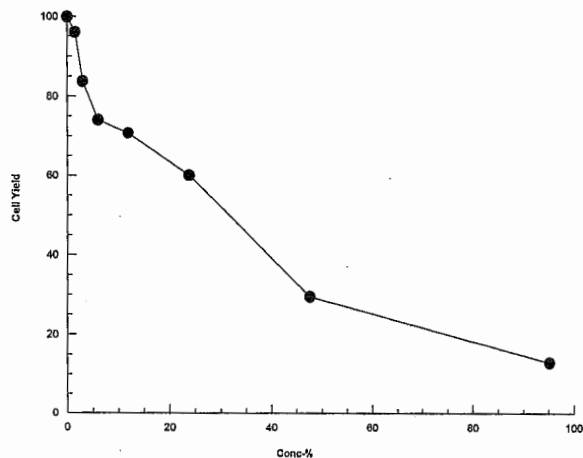
## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 17-8437-6662      Endpoint: Cell Yield  
Analyzed: 26 Oct-21 16:56      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 1 of 6)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 20-6449-5137	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 16:55	Analysis: Nonparametric-Multiple Comparison	Status Level: 1
Batch ID: 03-0159-9883	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 16 Sep-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 19 Sep-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 17-6220-4146	Code: Treated OSPW	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 3h (14.2 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C < T	95.2	>95.2	n/a	1.05	32.40%

## Wilcoxon/Bonferroni Adj Test

Control	vs	Control II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		1.5*	10	n/a	0	10	Exact	0.0141	Significant Effect
		3*	10	n/a	0	10	Exact	0.0141	Significant Effect
		6*	10	n/a	0	10	Exact	0.0141	Significant Effect
		11.9*	10	n/a	0	10	Exact	0.0141	Significant Effect
		23.8*	10	n/a	0	10	Exact	0.0141	Significant Effect
		47.6	22	n/a	0	10	Exact	1.0000	Non-Significant Effect
		95.2	42	n/a	0	10	Exact	1.0000	Non-Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	3.184	2.991	0.0207	Outlier Detected
Control Trend	Mann-Kendall Trend Test	3.184		1.0000	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	28094.6	4013.51	7	127.1	<1.0E-37	Significant Effect
Error	884	31.5714	28			
Total	28978.6		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	22.82	18.48	0.0018	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9295	0.9166	0.0242	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	27.75	24.69	30.81	27	23	33	1.292	13.17%	0.00%
1.5		4	96	77.04	115	94	84	112	5.958	12.41%	-245.95%
3		4	83.75	70.93	96.57	82	76	95	4.029	9.62%	-201.80%
6		4	74	70.56	77.44	74.5	71	76	1.08	2.92%	-166.67%
11.9		4	70.75	61.08	80.42	70.5	64	78	3.038	8.59%	-154.95%
23.8		4	60	56.56	63.44	59.5	58	63	1.08	3.60%	-116.22%
47.6		4	29.5	24.55	34.45	30.5	25	32	1.555	10.54%	-6.31%
95.2		4	13	11.7	14.3	13	12	14	0.4082	6.28%	53.15%



# CETIS Analytical Report

Report Date: 26 Oct-21 16:57 (p 2 of 6)  
Test Code/ID: 211864 / 20-5534-0548

## EC Alga Growth Inhibition Test

Nautilus Environmental

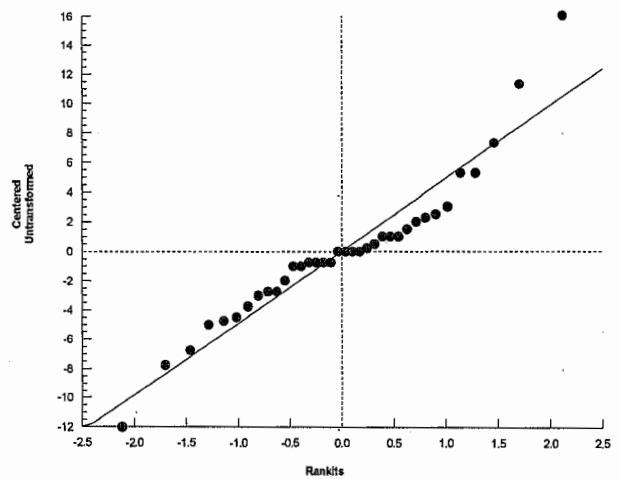
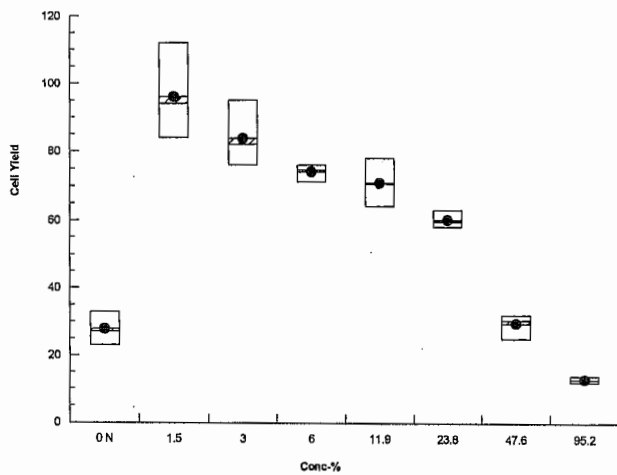
Analysis ID: 20-6449-5137  
Analyzed: 26 Oct-21 16:55  
Endpoint: Cell Yield  
Analysis: Nonparametric-Multiple Comparison

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	27	24	28	33	23	27	33	27
1.5		84	91	97	112				
3		83	76	81	95				
6		74	75	76	71				
11.9		73	64	68	78				
23.8		60	63	59	58				
47.6		31	30	25	32				
95.2		13	12	14	13				

### Graphics





***Pseudokirchneriella subcapitata* Summary Sheet**

Client: Hatfield (synovide)  
Work Order No.: 211938

Start Date: Sept. 24/21  
Set up by: SAU

**Sample Information:**

Sample ID: Treated OSPW  
Sample Date: Sept. 19/21  
Date Received: Sept. 23/21  
Sample Volume: 3x20L

**Test Organism Information:**

Culture Date: Sept. 17/21  
Age of culture (Day 0): 7d

**Zinc Reference Toxicant Results:**


Reference Toxicant ID: SC220  
Stock Solution ID: Sept<sup>5th</sup> 21Zn01  
Date Initiated: Sept. 30/21

72-h IC50 (95% CL): 30.2 (26.5 - 34.2) µg/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4) µg/L Zn CV (%): 9

**Test Results:**

	Algal Growth
IC25 %(v/v) (95% CL)	14.8 (10.6 - 19.8)
IC50 %(v/v) (95% CL)	58.5 (46.0 - 73.6)

Reviewed by: 

Date reviewed: Oct. 29, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client: Synovate/Hallfield Setup by: SAU  
 Sample ID: Treated OSPW Test Date/Time: Sept. 24/21 @ 1500h  
 Work Order No.: 211938 CER #: 4

Test Species: Pseudokirchneriella subcapitata  
 Culture Date: 091721 Age of Culture: 7d Culture Health: Good  
 Culture Count: 1 205 2 225 Average: 215 Culture Cell Density (c1):  $215 \times 10^4$  cells/mL

$$v1 = \frac{220,000 \text{ cells/mL} \times 50 \text{ mL}}{(c1) \times 215 \times 10^4 \text{ cells/mL}} = 5.1 \text{ mL}$$

Time Zero Counts: 1 22 2 25 Average: 23.5

No. of Cells/mL:  $23.5 \times 10^4$  cells/mL Initial Density: # cells/mL + 220  $\mu$ L x 10  $\mu$ L = 9773 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.9	25.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
(River Water) Site Control	8.1									
1.5	8.2									
3	8.2									
6	8.3									
11.9	8.5									
23.8	8.7									
47.6	8.9									
95.2	9.1	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SAU	SAU	SAU	ML	PL	SAU	SAU	ML	PL	SAU

Initial control pH: Well 1: 6.9 Well 2: 6.9

Final control pH: Well 1: 7.1 Well 2: 7.0

Light intensity (lux): 4390 Date measured: Sept. 24/21

Thermometer: 1 Light meter: 1 pH meter/probe: 1/1

Sample Description: Clear, yellowish, odourless liquid w/ some particulates

Comments: Dilutions were done with (River water) site control.

Reviewed: [Signature] Date reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: SynGene/HallDred Start Date/Time: Sept. 24/21 @ 1500h  
 Work Order #: Treated OSPN Termination Date: Sept. 27/21 @ 1500h  
 Sample ID: 211938 Test set up by: SAU  
 % (v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	20					SAU
	B	18					
	C	21					
	D	21					
	E	22					
	F	20					
	G	19					
	H	22					
1.5	A	77					
	B	81					
	C	94					
	D	89					
3	A	82					
	B	77					
	C	78					
	D	81					
6	A	69					
	B	64					
	C	79					
	D	72					
11.9	A	75					
	B	64					
	C	81					
	D	72					
23.8	A	61					
	B	79					
	C	64					
	D	68					
47.6	A	49					
	B	44					
	C	55					
	D	41					
95.2	A	31					
	B	39					
	C	38					
	D	32					

Comments:

Reviewed by: 

Date Reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: (syncrude) Halkfield Start Date/Time: Sept. 24/21 @ 1500h  
 Work Order #: 211938 Termination Date: Sept. 27/21 @ 1500h  
 Sample ID: Treated DSPW Test set up by: SAH  
 %(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control <sup>sm</sup>  Site Control  (River Water)	A	80					SAH
	B	108					
	C	88					
	D	87					
	E	101					
	F	90					
	G	82					
	H	95					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by: 

Date Reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 211938  
 Sample ID: Treated OSPW

Start Date/Time: 24-Sept-21 @ 1700h 1500h  
 Termination Date/Time: 27-Sept-21 @ 1700h 1500h

pg.1

Initial Cell Density: 9773 cell/mL 215000  
 0.22  
 0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> )	9772.727
% (v/v)							cell/mL	
Control	A	20				20	19.0	mean 19.4
	B	18				18	17.0	SD 1.407886
	C	21				21	20.0	CV 7.257994
	D	21				21	20.0	
	E	22				22	21.0	
	F	20				20	19.0	
	G	19				19	18.0	
	H	22				22	21.0	
1.5	A	77				77	76.0	
	B	84				84	83.0	
	C	94				94	93.0	
	D	89				89	88.0	
3	A	82				82	81.0	
	B	77				77	76.0	
	C	78				78	77.0	
	D	84				84	83.0	
6	A	69				69	68.0	
	B	64				64	63.0	
	C	79				79	78.0	
	D	72				72	71.0	
11.9	A	75				75	74.0	
	B	64				64	63.0	
	C	81				81	80.0	
	D	72				72	71.0	
23.8	A	61				61	60.0	
	B	79				79	78.0	
	C	64				64	63.0	
	D	68				68	67.0	
47.6	A	49				49	48.0	
	B	44				44	43.0	
	C	55				55	54.0	
	D	41				41	40.0	
95.2	A	31				31	30.0	
	B	39				39	38.0	
	C	38				38	37.0	
	D	32				32	31.0	

Reviewed by: 

Date reviewed: Oct. 29, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 211938  
 Sample ID: Treated OSPW

Start Date/Time: 24-Sept-21 @ 1700h <sup>1500h</sup>  
 Termination Date/Time: 27-Sept-21 @ 1700h <sup>1500h</sup>

pg.2

Initial Cell Density: 9773 cell/mL 215000

0.22

0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> )		9772.727
% (v/v)							cell/mL		
Site Control (River Water)	A	80				80	79.0	mean	90.4
	B	108				108	107.0	SD	9.50094
	C	88				88	87.0	CV	10.51015
	D	87				87	86.0		
	E	101				101	100.0		
	F	90				90	89.0		
	G	82				82	81.0		
	H	95				95	94.0		
1.5	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
3	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
11.9	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
23.8	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
47.6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
95.2	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: 

Date reviewed: Oct - 27, 2021



# CETIS Analytical Report

Report Date: 27 Oct-21 16:24 (p 5 of 6)  
Test Code/ID: 211938 / 07-4593-5616

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 17-7207-7794	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 27 Oct-21 16:23	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 19-4877-4572	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 24 Sep-21 15:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 27 Sep-21 15:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 7d
Sample ID: 04-9475-2352	Code: Treated OSPW	Project: Special Studies
Sample Date: 19 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 5d 2h (15.8 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	1.5	3	2.121	66.67	12.27%

## Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	1.224	2.526	11.09	10	CDF	0.4385	Non-Significant Effect
		3*	2.534	2.526	11.09	10	CDF	0.0492	Significant Effect
		6*	4.641	2.526	11.09	10	CDF	2.5E-04	Significant Effect
		11.9*	4.185	2.526	11.09	10	CDF	8.5E-04	Significant Effect
		23.8*	5.324	2.526	11.09	10	CDF	3.8E-05	Significant Effect
		47.6*	10.05	2.526	11.09	10	CDF	<1.0E-37	Significant Effect
		95.2*	12.84	2.526	11.09	10	CDF	<1.0E-37	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.592	2.991	0.2382	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.592		0.9049	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	12047.6	1721.09	7	33.48	<1.0E-37	Significant Effect
Error	1439.38	51.4062	28			
Total	13487		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	4.728	18.48	0.6931	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.974	0.9166	0.5442	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	90.38	82.43	98.32	88	79	107	3.359	10.51%	0.00%
1.5		4	85	73.45	96.55	85.5	76	93	3.629	8.54%	5.95%
3		4	79.25	73.99	84.51	79	76	83	1.652	4.17%	12.31%
6		4	70	60.02	79.98	69.5	63	78	3.136	8.96%	22.54%
11.9		4	72	60.75	83.25	72.5	63	80	3.536	9.82%	20.33%
23.8		4	67	54.47	79.53	65	60	78	3.937	11.75%	25.86%
47.6		4	46.25	36.49	56.01	45.5	40	54	3.065	13.26%	48.82%
95.2		4	34	27.5	40.5	34	30	38	2.041	12.01%	62.38%



CETIS Analytical Report

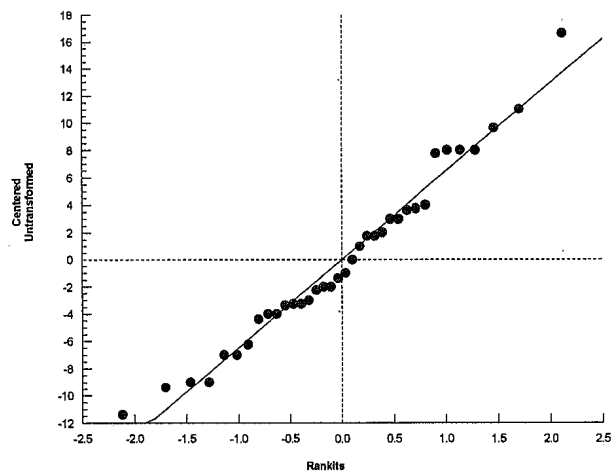
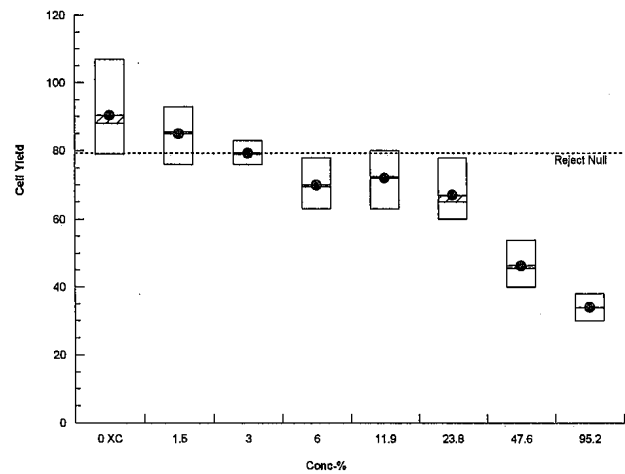
Report Date: 27 Oct-21 16:24 (p 6 of 6)  
Test Code/ID: 211938 / 07-4593-5616

EC Alga Growth Inhibition Test Nautilus Environmental

Analysis ID: 17-7207-7794      Endpoint: Cell Yield      CETIS Version: CETISv1.9.4  
Analyzed: 27 Oct-21 16:23      Analysis: Parametric-Control vs Treatments      Status Level: 1

Cell Yield Detail									
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	79	107	87	86	100	89	81	94
1.5		76	83	93	88				
3		81	76	77	83				
6		68	63	78	71				
11.9		74	63	80	71				
23.8		60	78	63	67				
47.6		48	43	54	40				
95.2		30	38	37	31				

Graphics





# CETIS Analytical Report

Report Date: 27 Oct-21 16:24 (p 1 of 2)  
Test Code/ID: 211938 / 07-4593-5616

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 09-7348-9368	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 27 Oct-21 16:23	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 19-4877-4572	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 24 Sep-21 15:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 27 Sep-21 15:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 7d
Sample ID: 04-9475-2352	Code: Treated OSPW	Project: Special Studies
Sample Date: 19 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 5d 2h (15.8 °C)	Client: Hatfield	

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Gompertz: $\mu = \alpha \cdot \exp[\log[0.5] \cdot (x/\delta)^{\gamma}]$	Normal [ $w=1$ ]	Off [ $\mu^*=\mu$ ]	None	None

## Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
5	-71.16	149.1	153.1	0.8566	Yes	1.494	2.558	0.2234	Non-Significant Lack of Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.9983	0.1166	2.452	100.2	40.79	857.4
IC10	3.076	1.412	5.26	32.5	19.01	70.83
IC15	6.058	3.547	9.178	16.51	10.9	28.19
IC20	9.946	6.572	14.02	10.05	7.133	15.22
IC25	14.8	10.59	19.78	6.759	5.055	9.446
IC40	36.31	28.96	44.86	2.754	2.229	3.454
IC50	58.52	46.05	73.56	1.709	1.359	2.171

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	89.65	2.455	84.65	94.64	36.52	<1.0E-37	Significant Parameter
$\gamma$	0.6396	0.09006	0.4563	0.8228	7.102	<1.0E-37	Significant Parameter
$\delta$	58.52	7.699	42.85	74.18	7.601	<1.0E-37	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	190500	63480	3	1149	<1.0E-37	Significant
Lack of Fit	384.1	76.81	5	1.494	0.2234	Non-Significant
Pure Error	1439	51.41	28			
Residual	1823	55.26	33			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Extreme Value	Grubbs Extreme Value Test	2.404	2.991	0.4504	No Outliers Detected
Variances	Bartlett Equality of Variance Test	4.728	14.07	0.6931	Equal Variances
	Mod Levene Equality of Variance	0.539	2.359	0.7975	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9678	0.9398	0.3673	Normal Distribution
	Anderson-Darling A2 Normality Test	0.3471	2.492	0.4838	Normal Distribution
Control Trend	Mann-Kendall Trend Test	2		0.9049	Non-Significant Trend in Controls



# CETIS Analytical Report

Report Date: 27 Oct-21 16:24 (p 2 of 2)  
Test Code/ID: 211938 / 07-4593-5616

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 09-7348-9368  
Analyzed: 27 Oct-21 16:23

Endpoint: Cell Yield  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Summary

### Calculated Variate

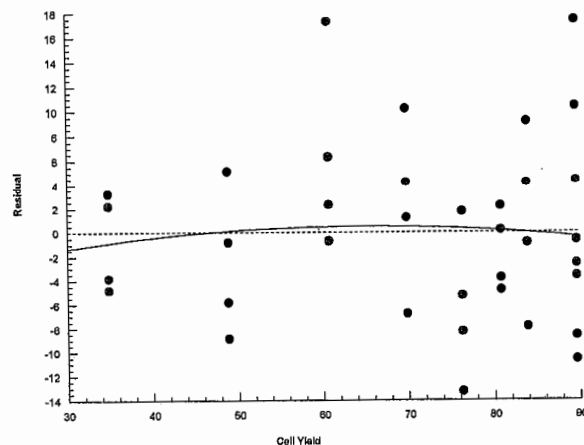
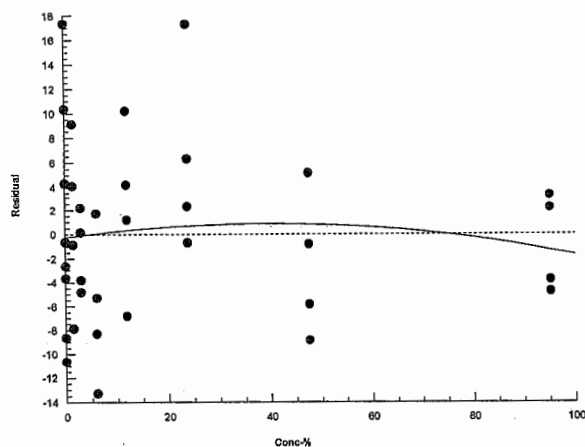
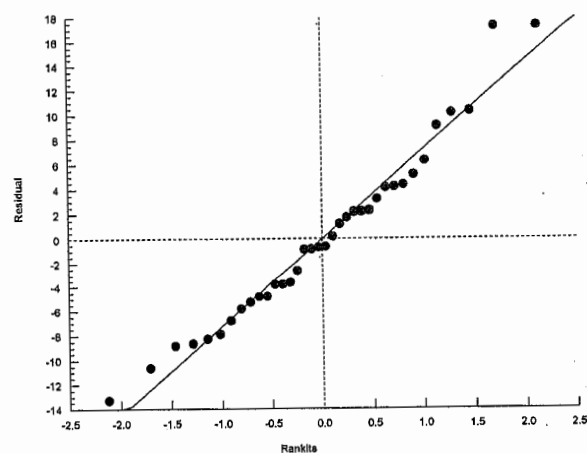
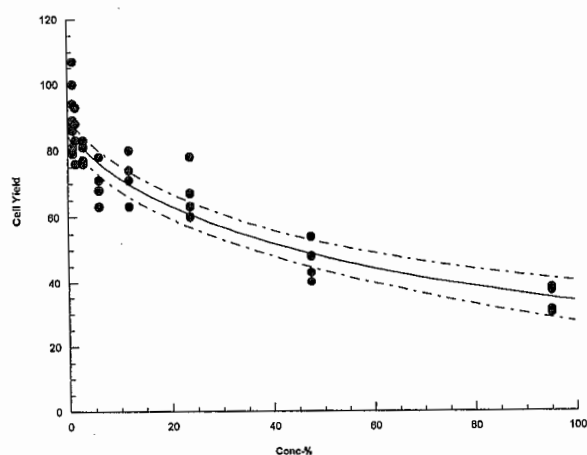
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	8	90.38	79	107	3.359	9.501	10.51%	0.0%
1.5		4	85	76	93	3.629	7.257	8.54%	5.95%
3		4	79.25	76	83	1.652	3.304	4.17%	12.31%
6		4	70	63	78	3.136	6.272	8.96%	22.54%
11.9		4	72	63	80	3.536	7.071	9.82%	20.33%
23.8		4	67	60	78	3.937	7.874	11.75%	25.86%
47.6		4	46.25	40	54	3.065	6.131	13.26%	48.82%
95.2		4	34	30	38	2.041	4.082	12.01%	62.38%

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	79	107	87	86	100	89	81	94
1.5		76	83	93	88				
3		81	76	77	83				
6		68	63	78	71				
11.9		74	63	80	71				
23.8		60	78	63	67				
47.6		48	43	54	40				
95.2		30	38	37	31				

### Graphics

Model: 3P Log-Gompertz:  $\mu = \alpha \cdot \exp[\log[0.5] \cdot (x/\delta)^\gamma]$  Distribution: Normal ( $\omega=1$ )





# CETIS Analytical Report

Report Date: 27 Oct-21 16:24 (p 3 of 6)  
Test Code/ID: 211938 / 07-4593-5616

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 15-8336-7702	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 27 Oct-21 16:22	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 19-4877-4572	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 24 Sep-21 15:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 27 Sep-21 15:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 7d
Sample ID: 04-9475-2352	Code: Treated OSPW	Project: Special Studies
Sample Date: 19 Sep-21 13:00	Material: Water Sample	Source: Hatfield
Receipt Date: 23 Sep-21 12:33	CAS (PC):	Station: Treated OSPW
Sample Age: 5d 2h (15.8 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C < T	<1.5	1.5	n/a	>66.67	43.25%

## Dunnett Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	1.5*		19.79	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	3*		18.05	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	6*		15.26	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	11.9*		15.87	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	23.8*		14.36	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	47.6*		8.103	2.526	8.379	10	CDF	<1.0E-37	Significant Effect
	95.2*		4.409	2.526	8.379	10	CDF	4.6E-04	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.271	2.991	0.6822	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.271		0.7305	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	20804.3	2972.04	7	101.3	<1.0E-37	Significant Effect
Error	821.375	29.3348	28			
Total	21625.6		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	14.6	18.48	0.0414	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9727	0.9166	0.5041	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	19.38	18.2	20.55	19.5	17	21	0.4978	7.27%	0.00%
1.5		4	85	73.45	96.55	85.5	76	93	3.629	8.54%	-338.71%
3		4	79.25	73.99	84.51	79	76	83	1.652	4.17%	-309.03%
6		4	70	60.02	79.98	69.5	63	78	3.136	8.96%	-261.29%
11.9		4	72	60.75	83.25	72.5	63	80	3.536	9.82%	-271.61%
23.8		4	67	54.47	79.53	65	60	78	3.937	11.75%	-245.81%
47.6		4	46.25	36.49	56.01	45.5	40	54	3.065	13.26%	-138.71%
95.2		4	34	27.5	40.5	34	30	38	2.041	12.01%	-75.48%



# CETIS Analytical Report

Report Date: 27 Oct-21 16:24 (p 4 of 6)  
Test Code/ID: 211938 / 07-4593-5616

## EC Alga Growth Inhibition Test

Nautilus Environmental

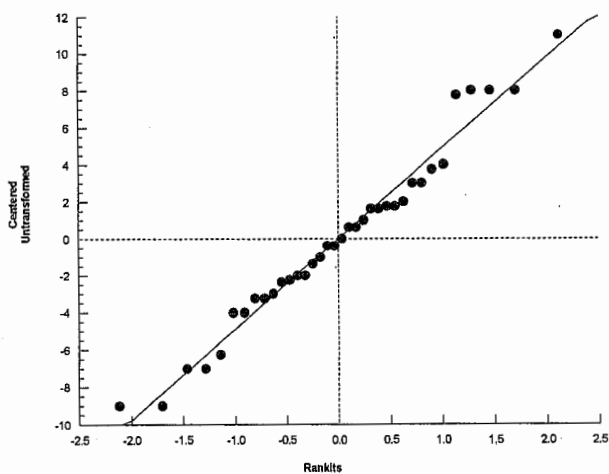
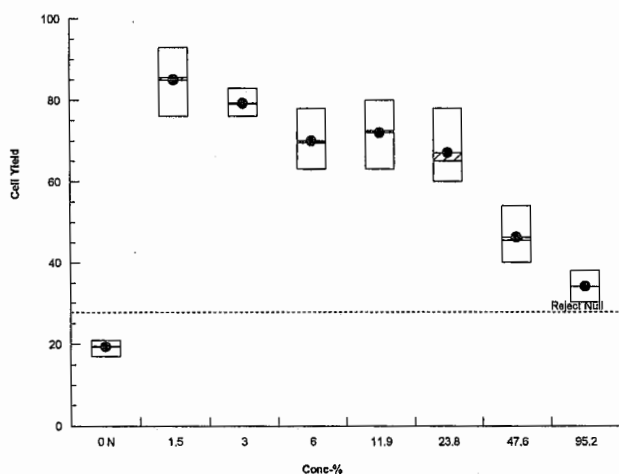
Analysis ID: 15-8336-7702  
Analyzed: 27 Oct-21 16:22  
Endpoint: Cell Yield  
Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	19	17	20	20	21	19	18	21
1.5		76	83	93	88				
3		81	76	77	83				
6		68	63	78	71				
11.9		74	63	80	71				
23.8		60	78	63	67				
47.6		48	43	54	40				
95.2		30	38	37	31				

### Graphics





***Pseudokirchneriella subcapitata* Summary Sheet**

Client: Hatfield  
Work Order No.: 212001

Start Date: Sept. 30/21  
Set up by: SAU

**Sample Information:**

Sample ID: Treated OSPW  
Sample Date: Sept. 26/21  
Date Received: Sept. 30/21  
Sample Volume: 1 x 20L

**Test Organism Information:**

Culture Date: Sept. 1/21 Sept. 24/21  
Age of culture (Day 0): 6d

**Zinc Reference Toxicant Results:**

Reference Toxicant ID: SC220  
Stock Solution ID: 21Zn01  
Date Initiated: Sept. 30/21

72-h IC50 (95% CL): 30.2 (26.5 - 34.2)  $\mu$ g/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4)  $\mu$ g/L Zn CV (%): 9

**Test Results:**

	Algal Growth
IC25 %(v/v) (95% CL)	8.9 (6.2 - 14.1)
IC50 %(v/v) (95% CL)	38.5 (28.3 - 46.0)

Reviewed by: 

Date reviewed: Nov. 5, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client : Hatfield (Synovate) Setup by: SAM  
 Sample ID: Treated OSPW Test Date/Time: Sept. 30/21 @ 1700h  
 Work Order No.: 212001 CER #: 4

Test Species: Pseudokirchneriella subcapitata  
 Culture Date: 092421 Age of Culture: 6d Culture Health: Good  
 Culture Count: 1 240 2 270 Average: 280 Culture Cell Density (c1):  $280 \times 10^4$  cells/mL

$$v1 = \frac{220,000 \text{ cells/mL} \times 60 \text{ mL}}{(c1) \quad 280 \times 10^4 \text{ cells/mL}} = 4.7 \text{ mL}$$

Time Zero Counts: 1 22 2 21 Average: 21.5

No. of Cells/mL:  $21.5 \times 10^4$  cells/mL Initial Density: # cells/mL + 220  $\mu$ L x 10  $\mu$ L =  $9773 \text{ cells/mL}$

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.9	23.0	25.0	24.0	25.0	25.0	✓	✓	✓	✓
(River water) Site Control	8.1	24.0								
1.5	8.2									
3	8.2									
6	8.3									
11.9	8.5									
23.8	8.7									
47.6	8.9									
95.2	9.2	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SAM	SAM	SAM	SAM	ML	RT	SAM	SAM	ML	RT

Initial control pH: Well 1: 6.8 Well 2: 6.8

Final control pH: Well 1: 6.9 Well 2: 6.9

Light intensity (lux): 4210 Date measured: Sept 30/21

Thermometer: 1 Light meter: 1 pH meter/probe: 1 / 1

Sample Description: Clear, yellow, odourless, w / some particulates

Comments: Dilutions done using site control (River water)

Reviewed: [Signature] Date reviewed: Nov 5, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Halliburton/Synco Start Date/Time: Sept. 30/21 @ 1700h  
 Work Order #: 212001 Termination Date: 5<sup>pm</sup> Oct. 3/21 @ 1700h  
 Sample ID: Treated OSPW Test set up by: SMU  
 %(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	22					SMU
	B	24					
	C	21					
	D	23					
	E	25					
	F	25					
	G	20					
	H	22					
1.5	A	72					
	B	83					
	C	67					
	D	70					
3	A	58					
	B	54					
	C	65					
	D	75					
6	A	66					
	B	62					
	C	57					
	D	64					
11.9	A	44					
	B	57					
	C	45					
	D	59					
23.8	A	40					
	B	51					
	C	43					
	D	52					
47.6	A	36					
	B	31					
	C	26					
	D	33					
95.2	A	24					
	B	20					
	C	22					
	D	21					

Comments:

Reviewed by:

Date Reviewed:



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Hatfield/synode Start Date/Time: Sept. 30/21 @ 1700h  
 Work Order #: 212001 Termination Date: Oct. 3/21 @ 1700h  
 Sample ID: Treated OSPW Test set up by: SAN  
 % (v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control  Site Control  (River Water)	A	71					SAN  ↓
	B	75					
	C	72					
	D	72					
	E	81					
	F	77					
	G	71					
	H	76					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Nov 5, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 212001  
 Sample ID: Treated OSPW

Start Date/Time: 30-Sept-21 @1700h  
 Termination Date/Time: 3-Oct-21 @1700h

pg.1

Initial Cell Density: 9773 cell/mL  
 215000  
 0.22  
 0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		9772.727
% (v/v)									
Control	A	22				22	21.0	mean	21.8
	B	24				24	23.0	SD	1.832251
	C	21				21	20.0	CV	8.415348
	D	23				23	22.0		
	E	25				25	24.0		
	F	25				25	24.0		
	G	20				20	19.0		
	H	22				22	21.0		
1.5	A	72				72	71.0		
	B	83				83	82.0		
	C	67				67	66.0		
	D	70				70	69.0		
3	A	58				58	57.0		
	B	54				54	53.0		
	C	65				65	64.0		
	D	75				75	74.0		
6	A	66				66	65.0		
	B	62				62	61.0		
	C	57				57	56.0		
	D	64				64	63.0		
11.9	A	44				44	43.0		
	B	57				57	56.0		
	C	45				45	44.0		
	D	59				59	58.0		
23.8	A	40				40	39.0		
	B	51				51	50.0		
	C	43				43	42.0		
	D	52				52	51.0		
47.6	A	36				36	35.0		
	B	31				31	30.0		
	C	35				35	34.0		
	D	33				33	32.0		
95.2	A	24				24	23.0		
	B	20				20	19.0		
	C	22				22	21.0		
	D	21				21	20.0		

Reviewed by: 

Date reviewed: Nov 5, 2021



***Pseudokirchneriella subcapitata* Algal Counts**


Client: Hatfield  
 WO#: 212001  
 Sample ID: Treated OSPW

Start Date/Time: 30-Sept-21 @1700h  
 Termination Date/Time: 3-Oct-21 @1700h

pg.2

Initial Cell Density: 9773 cell/mL  
 215000  
 0.22  
 0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		9772.727
% (v/v)									
Site Control	A	71				71	70.0	mean	73.4
	B	75				75	74.0	SD	3.543102
	C	72				72	71.0	CV	4.827264
	D	72				72	71.0		
	E	81				81	80.0		
	F	77				77	76.0		
	G	71				71	70.0		
	H	76				76	75.0		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: 

Date reviewed: Nov 5, 2021



# CETIS Analytical Report

Report Date: 04 Nov-21 15:15 (p 3 of 4)  
Test Code/ID: 212001a / 17-9124-7842

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 11-1922-7709	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 04 Nov-21 15:14	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 13-6499-1540	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 30 Sep-21 17:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 03 Oct-21 17:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 13-5892-9582	Code: Treated OSPW	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 30 Sep-21 11:31	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 5h (13.7 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	1.5	3	2.121	66.67	11.59%

## Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	0.4085	2.526	8.503	10	CDF	0.8172	Non-Significant Effect
		3*	3.38	2.526	8.503	10	CDF	0.0068	Significant Effect
		6*	3.602	2.526	8.503	10	CDF	0.0039	Significant Effect
		11.9*	6.871	2.526	8.503	10	CDF	<1.0E-37	Significant Effect
		23.8*	8.282	2.526	8.503	10	CDF	<1.0E-37	Significant Effect
		47.6*	12.07	2.526	8.503	10	CDF	<1.0E-37	Significant Effect
		95.2*	15.64	2.526	8.503	10	CDF	<1.0E-37	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.441	2.991	0.3992	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.441		0.7232	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	11326.9	1618.12	7	53.56	<1.0E-37	Significant Effect
Error	845.875	30.2098	28			
Total	12172.8		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	12.21	18.48	0.0940	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9809	0.9166	0.7766	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	73.38	70.41	76.34	72.5	70	80	1.253	4.83%	0.00%
1.5		4	72	60.9	83.1	70	66	82	3.488	9.69%	1.87%
3		4	62	47.36	76.64	60.5	53	74	4.601	14.84%	15.50%
6		4	61.25	55.1	67.4	62	56	65	1.931	6.31%	16.52%
11.9		4	50.25	37.76	62.74	50	43	58	3.924	15.62%	31.52%
23.8		4	45.5	36.09	54.91	46	39	51	2.958	13.00%	37.99%
47.6		4	32.75	29.22	36.28	33	30	35	1.109	6.77%	55.37%
95.2		4	20.75	18.03	23.47	20.5	19	23	0.8539	8.23%	71.72%



# CETIS Analytical Report

Report Date: 04 Nov-21 15:15 (p 4 of 4)  
Test Code/ID: 212001a / 17-9124-7842

## EC Alga Growth Inhibition Test

Nautilus Environmental

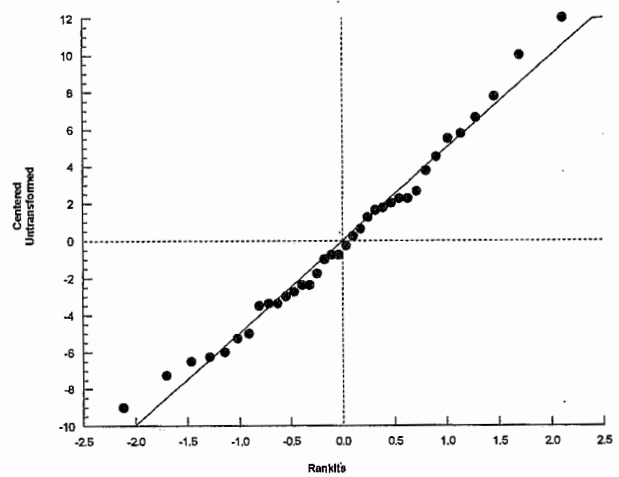
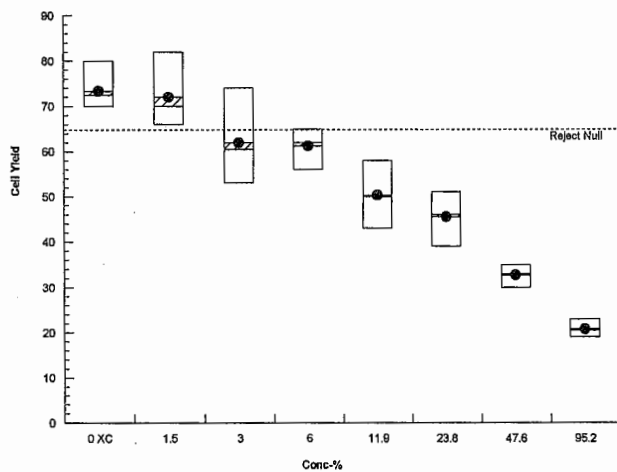
Analysis ID: 11-1922-7709 Endpoint: Cell Yield  
Analyzed: 04 Nov-21 15:14 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	70	74	71	71	80	76	70	75
1.5		71	82	66	69				
3		57	53	64	74				
6		65	61	56	63				
11.9		43	56	44	58				
23.8		39	50	42	51				
47.6		35	30	34	32				
95.2		23	19	21	20				

### Graphics





## CETIS Analytical Report

Report Date: 04 Nov-21 15:15 (p 1 of 2)  
 Test Code/ID: 212001a / 17-9124-7842

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 19-5599-4545	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 04 Nov-21 15:15	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 13-6499-1540	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 30 Sep-21 17:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 03 Oct-21 17:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 13-5892-9582	Code: Treated OSPW	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 30 Sep-21 11:31	CAS (PC):	Station: Treated OSPW
Sample Age: 4d 5h (13.7 °C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1108605	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha$ :5%)
Extreme Value	Grubbs Extreme Value Test	2.441	2.991	0.3992	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.441		0.7232	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	1.785	n/a	3.539	56.04	28.26	n/a
IC10	2.309	1.164	5.281	43.32	18.94	85.9
IC15	2.931	1.77	8.915	34.11	11.22	56.51
IC20	7.066	0.3113	9.678	14.15	10.33	321.3
IC25	8.89	6.165	14.12	11.25	7.081	16.22
IC40	25.81	8.982	33.89	3.875	2.951	11.13
IC50	38.48	28.33	46.02	2.599	2.173	3.529

## Cell Yield Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	8	73.38	70	80	3.543	4.83%	0.0%	73.38	0.0%
1.5		4	72	66	82	6.976	9.69%	1.87%	72	1.87%
3		4	62	53	74	9.201	14.84%	15.5%	62	15.5%
6		4	61.25	56	65	3.862	6.31%	16.52%	61.25	16.52%
11.9		4	50.25	43	58	7.848	15.62%	31.52%	50.25	31.52%
23.8		4	45.5	39	51	5.916	13.00%	37.99%	45.5	37.99%
47.6		4	32.75	30	35	2.217	6.77%	55.37%	32.75	55.37%
95.2		4	20.75	19	23	1.708	8.23%	71.72%	20.75	71.72%

## Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	70	74	71	71	80	76	70	75
1.5		71	82	66	69				
3		57	53	64	74				
6		65	61	56	63				
11.9		43	56	44	58				
23.8		39	50	42	51				
47.6		35	30	34	32				
95.2		23	19	21	20				



# CETIS Analytical Report

Report Date: 04 Nov-21 15:15 (p 2 of 2)  
Test Code/ID: 212001a / 17-9124-7842

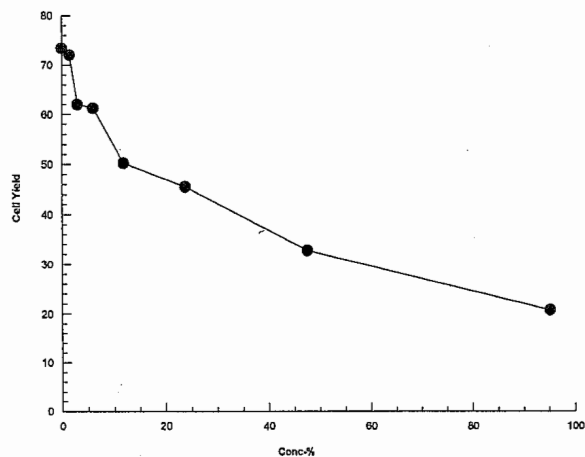
## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 19-5599-4545      Endpoint: Cell Yield  
Analyzed: 04 Nov-21 15:15      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





### *Pseudokirchneriella subcapitata* Summary Sheet

Client: Hatfield  
Work Order No.: 212001

Start Date: Sept. 30/21 @ 1700h  
Set up by: SAU

#### Sample Information:

Sample ID: Reactor 2 Water  
Sample Date: Sept. 26/21  
Date Received: Sept. 30/21  
Sample Volume: 2 x 26L

#### Test Organism Information:

Culture Date: Sept. 24/21  
Age of culture (Day 0): 6d

#### Zinc Reference Toxicant Results:

Reference Toxicant ID: Sc 220  
Stock Solution ID: 21Zn01  
Date Initiated: Sept. 30/21

72-h IC<sub>50</sub> (95% CL): 30.2 (26.5 - 34.2) µg/L Zn

72-h IC<sub>50</sub> Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4) µg/L Zn CV (%): 9

#### Test Results:

	Algal Growth
IC <sub>25</sub> %(v/v) (95% CL)	60.4 (44.9 - 66.9)
IC <sub>50</sub> %(v/v) (95% CL)	> 95.2

Reviewed by: 

Date reviewed: Nov. 5, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client: Hatfield/Syncrude Setup by: SAH  
 Sample ID: Reactor 2 water Test Date/Time: Sept. 30/21 @ 1700h  
 Work Order No.: 212001 CER #: 4

Test Species: Pseudokirchneriella subcapitata  
 Culture Date: Sept. 24/21 Age of Culture: 6d Culture Health: Good  
 Culture Count: 1 290 2 270 Average: 280 Culture Cell Density (c1):  $280 \times 10^4$  cells/mL

$$v1 = \frac{220,000 \text{ cells/mL} \times 60 \text{ mL}}{(c1) \quad 280 \times 10^4 \text{ cells/mL}} = 4.7 \text{ mL}$$

Time Zero Counts: 1 22 2 21 Average: 21.5

No. of Cells/mL:  $21.5 \times 10^4$  cells/mL Initial Density: # cells/mL + 220  $\mu$ L x 10  $\mu$ L = 9773 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.9	23.0	25.0	24.0	25.0	25.0	✓	✓	✓	✓
(River water) Site Control	8.1	24.0	↓	↓	↓	↓	↓	↓	↓	↓
1.5	8.1	↓	↓	↓	↓	↓	↓	↓	↓	↓
3	8.1	↓	↓	↓	↓	↓	↓	↓	↓	↓
6	8.2	↓	↓	↓	↓	↓	↓	↓	↓	↓
11.9	8.2	↓	↓	↓	↓	↓	↓	↓	↓	↓
23.8	8.3	↓	↓	↓	↓	↓	↓	↓	↓	↓
47.6	8.4	↓	↓	↓	↓	↓	↓	↓	↓	↓
95.2	8.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SAH	SAH	SAH	SAH	702	RZJ	SAH	SAH	702	RZJ

Initial control pH: Well 1: 6.8 Well 2: 6.8

Final control pH: Well 1: 6.9 Well 2: 6.9

Light intensity (lux): 4210 Date measured: Sept. 30/21

Thermometer: 1 Light meter: 1 pH meter/probe: 1 / 1

Sample Description: Clear, yellowish, odourless, w/ A<sub>680</sub> some particulates

Comments: Dilution done using site control (River water)

Reviewed: SAH Date reviewed: Nov. 5, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Halliburton/Sydney Start Date/Time: Sept. 30/21 @ 1700h  
 Work Order #: 212001 Termination Date: Oct. 3/21 @ 1700h  
 Sample ID: Reactor 2 Water Test set up by: SAW  
 %(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	20					SAW
	B	19					
	C	20					
	D	19					
	E	20					
	F	19					
	G	21					
	H	19					
1.5	A	54					
	B	53					
	C	47					
	D	61					
3	A	64					
	B	47					
	C	50					
	D	64					
6	A	67					
	B	52					
	C	63					
	D	67					
11.9	A	67					
	B	64					
	C	59					
	D	64					
23.8	A	51					
	B	74					
	C	52					
	D	71					
47.6	A	65					
	B	62					
	C	49					
	D	67					
95.2	A	40					
	B	33					
	C	32					
	D	37					

Comments: \_\_\_\_\_

Reviewed by: [Signature] Date Reviewed: Nov 5, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Hartfield/SynGene Start Date/Time: Sept. 20/21 @ 1700h  
 Work Order #: 212001 Termination Date: Oct. 3/21 @ 1700h  
 Sample ID: Reactor 2 water Test set up by: SAU  
 % (v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control  Side Control	A	74					SAU
	B	68					
	C	66					
	D	69					
	E	66					
	F	66					
	G	67					
	H	70					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Nov. 5, 2021



***Pseudokirchneriella subcapitata* Algal Counts**


Client: Hatfield  
 WO#: 212001  
 Sample ID: Reactor 2 Water

Start Date/Time: 30-Sept-21 @1700h  
 Termination Date/Time: 3-Oct-21 @1700h

pg.1

Initial Cell Density: 9773 cell/mL  
 215000  
 0.22  
 0.01  
 9772.727

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		
% (v/v)									
Control	A	20				20	19.0	mean	18.6
	B	19				19	18.0	SD	0.744024
	C	20				20	19.0	CV	3.98989
	D	19				19	18.0		
	E	20				20	19.0		
	F	19				19	18.0		
	G	21				21	20.0		
	H	19				19	18.0		
1.5	A	54				54	53.0		
	B	53				53	52.0		
	C	47				47	46.0		
	D	61				61	60.0		
3	A	64				64	63.0		
	B	47				47	46.0		
	C	50				50	49.0		
	D	64				64	63.0		
6	A	67				67	66.0		
	B	52				52	51.0		
	C	63				63	62.0		
	D	67				67	66.0		
11.9	A	67				67	66.0		
	B	64				64	63.0		
	C	59				59	58.0		
	D	64				64	63.0		
23.8	A	51				51	50.0		
	B	74				74	73.0		
	C	52				52	51.0		
	D	71				71	70.0		
47.6	A	65				65	64.0		
	B	62				62	61.0		
	C	49				49	48.0		
	D	67				67	66.0		
95.2	A	40				40	39.0		
	B	33				33	32.0		
	C	32				32	31.0		
	D	37				37	36.0		

Reviewed by: 

Date reviewed: Nov 5, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 212001  
 Sample ID: Reactor 2 Water

Start Date/Time: 30-Sept-21 @1700h  
 Termination Date/Time: 3-Oct-21 @1700h

pg.2

Initial Cell Density: 9773 cell/mL 215000  
 0.22  
 0.01

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> )		9772.727
%(v/v)							cell/mL		
Site Control	A	74				74	73.0	mean	67.3
	B	68				68	67.0	SD	2.764572
	C	66				66	65.0	CV	4.109499
	D	69				69	68.0		
	E	66				66	65.0		
	F	66				66	65.0		
	G	67				67	66.0		
	H	70				70	69.0		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: 

Date reviewed: Nov 5, 2021



# CETIS Analytical Report

Report Date: 04 Nov-21 15:20 (p 1 of 2)  
Test Code/ID: 212001b / 07-4840-6517

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 01-3427-8941	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 04 Nov-21 15:17	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 13-6499-1540	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 30 Sep-21 17:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 03 Oct-21 17:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 19-5421-9269	Code: Reactor 2 Water	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 30 Sep-21 11:31	CAS (PC):	Station: Reactor 2 Water
Sample Age: 4d 5h (13.7 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	47.6	95.2	67.32	2.101	15.46%

## Dunnett Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5*	3.523	2.526	10.4	10	CDF	0.0048	Significant Effect
		3*	2.916	2.526	10.4	10	CDF	0.0209	Significant Effect
		6	1.458	2.526	10.4	10	CDF	0.3289	Non-Significant Effect
		11.9	1.154	2.526	10.4	10	CDF	0.4733	Non-Significant Effect
		23.8	1.519	2.526	10.4	10	CDF	0.3027	Non-Significant Effect
		47.6	1.822	2.526	10.4	10	CDF	0.1908	Non-Significant Effect
		95.2*	7.958	2.526	10.4	10	CDF	<1.0E-37	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.996	2.991	1.0000	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	1.996		0.5634	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3205.39	457.913	7	10.14	2.9E-06	Significant Effect
Error	1264.5	45.1607	28			
Total	4469.89		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	12.92	18.48	0.0741	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9713	0.9166	0.4615	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	67.25	64.94	69.56	66.5	65	73	0.9774	4.11%	0.00%
1.5		4	52.75	43.62	61.88	52.5	46	60	2.869	10.88%	21.56%
3		4	55.25	40.88	69.62	56	46	63	4.516	16.35%	17.84%
6		4	61.25	49.97	72.53	64	51	66	3.544	11.57%	8.92%
11.9		4	62.5	57.22	67.78	63	58	66	1.658	5.31%	7.06%
23.8		4	61	41.6	80.4	60.5	50	73	6.096	19.99%	9.29%
47.6		4	59.75	46.86	72.64	62.5	48	66	4.049	13.55%	11.15%
95.2		4	34.5	28.62	40.38	34	31	39	1.848	10.72%	48.70%



# CETIS Analytical Report

Report Date: 04 Nov-21 15:20 (p 2 of 2)  
Test Code/ID: 212001b / 07-4840-6517

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 01-3427-8941  
Analyzed: 04 Nov-21 15:17

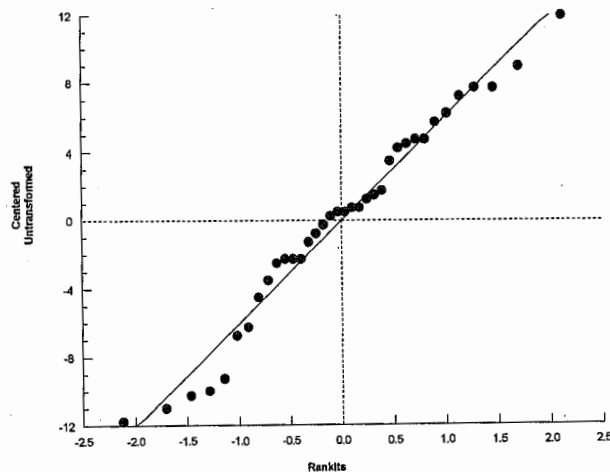
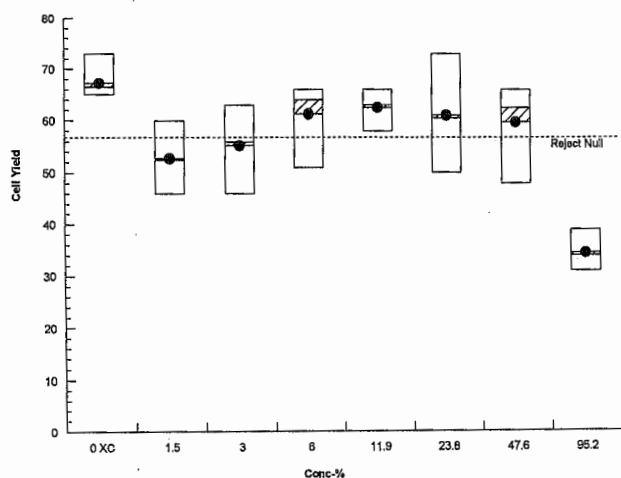
Endpoint: Cell Yield  
Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	73	67	65	68	65	65	66	69
1.5		53	52	46	60				
3		63	46	49	63				
6		66	51	62	66				
11.9		66	63	58	63				
23.8		50	73	51	70				
47.6		64	61	48	66				
95.2		39	32	31	36				

### Graphics





# CETIS Analytical Report

Report Date: 04 Nov-21 15:20 (p 1 of 2)  
Test Code/ID: 212001b / 07-4840-6517

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 06-9622-4859	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 04 Nov-21 15:19	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 13-6499-1540	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 30 Sep-21 17:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 03 Oct-21 17:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 19-5421-9269	Code: Reactor 2 Water	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 30 Sep-21 11:31	CAS (PC):	Station: Reactor 2 Water
Sample Age: 4d 5h (13.7 °C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	794559	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	1.996	2.991	1.0000	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	1.996		0.5634	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.4369	0.2133	1.013	228.9	98.73	468.7
IC10	1.065	0.4534	77.97	93.93	1.283	220.5
IC15	49.82	n/a	55.74	2.007	1.794	n/a
IC20	54.87	20.09	60.77	1.823	1.645	4.977
IC25	60.42	44.89	66.86	1.655	1.496	2.228
IC40	80.59	67.99	93.18	1.241	1.073	1.471
IC50	>95.2	n/a	n/a	<1.05	n/a	n/a

## Cell Yield Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	8	67.25	65	73	2.765	4.11%	0.0%	67.25	0.0%
1.5		4	52.75	46	60	5.737	10.88%	21.56%	58.75	12.64%
3		4	55.25	46	63	9.032	16.35%	17.84%	58.75	12.64%
6		4	61.25	51	66	7.089	11.57%	8.92%	58.75	12.64%
11.9		4	62.5	58	66	3.317	5.31%	7.06%	58.75	12.64%
23.8		4	61	50	73	12.19	19.99%	9.29%	58.75	12.64%
47.6		4	59.75	48	66	8.098	13.55%	11.15%	58.75	12.64%
95.2		4	34.5	31	39	3.697	10.72%	48.7%	34.5	48.7%

## Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	73	67	65	68	65	65	66	69
1.5		53	52	46	60				
3		63	46	49	63				
6		66	51	62	66				
11.9		66	63	58	63				
23.8		50	73	51	70				
47.6		64	61	48	66				
95.2		39	32	31	36				



# CETIS Analytical Report

Report Date: 04 Nov-21 15:20 (p 2 of 2)  
Test Code/ID: 212001b / 07-4840-6517

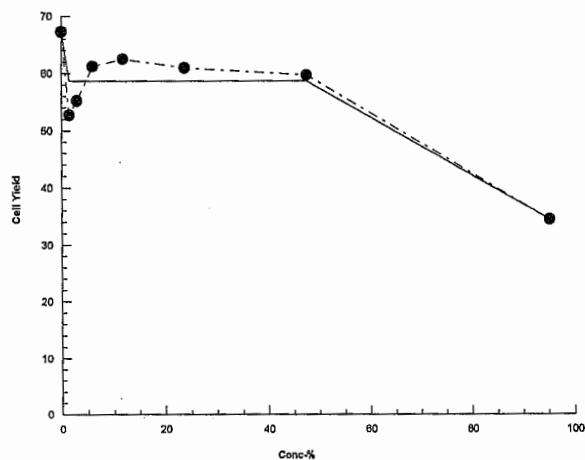
## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 06-9622-4859      Endpoint: Cell Yield  
Analyzed: 04 Nov-21 15:19      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





***Pseudokirchneriella subcapitata* Summary Sheet**

Client: Hartfield  
Work Order No.: 212081

Start Date: Oct. 7/21  
Set up by: SAU

**Sample Information:**

Sample ID: Treated OSPW  
Sample Date: Oct. 3/21  
Date Received: Oct. 7/21  
Sample Volume: 1 x 20L

**Test Organism Information:**

Culture Date: Oct. 1/21  
Age of culture (Day 0): 6d

**Zinc Reference Toxicant Results:**

Reference Toxicant ID: SC220  
Stock Solution ID: 21ZnO1  
Date Initiated: Sept. 30/21

72-h IC50 (95% CL): 30.2 (26.5 - 34.2)  $\mu$ g/L Zn

72-h IC50 Reference Toxicant Mean and Range: 31.8 (26.4 - 38.4)  $\mu$ g/L Zn CV (%): 9

**Test Results:**

	Algal Growth
IC25 %(v/v) (95% CL)	50.7 (41.5 - 60.0)
IC50 %(v/v) (95% CL)	82.9 (71.6 - 96.0)

Reviewed by: 

Date reviewed: Nov. 15, 2021



## 72-h Algal Growth Inhibition Toxicity Test Water Quality Measurements

Client : Hatfield/Synclude

Setup by: SAH

Sample ID: Treated OSPW

Test Date/Time: Oct. 7/21 @ 1600h

Work Order No.: 212081

CER #: 4

Test Species: Pseudokirchneriella subcapitata

Culture Date: Oct. 1/21

Age of Culture: 6d

Culture Health: Good

Culture Count: 1 160 2 170

Average: 165

Culture Cell Density (c1):  $165 \times 10^4$  cells/mL

$$v1 = \frac{220,000 \text{ cells/mL} \times 60 \text{ mL}}{(c1) \quad 165 \times 10^4 \text{ cells/mL}} = 8 \text{ mL}$$

Time Zero Counts: 1 22 2 22

Average: 22

No. of Cells/mL:  $22 \times 10^4$  cells/mL

Initial Density: # cells/mL + 220  $\mu$ L x 10  $\mu$ L = 10000 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature				Microplates rotated 2X per day?			
	pH	Temp (°C)	(°C)							
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.7	23.0	24.0	25.0	25.0	25.0	✓	✓	✓	✓
Site Control	8.3	22.0	↓	↓	↓	↓	↓	↓	↓	↓
1.5	8.3	↓	↓	↓	↓	↓	↓	↓	↓	↓
3	8.3	↓	↓	↓	↓	↓	↓	↓	↓	↓
6	8.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
11.9	8.6	↓	↓	↓	↓	↓	↓	↓	↓	↓
23.8	8.8	↓	↓	↓	↓	↓	↓	↓	↓	↓
47.6	9.2	↓	↓	↓	↓	↓	↓	↓	↓	↓
95.2	9.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
Initials	SAH	SAH	SAH	JL	JL	LB	SAH	JL	JL	KLS

Initial control pH: Well 1: 6.8

Well 2: 6.8

Final control pH: Well 1: 6.9

Well 2: 7.0

Light intensity (lux): 4240

Date measured: Oct. 7/21

Thermometer: 1 Light meter: 1 pH meter/probe: 1, 1

Sample Description: Clear, yellow, odorless, w/ some particulates

Comments: Dilutions were done using Site Control (River water) as

Reviewed: [Signature]

Date reviewed: Nov. 15, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: Synovate/Hatfield Start Date/Time: Oct. 7/21 @ 1600h  
 Work Order #: 212081 Termination Date: Oct. 10/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SM  
 %(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	21					SM
	B	20					
	C	22					
	D	20					
	E	20					
	F	22					
	G	25					
	H	21					
1.5	A	51					
	B	49					
	C	53					
	D	64					
3	A	54					
	B	49					
	C	49					
	D	54					
6	A	51					
	B	49					
	C	49					
	D	62					
11.9	A	62					
	B	58					
	C	61					
	D	53					
23.8	A	50					
	B	57					
	C	59					
	D	54					
47.6	A	39					
	B	42					
	C	44					
	D	42					
95.2	A	20					
	B	27					
	C	24					
	D	28					

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Nov. 15, 2021



***Pseudokirchneriella subcapitata* Toxicity Test Data Sheet**  
**72-h Algal Cell Counts**

Client: SynGene/Hallvard Start Date/Time: Oct. 7/21 @ 1600h  
 Work Order #: 212081 Termination Date: Oct 10/21 @ 1600h  
 Sample ID: Treated OSPW Test set up by: SAU  
 %(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control Site control (River water)	A	57					SAU
	B	50					
	C	65					
	D	54					
	E	56					
	F	58					
	G	53					
	H	65					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments: \_\_\_\_\_

Reviewed by:  Date Reviewed: Nov. 15, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 212081  
 Sample ID: Treated OSPW

Start Date/Time: 7-Oct-21 @1600h  
 Termination Date/Time: 10-Oct-21 @1600h

pg.1

Initial Cell Density: 10000 cell/mL  
 220000  
 0.22  
 0.01  
 10000

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		
% (v/v) Control	A	21				21	20.0	mean	20.4
	B	20				20	19.0	SD	1.685018
	C	22				22	21.0	CV	8.270027
	D	20				20	19.0		
	E	20				20	19.0		
	F	22				22	21.0		
	G	25				25	24.0		
	H	21				21	20.0		
1.5	A	51				51	50.0		
	B	49				49	48.0		
	C	53				53	52.0		
	D	64				64	63.0		
3	A	54				54	53.0		
	B	49				49	48.0		
	C	49				49	48.0		
	D	54				54	53.0		
6	A	51				51	50.0		
	B	49				49	48.0		
	C	49				49	48.0		
	D	62				62	61.0		
11.9	A	62				62	61.0		
	B	58				58	57.0		
	C	61				61	60.0		
	D	53				53	52.0		
23.8	A	50				50	49.0		
	B	57				57	56.0		
	C	59				59	58.0		
	D	54				54	53.0		
47.6	A	39				39	38.0		
	B	42				42	41.0		
	C	44				44	43.0		
	D	42				42	41.0		
95.2	A	20				20	19.0		
	B	27				27	26.0		
	C	24				24	23.0		
	D	28				28	27.0		

Reviewed by: 

Date reviewed: Nov 15, 2021



***Pseudokirchneriella subcapitata* Algal Counts**

Client: Hatfield  
 WO#: 212081  
 Sample ID: Treated OSPW

Start Date/Time: 7-Oct-21 @1600h  
 Termination Date/Time: 10-Oct-21 @1600h

pg.2

Initial Cell Density: 10000 cell/mL 220000  
 0.22  
 0.01  
 10000

Concentration	Rep	Count 1 (x 10 <sup>4</sup> )	Count 2 (x 10 <sup>4</sup> )	Count 3 (x 10 <sup>4</sup> )	Count 4 (x 10 <sup>4</sup> )	Mean (x 10 <sup>4</sup> )	Cell Yield (x 10 <sup>4</sup> ) cell/mL		
% (v/v)									
Site Control	A	57				57	56.0	mean	56.3
	B	50				50	49.0	SD	5.391793
	C	65				65	64.0	CV	9.585409
	D	54				54	53.0		
	E	56				56	55.0		
	F	58				58	57.0		
	G	53				53	52.0		
	H	65				65	64.0		
1.5	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
3	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
11.9	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
23.8	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
47.6	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
95.2	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: \_\_\_\_\_

Date reviewed: \_\_\_\_\_



# CETIS Analytical Report

Report Date: 10 Nov-21 15:27 (p 1 of 2)  
Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 00-4084-7011	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 10 Nov-21 15:25	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 17-3826-5090	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 07 Oct-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 10 Oct-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 00-1106-4238	Code: Treated OSPW	Project: Special Studies
Sample Date: 04 Oct-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 07 Oct-21 12:27	CAS (PC):	Station: Treated OSPW
Sample Age: 76h (10.7 °C)	Client: Hatfield	

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu = \alpha \cdot [1 - \Phi[\log[x/\delta]/\gamma]]$	Normal [ $\omega=1$ ]	Off [ $\mu^*=\mu$ ]	None	None

## Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
11	-56.72	120.2	124.2	0.8013	Yes	1.71	2.558	0.1650	Non-Significant Lack of Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	25.01	n/a	33.38	3.998	2.996	n/a
IC10	32.59	20.39	41.72	3.068	2.397	4.903
IC15	38.96	28.3	48.39	2.566	2.067	3.533
IC20	44.91	35.08	54.35	2.227	1.84	2.85
IC25	50.72	41.49	60.05	1.972	1.665	2.41
IC40	68.93	59.89	78.82	1.451	1.269	1.67
IC50	82.9	71.6	95.99	1.206	1.042	1.397

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	54.44	1.015	52.37	56.5	53.63	<1.0E-37	Significant Parameter
$\gamma$	0.7285	0.1315	0.461	0.996	5.541	3.7E-06	Significant Parameter
$\delta$	82.9	6.117	70.46	95.35	13.55	<1.0E-37	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	91160	30390	3	1226	<1.0E-37	Significant
Lack of Fit	191.3	38.27	5	1.71	0.1650	Non-Significant
Pure Error	626.5	22.38	28			
Residual	817.8	24.78	33			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Extreme Value	Grubbs Extreme Value Test	1.978	2.991	1.0000	No Outliers Detected
Variances	Bartlett Equality of Variance Test	5.455	14.07	0.6047	Equal Variances
	Mod Levene Equality of Variance	0.388	2.359	0.9015	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9409	0.9398	0.0541	Normal Distribution
	Anderson-Darling A2 Normality Test	0.5957	2.492	0.1234	Normal Distribution
Control Trend	Mann-Kendall Trend Test	6		0.5484	Non-Significant Trend in Controls



# CETIS Analytical Report

Report Date: 10 Nov-21 15:27 (p 2 of 2)  
Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 00-4084-7011  
Analyzed: 10 Nov-21 15:25

Endpoint: Cell Yield  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Summary

### Calculated Variate

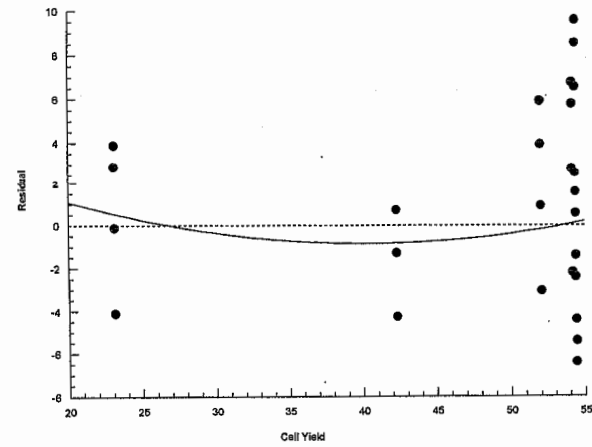
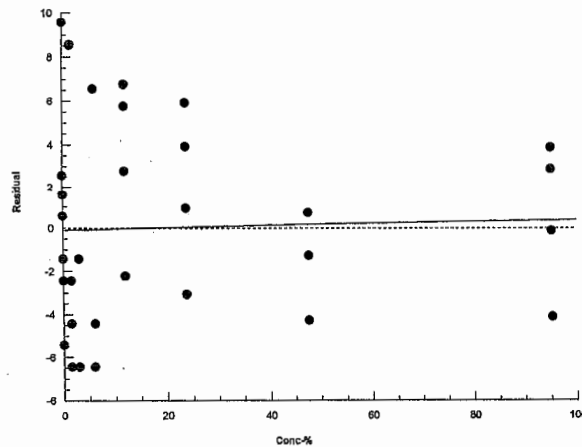
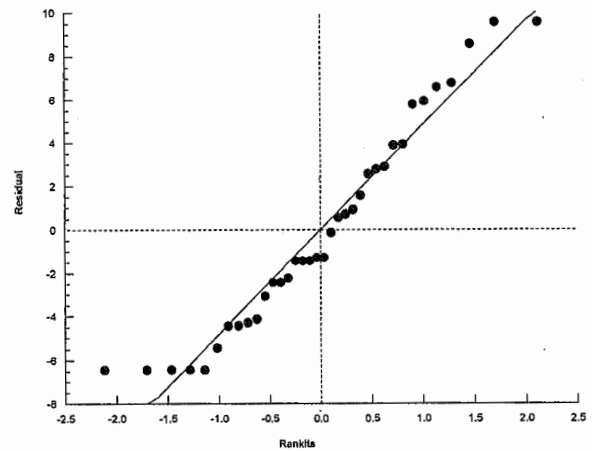
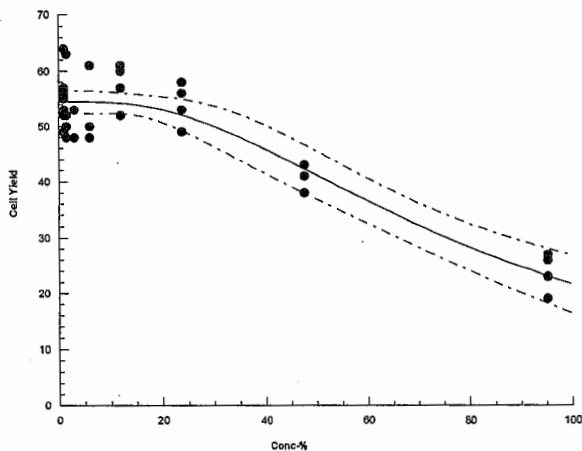
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	8	56.25	49	64	1.906	5.392	9.59%	0.0%
1.5		4	53.25	48	63	3.351	6.702	12.59%	5.33%
3		4	50.5	48	53	1.443	2.887	5.72%	10.22%
6		4	51.75	48	61	3.119	6.238	12.05%	8.0%
11.9		4	57.5	52	61	2.021	4.041	7.03%	-2.22%
23.8		4	54	49	58	1.958	3.916	7.25%	4.0%
47.6		4	40.75	38	43	1.031	2.062	5.06%	27.56%
95.2		4	23.75	19	27	1.797	3.594	15.13%	57.78%

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	56	49	64	53	55	57	52	64
1.5		50	48	52	63				
3		53	48	48	53				
6		50	48	48	61				
11.9		61	57	60	52				
23.8		49	56	58	53				
47.6		38	41	43	41				
95.2		19	26	23	27				

### Graphics

Model: 3P Cum Log-Normal (Probit):  $\mu = \alpha \cdot [1 - \Phi[\log(x/\delta)/\gamma]]$  Distribution: Normal [ $\omega=1$ ]





# CETIS Analytical Report

Report Date: 10 Nov-21 15:27 (p 3 of 6)  
Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 09-2360-8361	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 10 Nov-21 15:24	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 17-3826-5090	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 07 Oct-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 10 Oct-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 00-1106-4238	Code: Treated OSPW	Project: Special Studies
Sample Date: 04 Oct-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 07 Oct-21 12:27	CAS (PC):	Station: Treated OSPW
Sample Age: 76h (10.7 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C < T	95.2	>95.2	n/a	1.05	30.20%

## Dunnett Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control	1.5*		13.5	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	3*		12.37	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	6*		12.88	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	11.9*		15.24	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	23.8*		13.81	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	47.6*		8.366	2.526	6.152	10	CDF	<1.0E-37	Significant Effect
	95.2		1.386	2.526	6.152	10	CDF	0.3613	Non-Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.741	2.991	0.1380	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.741		0.9173	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	7777.43	1111.06	7	70.24	<1.0E-37	Significant Effect
Error	442.875	15.817	28			
Total	8220.31		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	11.34	18.48	0.1244	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9398	0.9166	0.0500	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	8	20.38	18.97	21.78	20	19	24	0.5957	8.27%	0.00%
1.5		4	53.25	42.59	63.91	51	48	63	3.351	12.59%	-161.35%
3		4	50.5	45.91	55.09	50.5	48	53	1.443	5.72%	-147.85%
6		4	51.75	41.82	61.68	49	48	61	3.119	12.05%	-153.99%
11.9		4	57.5	51.07	63.93	58.5	52	61	2.021	7.03%	-182.21%
23.8		4	54	47.77	60.23	54.5	49	58	1.958	7.25%	-165.03%
47.6		4	40.75	37.47	44.03	41	38	43	1.031	5.06%	-100.00%
95.2		4	23.75	18.03	29.47	24.5	19	27	1.797	15.13%	-16.56%



# CETIS Analytical Report

Report Date: 10 Nov-21 15:27 (p 4 of 6)  
Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

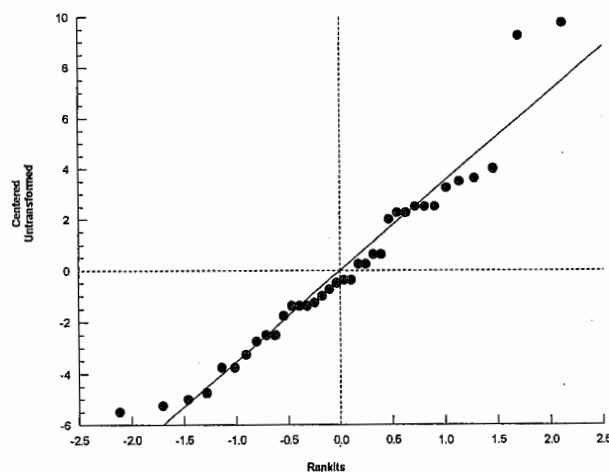
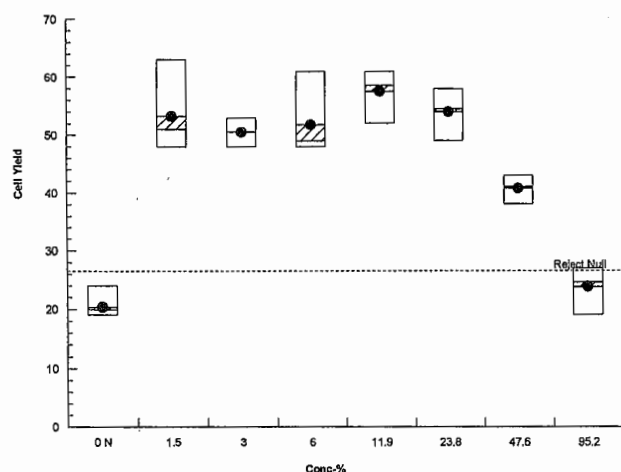
Analysis ID: 09-2360-8361 Endpoint: Cell Yield  
Analyzed: 10 Nov-21 15:24 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	N	20	19	21	19	19	21	24	20
1.5		50	48	52	63				
3		53	48	48	53				
6		50	48	48	61				
11.9		61	57	60	52				
23.8		49	56	58	53				
47.6		38	41	43	41				
95.2		19	26	23	27				

### Graphics





## CETIS Analytical Report

 Report Date: 10 Nov-21 15:27 (p 1 of 6)  
 Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID: 03-4180-2823	Endpoint: Cell Yield	CETIS Version: CETISv1.9.4
Analyzed: 10 Nov-21 15:24	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 17-3826-5090	Test Type: Cell Growth	Analyst: Sierra Klueppel
Start Date: 07 Oct-21 16:00	Protocol: EC/EPS 1/RM/25	Diluent: River Water
Ending Date: 10 Oct-21 16:00	Species: Pseudokirchneriella subcapitata	Brine:
Test Length: 72h	Taxon: Chlorophyta	Source: In-House Culture Age: 6d
Sample ID: 00-1106-4238	Code: Treated OSPW	Project: Special Studies
Sample Date: 07 Oct-21 12:00	Material: Water Sample	Source: Hatfield
Receipt Date: 07 Oct-21 12:27	CAS (PC):	Station: Treated OSPW
Sample Age: 76h (10.7 °C)	Client: Hatfield	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	23.8	47.6	33.66	4.202	13.01%

## Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Site Control		1.5	1.036	2.526	7.318	10	CDF	0.5332	Non-Significant Effect
		3	1.985	2.526	7.318	10	CDF	0.1445	Non-Significant Effect
		6	1.554	2.526	7.318	10	CDF	0.2883	Non-Significant Effect
		11.9	-0.4315	2.526	7.318	10	CDF	0.9789	Non-Significant Effect
		23.8	0.7768	2.526	7.318	10	CDF	0.6620	Non-Significant Effect
		47.6*	5.351	2.526	7.318	10	CDF	3.5E-05	Significant Effect
		95.2*	11.22	2.526	7.318	10	CDF	<1.0E-37	Significant Effect

## Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value Test	2.305	2.991	0.6155	No Outliers Detected
Control Trend	Mann-Kendall Trend Test	2.305		0.7195	Non-Significant Trend in Controls

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3739.5	534.214	7	23.88	<1.0E-37	Significant Effect
Error	626.5	22.375	28			
Total	4366		35			

## Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	5.455	18.48	0.6047	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9517	0.9166	0.1179	Normal Distribution

## Cell Yield Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	XC	8	56.25	51.74	60.76	55.5	49	64	1.906	9.59%	0.00%
1.5		4	53.25	42.59	63.91	51	48	63	3.351	12.59%	5.33%
3		4	50.5	45.91	55.09	50.5	48	53	1.443	5.72%	10.22%
6		4	51.75	41.82	61.68	49	48	61	3.119	12.05%	8.00%
11.9		4	57.5	51.07	63.93	58.5	52	61	2.021	7.03%	-2.22%
23.8		4	54	47.77	60.23	54.5	49	58	1.958	7.25%	4.00%
47.6		4	40.75	37.47	44.03	41	38	43	1.031	5.06%	27.56%
95.2		4	23.75	18.03	29.47	24.5	19	27	1.797	15.13%	57.78%



# CETIS Analytical Report

Report Date: 10 Nov-21 15:27 (p 2 of 6)  
Test Code/ID: 212081 / 00-2593-1793

## EC Alga Growth Inhibition Test

Nautilus Environmental

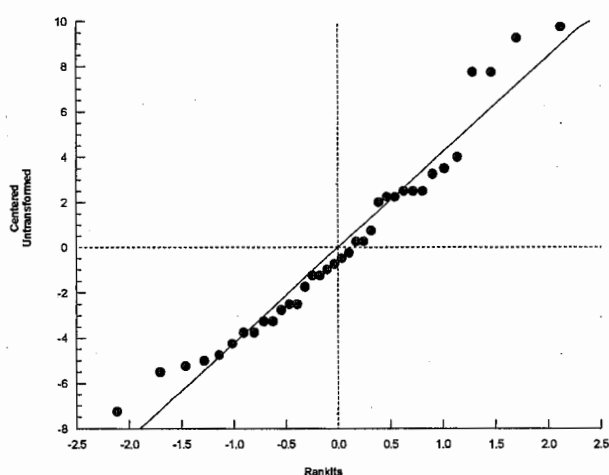
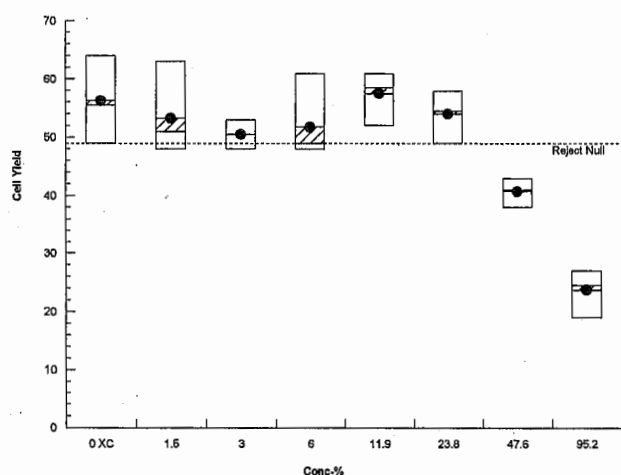
Analysis ID: 03-4180-2823 Endpoint: Cell Yield  
Analyzed: 10 Nov-21 15:24 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.4  
Status Level: 1

### Cell Yield Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	XC	56	49	64	53	55	57	52	64
1.5		50	48	52	63				
3		53	48	48	53				
6		50	48	48	61				
11.9		61	57	60	52				
23.8		49	56	58	53				
47.6		38	41	43	41				
95.2		19	26	23	27				

### Graphics





## **APPENDIX G – Amphipod (*Hyaella azteca*) Toxicity Test Data**



## ***Hyalella azteca* Water-only Test Summary Sheet**

Client: Simenide / Hatfield  
Work Order No.: 211807

Start Date: Sept 10/21  
Set up by: KJL/MDO

### **Sample Information:**

Sample ID: River Water + Treated OSPW  
Sample Date: Sept 6/21  
Date Received: Sept 10/21  
Sample Volume: 80L

### **Test Organism Information:**

Species: *Hyalella azteca*  
Supplier: Aquatic Biosystems, Co  
Date received: Sept 9/21  
Age or size (Day 0): 7-9 d.  
% Mortality in 24 h prior to testing: 0

### **NaCl Reference Toxicant Results:**

Reference Toxicant ID: HA208  
Stock Solution ID: n/a  
Date Initiated: Sept 10/21

96-h LC50 (95% CL): 4.6(4.1-5.3) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.4(4.1-10.1) g/L NaCl CV (%): 23

### **Test Results:**

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95% CL)	>100	
IC25%(v/v) (95% CL)		92.6(70.0 - n/a)
IC50%(v/v) (95% CL)		>100

Reviewed by: KJL

Date reviewed: Nov. 15, 2021



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synco/Hatfield  
Work Order No.: 211807  
Sample ID: River Water + Treated OSPW

Start Date: Sept 10/21  
Termination Date: Sept 24/21  
CER #: 6  
Test Organism: *Hyalella azteca*

WEEK 1

Temperature (°C)

Sample ID/Conc. (% v/v)	Day													
	0	1	2	3		4		5		6		7		8
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.5	23.0	22.5	22.5	22.0	22.5		22.0	22.0	22.5		22.0	22.0	22.0
Site Ctn	22.0			22.5	22.0				22.0	22.0		22.5		22.0
1.56				22.5	22.5				22.5	22.0		22.5		22.5
3.13				22.5	22.5				22.5			22.5		22.5
6.25		22.5		22.5	22.5				22.5			22.5		22.5
12.5				22.5	22.5				22.0			22.0		22.5
25			23.0	22.5	22.5				22.0			22.5		22.5
50				22.5	22.5				22.0			22.5	22.5	22.5
100				22.5	22.5				22.0	22.5		22.5	23.0	22.5
Technician Initials	KJL/MDO	IMC	PKY	MDO	MDO	MDO		MDO	MDO	MDO		MDO	MDO	IMC
Thermometer:	6													

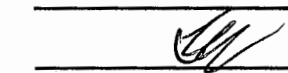
Conductivity (µS)

Sample ID/Conc. (% v/v)	Day													
	0	1	2	3		4		5		6		7		8
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	423	441	445	454	427	444		452	423	432		440	446	461
Site Ctn	353	390	386	392	403	382		392	353	359		369	353	378
1.56	396	387	422	427	403	418		427	401	410		419	398	424
3.13	438	470	465	470	446	460		468	446	454		462	442	474
6.25	524	672	666	670	533	584		592	534	545		553	528	561
12.5	696	715	704	710	708	715		734	649	726		741	700	750
25	1039	1044	1040	1048	1063	1065		1074	1075	1086		1094	1046	1092
50	1708	1687	1673	1684	1734	1729		1739	1755	1770		1780	1719	1773
100	3010	2940	2900	2910	3050	3020		3040	3060	3090		3100	3040	3150
Technician Initials	KJL/MDO	IMC	PKY	MDO	MDO	MDO		MDO	MDO	MDO		MDO	MDO	IMC
Conductivity meter:	313													

Comments:

Day 3: many organisms removed w pipette from C3's 25, 50, 100% OSPW.  
Day 5 (Sept 15) 100% OSPW filtered due to high levels of proliferation by

Reviewed by:



Date Reviewed:

Nov 10, 2021

0356



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 211807  
Sample ID: Puro Water + Treated OSPW

Start Date: Sept 10/21  
Termination Date: Sept 24/21  
Test Organism: *Hyalella azteca*

WEEK 1

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	0	1	2	3		4		5		6		7		8
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctrl	8.6	6.3	5.3	6.2	7.8	5.9		5.6	8.2	5.9		6.0	8.3	6.2
Site Ctrl	8.2	6.4	5.5	7.9	8.1	5.5		5.5	8.5	6.1		5.9	8.4	6.1
1.56	8.2	6.3	5.6	6.1	8.0	5.7		5.6	8.3	5.6		5.4	8.4	6.0
3.13	8.4	6.4	5.6	6.3	8.0	5.6		5.5	8.5	5.8		5.8	8.3	6.0
6.25	8.5	6.4	5.4	6.3	7.9	5.7		5.7	8.4	6.4		6.1	8.3	6.0
12.5	8.4	6.5	5.7	6.4	7.9	5.9		6.1	8.5	6.0		6.4	8.3	6.0
25	8.0	6.4	5.8	6.4	7.8	5.8		5.6	8.5	6.1		5.8	8.1	5.9
50	8.2	6.2	5.8	6.5	7.8	5.9		6.0	8.4	6.3		6.6	8.0	5.8
100	7.2	5.9	5.5	7.8	7.0	5.5		5.9	7.8	5.9		6.0	7.1	5.8
				6.3										
Technician Initials	KJM/MDO	IMC	PKK	MDO	MDO	MDO		MDO	MDO	MDO		MDO	MDO	IMC

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	0	1	2	3		4		5		6		7		8
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctrl	7.4	7.3	7.1	7.3	7.8	7.2		7.3	7.7	7.0		7.1	7.7	6.2
Site Ctrl	7.8	7.5	7.2	7.4	7.8	7.3		7.5	7.9	7.2		7.2	7.8	6.7
1.56	8.0	7.7	7.4	7.5	8.0	7.4		7.6	7.9	7.2		7.3	7.8	6.7
3.13	8.1	7.9	7.5	7.6	8.1	7.5		7.6	8.0	7.3		7.3	7.9	6.8
6.25	8.3	8.0	7.6	7.7	8.2	7.6		7.7	8.0	7.6		7.5	8.0	7.5
12.5	8.5	8.3	7.7	7.8	8.4	7.7		7.9	8.3	7.7		7.7	8.1	7.7
25	8.8	8.4	8.0	8.0	8.6	8.0		8.0	8.5	7.9		7.7	8.3	7.8
50	9.0	8.6	8.4	8.3	8.8	8.4		8.3	8.8	8.3		8.1	8.5	8.1
100	9.2	8.9	8.8	8.7	9.0	8.7		8.7	9.0	8.6		8.5	8.6	8.4
												8.4		
Technician Initials	KJM/MDO	IMC	PKK	MDO	MDO	MDO		MDO	MDO	MDO		MDO	MDO	IMC

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 450-850

Comments: 105% OSPW FILTERED Sept 15/21 due to 11 amounts of bugs.

Reviewed by: [Signature]

Date Reviewed: Nov 10, 2021



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 211807  
Sample ID: Pre-Water + Treated OSPW

Start Date: Sep+10/21  
Termination Date: Sep+24/21  
CER #: 6  
Test Organism: Hyalomma azteca

**Temperature (°C)**

WEEK 1

Sample ID/Conc. (%v/v)	Day													
	9		10		11		12		13		14			
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.5	22.5	22.5	22.5			22.5	22.5	22.5		22.5			
Site Ctn		22.5	22.0				22.0				22.5			
1.56		22.5	22.0								22.5			
3.13		22.5	22.0								22.5			
6.25		22.5	22.0								22.5			
12.5		22.5	22.0								22.5			
25		22.5	22.0						23.0		22.5			
50		22.5	22.5						22.5		22.5			
100		22.5	22.5						23.0	22.5	22.5			
Technician Initials	PM	EL	MDO	MDO			MDO	MDO	MDO		EC			

Thermometer: 6

**Conductivity (µS)**

Sample ID/Conc. (%v/v)	Day													
	9		10		11		12		13		14			
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	456	462	425	442			451	425	443		452			
Site Ctn	373	371	354	371			378	356	366		374			
1.56	426	424	401	416			422	402	416		421			
3.13	465	470	447	462			469	447	463		467			
6.25	553	559	537	553			561	536	554		556			
12.5	735	742	715	740			747	716	728		726			
25	1089	1093	1074	1091			1102	1078	1092		1095			
50	1758	1755	1755	1767			1775	1760	1774		1775			
100	3070	3070	3070	3080			3100	3090	3090		3100			
Technician Initials	PM	EL	MDO	MDO			MDO	MDO	MDO		EC			

Conductivity meter: 3

Comments:

Reviewed by: [Signature]

Date Reviewed: Nov-10, 2021



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Haffield Start Date: Sept 10/21  
Work Order No.: 211807 Termination Date: Sept 24/21  
Sample ID: River Water + Treated CSPW Test Organism: *Hyalella azteca*

WEEK 1

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	9	10		11		12		13		14				
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	5.7	5.5	8.3	5.9		5.6	8.4	5.8		5.0	5.8			
Site Ctn	5.8	5.2	8.2	5.6		5.4	8.7	6.0		4.8	5.9			
1.56	6.6	5.5	8.2	5.8		5.8	8.5	6.0		5.6	6.2			
3.13	5.7	5.4	8.3	5.8		5.5	8.5	6.4		5.7	5.8			
6.25	5.3	5.5	8.3	5.6		5.5	8.5	5.7		4.8	5.9			
12.5	5.8	5.4	8.2	5.6		5.5	8.5	5.8		4.4	5.9			
25	5.5	5.4	8.2	6.0		5.8	8.5	5.8		4.6	5.8			
50	5.5	5.3	8.1	6.0		5.6	8.2	5.8		4.6	5.8			
100	5.6	5.2	7.7	5.5		5.5	8.0	5.5		4.6	5.8			
Technician Initials	AM	EC	MDO	MDO		MDO	MDO	MDO		EC				

DO meter:

25  
MDO

pH

Sample ID/Conc. (% v/v)	Day													
	9	10		11		12		13		14				
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	7.1	7.1	7.6	7.1		7.1	7.8	7.3		7.0				
Site Ctn	7.3	7.3	7.7	7.3		7.2	7.6	7.5		7.3				
1.56	7.6	7.5	7.8	7.4		7.3	7.7	7.5		7.4				
3.13	7.5	7.4	7.8	7.4		7.3	7.7	7.6		7.5				
6.25	7.6	7.5	7.9	7.5		7.3	7.8	7.5		7.4				
12.5	7.7	7.6	8.0	7.6		7.4	7.9	7.6		7.5				
25	7.9	7.8	8.2	7.9		7.7	8.1	7.8		7.6				
50	8.1	8.0	8.4	8.1		7.9	8.3	8.2		8.0				
100	8.4	8.4	8.6	8.4		8.2	8.4	8.4		8.3				
Technician Initials	AM	EC	MDO	MDO		MDO	MDO	MDO		EC				

pH meter:

3

Light meter:

1st-1

Light intensity (Lux):

500-920

Comments:

Reviewed by:

[Signature]

Date Reviewed:

Nov 10, 2021



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 211807  
Sample ID: SH ~~atct~~ River Water + Treated ASPW  
MD

Start Date: Sept 10/21  
Termination Date: Sept 24/21  
Test Organism: Hyalella azteca  
Balance: 1

Week 1

Sample ID (% V/V)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	A	8	0	2	CMP	999.02	1000.22	8	EC/PB
	2	B	10	0	0	↓	1009.06	1010.81	10	PB
	3	C	10	0	0	↓	1009.03	1011.50	10	PB
	4	D	10	0	0	↓	1013.59	1014.89	10	PB
	5	E	10	0	0	↓	1006.62	1008.02	10	PB
Site Control	6	A	10	0	0	CMP	1000.18	1002.21	10	PB
	7	B	10	0	0	↓	1012.49	1014.88	10	↓
	8	C	10	0	0	↓	1004.34	1006.30	10	↓
	9	D	10	0	0	↓	996.74	998.90	10	↓
	10	E	10	0	0	↓	992.83	995.23	10	↓
1.56	11	A	10	0	0	CMP	998.08	1000.00	10	PB
	12	B	10	0	0	↓	1014.96	1017.45	10	↓
	13	C	9	0	1	↓	1002.07	1004.72	9	↓
	14	D	10	0	0	↓	998.49	1000.94	10	↓
	15	E	10	0	0	↓	1013.75	1016.31	10	↓
3.13	16	A	10	0	0	CMP	1011.15	1013.62	10	PB
	17	B	10	0	0	↓	993.43	996.48	10	↓
	18	C	10	0	0	↓	997.33	999.72	10	↓
	19	D	9	0	1	↓	990.64	992.61	9	↓
	20	E	10	0	0	↓	993.18	996.12	10	↓

Date/time pan placed in oven: Sept 7/21 @ 3:30pm  
Date/time pan removed from oven: Sept 17/21 @ 12:00pm

Date/time pan + organisms placed in oven: Sept 24/21 @ 12:00pm  
Date/time pan + organisms removed from oven: Sept 27/21 @ 1:30pm

Comments: 10% reweight = pan # = 11 = 999.89, 21 = 1001.17, 36 = 999.74, 42 = 1006.60, 2 = 1010.89

Reviewed by: [Signature]

Date Reviewed: Nov 10, 2021



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 211807  
Sample ID: River Water + Treated OSPW

Start Date: Sept 10/21  
Termination Date: Sept 24/21  
Test Organism: Hyalella azteca  
Balance: 1

Week 1

Sample ID (% V/V)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control 6.25	21	A	10	0	0	KJL	998.86	1001.42	10	PKB
	22	B	10	↓	0	↓	992.35	994.89	10	↓
	23	C	9	↓	1	↓	1004.93	1007.43	9	↓
	24	D	10	↓	0	↓	1001.69	1003.96	10	↓
	25	E	10	↓	0	↓	1001.15	1003.63	10	↓
12.5	26	A	10	0	0	KJL	1002.75	1005.61	10	PKB
	27	B	10	0	0	↓	1003.22	1005.64	10	↓
	28	C	9	1	0	↓	1003.49	1006.35	9	↓
	29	D	9	1	0	↓	1009.39	1011.89	PKB 109	↓
	30	E	10	0	0	↓	1017.31	1019.75	9 * 10	↓
25	31	A	10	0	0	KJL	1003.38	1006.36	90	PKB
	32	B	10	↓	0	↓	1006.93	1009.40	10	↓
	33	C	10	↓	0	↓	1009.94	1012.94	10	↓
	34	D	10	↓	0	↓	1014.06	1016.52	10	↓
	35	E	9	↓	1	↓	1007.75	1010.07	9	↓
50	36	A	10	0	0	KJL	997.54	999.95	10	PKB
	37	B	10	↓	↓	↓	1018.53	1021.08	10	↓
	38	C	9	↓	mx 1	↓	1012.50	1014.97	9	↓
	39	D	10	↓	↓	↓	1008.64	1011.02	10	↓
	40	E	10	↓	↓	↓	1002.43	1004.90	10	↓

Date/time pan placed in oven: Sept 7/21 @ 1530h

Date/time pan removed from oven: Sept 17 @ 1500h Sept 17 @ 1200h

Date/time pan + organisms placed in oven: Sept 24/21 @ 1200h

Date/time pan + organisms removed from oven: Sept 27/21 @ 1300h

Comments:

\*1 lost 1 during transfer.

Reviewed by: [Signature]

Date Reviewed: Nov 10, 2021



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 211807  
Sample ID: River Water x Treated OSPW

Start Date: Sept 10/21  
Termination Date: Sept 24/21  
Test Organism: Hyalella azteca  
Balance: 1

Week 1

Sample ID (% V/V)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	41	A	10	0	0	KJL	1004.53	1006.65	10	KJL
100	42	B	10	↓	0	↓	1007.25	1009.04	10	↓
	43	C	10	↓	0	↓	992.80	994.30	10	↓
	44	D	8	↓	2	↓	1005.13	1006.42	8	↓
	45	E	9	↓	1	↓	1010.20	1012.11	9	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 7/21 @ 1530h  
Date/time pan removed from oven: Sept 17/21 @ 1200h

Date/time pan + organisms placed in oven: Sept 24/21 @ 1200h  
Date/time pan + organisms removed from oven: Sept 27/21 @ 1300h

Comments:

Reviewed by: KJL

Date Reviewed: Nov 10, 2021



# CETIS Summary Report

Report Date: 15 Nov-21 10:13 (p 1 of 2)  
Test Code/ID: Week10SPW / 10-3630-3693

## Hyaella 14-d Survival and Growth <sup>Water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Batch ID: 10-5576-9406	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 10 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Reconstituted Water
Ending Date: 24 Sep-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 13-3617-2784	Code: Week10SPW	Project: Special Studies
Sample Date: 06 Sep-21 15:00	Material: Effluent	Source: Hatfield
Receipt Date: 10 Sep-21 12:52	CAS (PC):	Station: OSPW
Sample Age: 81h	Client: Hatfield	

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
01-1268-6210	10d Survival Rate	Fisher Exact Test	1.0000	Site Control passed 10d survival rate	1
13-2158-8796	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9706	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
06-7332-9345	10d Survival Rate 14d	Linear Interpolation (ICPIN)	EC5	81.28	12.48	n/a	1.23	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
			EC50	>100	n/a	n/a	<1	
15-9189-4752	Mean Dry Weight-mg	Linear Interpolation (ICPIN)	IC5	55.29	39.52	61.84	1.809	1
			IC10	62.93	52.77	75.87	1.589	
			IC15	71.6	59.03	93.19	1.397	
			IC20	81.45	64.44	n/a	1.228	
			IC25	92.63	69.99	n/a	1.08	
			IC40	>100	n/a	n/a	<1	
			IC50	>100	n/a	n/a	<1	

### 14d 10d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9600	0.8489	1.0000	0.8000	1.0000	0.0400	0.0894	9.32%	0.00%
0	XC	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-4.17%
1.56		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
3.13		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
6.25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
12.5		5	0.9600	0.8920	1.0000	0.9000	1.0000	0.0245	0.0548	5.71%	0.00%
25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
50		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
100		5	0.9400	0.8289	1.0000	0.8000	1.0000	0.0400	0.0894	9.52%	2.08%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1684	0.11	0.2268	0.13	0.247	0.02102	0.04701	27.92%	0.00%
0	XC	5	0.2188	0.1937	0.2439	0.196	0.24	0.009041	0.02022	9.24%	-29.93%
1.56		5	0.2473	0.2018	0.2928	0.192	0.2944	0.01638	0.03662	14.81%	-46.85%
3.13		5	0.2608	0.2148	0.3067	0.2189	0.305	0.01655	0.03701	14.19%	-54.86%
6.25		5	0.2526	0.23	0.2751	0.227	0.2778	0.008136	0.01819	7.20%	-49.98%
12.5		5	0.2789	0.245	0.3129	0.242	0.3178	0.01222	0.02732	9.79%	-65.64%
25		5	0.2653	0.237	0.2935	0.246	0.3	0.01018	0.02276	8.58%	-57.52%
50		5	0.2511	0.233	0.2692	0.238	0.2744	0.00652	0.01458	5.81%	-49.10%
100		5	0.1829	0.1474	0.2184	0.15	0.2122	0.01279	0.0286	15.64%	-8.61%

N = negative (lab) control  
XC = Site control



# CETIS Summary Report

Report Date: 15 Nov-21 10:13 (p 2 of 2)  
Test Code/ID: Week1OSPW / 10-3630-3693

## Hyalella 14-d Survival and Growth <sup>Water only</sup> ~~Sediment~~ Test

Nautilus Environmental

### 14d ~~100~~ Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.8000	1.0000	1.0000	1.0000	1.0000
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	0.9000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	0.9000	1.0000
6.25		1.0000	1.0000	0.9000	1.0000	1.0000
12.5		1.0000	1.0000	0.9000	0.9000	1.0000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	1.0000	0.9000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.8000	0.9000

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.15	0.175	0.247	0.13	0.14
0	XC	0.203	0.239	0.196	0.216	0.24
1.56		0.192	0.249	0.2944	0.245	0.256
3.13		0.247	0.305	0.239	0.2189	0.294
6.25		0.256	0.254	0.2778	0.227	0.248
12.5		0.286	0.242	0.3178	0.2778	0.2711
25		0.2756	0.247	0.3	0.246	0.2578
50		0.241	0.255	0.2744	0.238	0.247
100		0.212	0.179	0.15	0.1612	0.2122

### 14d ~~100~~ Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	8/10	10/10	10/10	10/10	10/10
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	9/10	10/10	10/10
3.13		10/10	10/10	10/10	9/10	10/10
6.25		10/10	10/10	9/10	10/10	10/10
12.5		10/10	10/10	9/10	9/10	10/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	10/10	9/10	10/10	10/10
100		10/10	10/10	10/10	8/10	9/10



# CETIS Analytical Report

Report Date: 26 Oct-21 10:48 (p 1 of 4)  
Test Code/ID: Week10SPW / 10-3630-3693

## Hyaella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 06-7332-9345	Endpoint: <sup>14d</sup> 10d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 10:48	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 10-5576-9406	Test Type: Growth-Survival ( <sup>14d</sup> 10d)	Analyst: Mikayla Oldach
Start Date: 10 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Reconstituted Water
Ending Date: 24 Sep-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 13-3617-2784	Code: Week10SPW	Project: Special Studies
Sample Date: 06 Sep-21 15:00	Material: Effluent	Source: Hatfield
Receipt Date: 10 Sep-21 12:52	CAS (PC):	Station: OSPW
Sample Age: 81h	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	297471	200	Yes	Two-Point Interpolation

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	81.28	12.48	n/a	1.23	n/a	8.012
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

### <sup>14d</sup> 10d Survival Rate Summary

#### Calculated Variate(A/B)

#### Isotonic Variate

Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
1.56		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.98	2.0%
3.13		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.98	2.0%
6.25		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.98	2.0%
12.5		5	0.9600	0.9000	1.0000	0.0548	5.71%	4.0%	48/50	0.9733	2.67%
25		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.9733	2.67%
50		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.9733	2.67%
100		5	0.9400	0.8000	1.0000	0.0894	9.52%	6.0%	47/50	0.94	6.0%

### <sup>14d</sup> 10d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	0.9000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	0.9000	1.0000
6.25		1.0000	1.0000	0.9000	1.0000	1.0000
12.5		1.0000	1.0000	0.9000	0.9000	1.0000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	1.0000	0.9000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.8000	0.9000

### <sup>14d</sup> 10d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	9/10	10/10	10/10
3.13		10/10	10/10	10/10	9/10	10/10
6.25		10/10	10/10	9/10	10/10	10/10
12.5		10/10	10/10	9/10	9/10	10/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	10/10	9/10	10/10	10/10
100		10/10	10/10	10/10	8/10	9/10



# CETIS Analytical Report

Report Date: 26 Oct-21 10:48 (p 2 of 4)  
Test Code/ID: Week1OSPW / 10-3630-3693

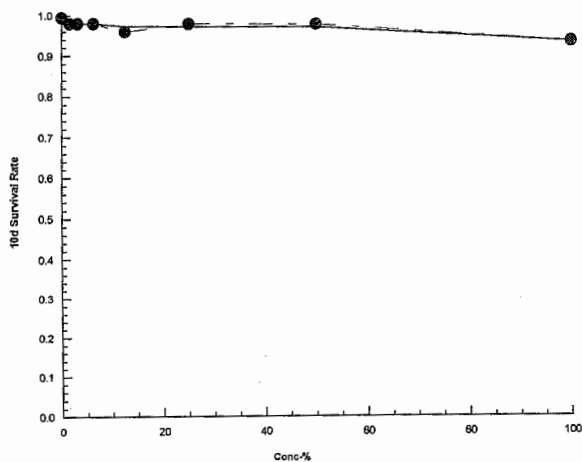
*water only*  
Hyalella 14-d Survival and Growth ~~Sediment~~ Test

Nautilus Environmental

Analysis ID: 06-7332-9345      Endpoint: *14d* Survival Rate  
Analyzed: 26 Oct-21 10:48      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# CETIS Analytical Report

Report Date: 26 Oct-21 10:48 (p 3 of 4)  
Test Code/ID: Week10SPW / 10-3630-3693

## Hyaella 14-d Survival and Growth <sup>Water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Analysis ID: 15-9189-4752	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 10:48	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 10-5576-9406	Test Type: Growth-Survival (14d)	Analyst: Mikayla Oldach
Start Date: 10 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Reconstituted Water
Ending Date: 24 Sep-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 13-3617-2784	Code: Week10SPW	Project: Special Studies
Sample Date: 06 Sep-21 15:00	Material: Effluent	Source: Hatfield
Receipt Date: 10 Sep-21 12:52	CAS (PC):	Station: OSPW
Sample Age: 81h	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	750237	200	Yes	Two-Point Interpolation

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	55.29	39.52	61.84	1.809	1.617	2.53
IC10	62.93	52.77	75.87	1.589	1.318	1.895
IC15	71.6	59.03	93.19	1.397	1.073	1.694
IC20	81.45	64.44	n/a	1.228	n/a	1.552
IC25	92.63	69.99	n/a	1.08	n/a	1.429
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

### Mean Dry Weight-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	5	0.2188	0.196	0.24	0.02022	9.24%	0.0%	0.2539	0.0%
1.56		5	0.2473	0.192	0.2944	0.03662	14.81%	-13.02%	0.2539	0.0%
3.13		5	0.2608	0.2189	0.305	0.03701	14.19%	-19.18%	0.2539	0.0%
6.25		5	0.2526	0.227	0.2778	0.01819	7.20%	-15.43%	0.2539	0.0%
12.5		5	0.2789	0.242	0.3178	0.02732	9.79%	-27.48%	0.2539	0.0%
25		5	0.2653	0.246	0.3	0.02276	8.58%	-21.24%	0.2539	0.0%
50		5	0.2511	0.238	0.2744	0.01458	5.81%	-14.76%	0.2511	1.12%
100		5	0.1829	0.15	0.2122	0.0286	15.64%	16.41%	0.1829	27.98%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.203	0.239	0.196	0.216	0.24
1.56		0.192	0.249	0.2944	0.245	0.256
3.13		0.247	0.305	0.239	0.2189	0.294
6.25		0.256	0.254	0.2778	0.227	0.248
12.5		0.286	0.242	0.3178	0.2778	0.2711
25		0.2756	0.247	0.3	0.246	0.2578
50		0.241	0.255	0.2744	0.238	0.247
100		0.212	0.179	0.15	0.1612	0.2122



# CETIS Analytical Report

Report Date: 26 Oct-21 10:48 (p 4 of 4)

Test Code/ID: Week1OSPW / 10-3630-3693

*Water only*  
Hyalella 14-d Survival and Growth ~~Sediment~~ Test

Nautilus Environmental

Analysis ID: 15-9189-4752

Endpoint: Mean Dry Weight-mg

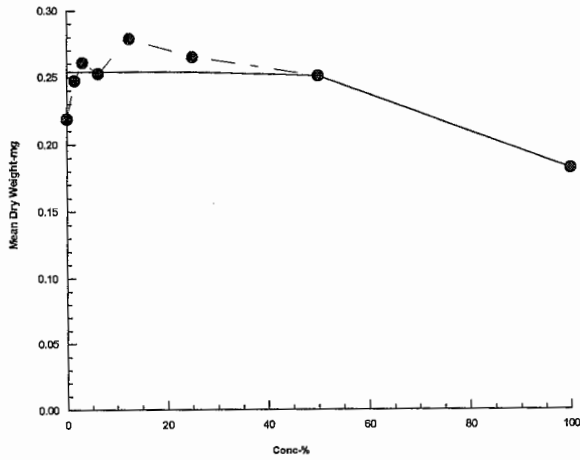
CETIS Version: CETISv1.9.4

Analyzed: 26 Oct-21 10:48

Analysis: Linear Interpolation (ICPIN)

Status Level: 1

## Graphics





## *Hyalella azteca* Water-only Test Summary Sheet

Client: Synconide/Hatfield  
Work Order No.: 211863

Start Date: Sept 16/21  
Set up by: MDO

### Sample Information:

Sample ID: River Water + Treated OSPW  
Sample Date: Sept 12/21  
Date Received: Sept 16/21  
Sample Volume: NO BDL 3x20L + 1x20L

### Test Organism Information:

Species: *Hyalella azteca*  
Supplier: Aquatic Biosystems, CO  
Date received: Sept 15/21  
Age or size (Day 0): 7-9 d  
% Mortality in 24 h prior to testing: 0

### NaCl Reference Toxicant Results:

Reference Toxicant ID: HA210  
Stock Solution ID: n/a  
Date Initiated: Sept 16/21

96-h LC50 (95% CL): 4.6(4.1-5.3) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.5(4.1-10.1) g/L NaCl CV (%): 23

### Test Results:

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95%CL)	>100	
IC25%(v/v) (95%CL)		70.1(53.2-87.2)
IC50%(v/v) (95%CL)		>100

Reviewed by: 

Date reviewed: Nov 16, 2021



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client:  
Work Order No.:  
Sample ID:

Simenude/Hatfield  
211863  
River water + Treated  
OSPW

Start Date: Sep 16/21  
Termination Date: Sep 30/21  
CER #: 6  
Test Organism: Hyalomma azteca

Temperature (°C)

WEEK 2

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.0	22.5	22.0	22.0	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Site Ctn	22.0	22.0					22.5	22.0				22.0		22.5
1.56	22.0	22.0					22.5					22.0		22.5
3.13	22.0	22.0					22.5					22.0		22.5
6.25	22.0	22.0					22.5					22.0		22.5
12.5	22.0						22.5					22.0		22.5
25	22.0						22.5					22.0		22.5
50	22.0						22.5					22.0		22.5
100	22.0		23.0				22.5					23.0		22.5
Technician Initials	MDO	MDO	MDO	Imc	pm	EC	MDO	MDO			MDO	MDO	MDO	EC
Thermometer:	6													

Conductivity (µS)

WEEK 2

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	426	437	435	450	448	457	425	444		452	425	440		445
Site Ctn	360	372	356	378	376	384	357	380		388	356	374		381
1.56	401	411	400	420	417	425	403	421		429	402	418		427
3.13	443	454	444	466	460	467	448	463		471	447	461		469
6.25	530	536	529	548	546	553	538	550		560	536	551		557
12.5	705	709	704	715	733	775	715	743		750	716	724		731
25	1066	1060	1063	1078	1079	1086	1083	1094		1102	1078	1084		1087
50	1745	1698	1747	1759	1747	1752	1778	1777		1786	1750	1767		1776
100	3080	3030	3090	3100	3070	3110	3100			3110	3090	3090		3100
Technician Initials	MDO	MDO	MDO	Imc	pm	EC	MDO	MDO			MDO	MDO	MDO	EC
Conductivity meter:	3													

Comments: Day 0: 100% OSPW filtered due to high levels of competing organisms.  
Day 5 (Sep 21): River water filtered due to bug presence.  
0.22.5

Reviewed by:

Date Reviewed:

Nov 10, 2021



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Synchrude/Hatfield  
 Work Order No.: 211803  
 Sample ID: River Water + Treated  
OSRW

Start Date: Sept 16 121  
 Termination Date: Sept 30 121  
 Test Organism: Hyalella azteca

WEEK 2

### Dissolved Oxygen (mg/L)

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	8.3	6.8	8.3	6.3	5.6	5.5	8.3	5.9			5.6	8.4	5.8	4.3
Site Ctn	8.4	7.0	8.5	6.3	5.8	5.7	8.0	5.7			5.8	8.7	5.9	4.6
1.56	8.5	6.7	8.5	6.4	5.8	5.6	8.1	5.7			5.9	8.6	5.7	4.6
3.13	8.6	6.7	8.5	6.4	5.8	5.6	8.2	5.8			5.8	8.6	5.7	4.4
6.25	8.6	6.8	8.4	6.6	5.7	5.7	8.2	5.8			5.2	8.6	5.4	4.7
12.5	8.5	6.9	8.4	6.5	5.7	5.7	8.2	5.9			5.6	8.6	5.5	4.8
25	8.6	6.9	8.4	6.5	5.7	5.5	8.1	5.8			5.2	8.5	5.5	4.6
50	8.6	6.9	8.2	6.4	5.7	5.4	8.1	5.8			5.8	8.5	5.9	4.8
100	8.7	6.9	7.7	6.3	5.8	5.9	7.8	5.9			5.9	8.4	5.8	4.8
Technician Initials	MDO	MDO	MDO	JMC	PM	EC	MDO	MDO			MDO	MDO	MDO	EC

DO meter: 5

### pH

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	7.5	7.4	7.7	7.3	7.2	7.1	7.6	7.2			7.1	7.8	7.2	7.1
Site Ctn	7.7	7.6	7.7	7.5	7.4	7.4	7.7	7.4			7.3	7.7	7.4	7.2
1.56	7.8	7.6	7.8	7.6	7.4	7.4	7.8	7.4			7.4	7.8	7.4	7.3
3.13	7.9	7.7	7.9	8.0	7.5	7.5	7.8	7.5			7.4	7.9	7.5	7.4
6.25	8.0	7.8	8.0	8.1	7.5	7.5	8.0	7.6			7.4	8.0	7.5	7.4
12.5	8.3	7.9	8.2	8.3	7.6	7.7	8.1	7.7			7.5	8.1	7.6	7.5
25	8.5	8.2	8.5	8.4	7.9	7.9	8.3	7.9			7.6	8.4	7.9	7.8
50	8.8	8.5	8.7	8.6	8.1	8.1	8.5	8.2			8.0	8.6	8.2	8.0
100	9.0	8.8	8.9	8.7	8.5	8.5	8.7	8.6			8.3	8.7	8.6	8.4
Technician Initials	MDO	MDO	MDO	JMC	PM	EC	MDO	MDO			MDO	MDO	MDO	EC

pH meter: 3

Light meter: lit - 1

Light intensity (Lux): 450-850

Comments: \_\_\_\_\_

Reviewed by: [Signature]

Date Reviewed: Nov -10, 2021



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client:  
Work Order No.:  
Sample ID:

Synchrude/Hatfield  
2118163  
River Water + Treated  
OSPW

Start Date: Sept 16/21  
Termination Date: Sept 30/21  
CER #: 6  
Test Organism: *Hyalomma azteca*

WEEK 2

Temperature (°C)

Sample ID/Conc. (% v/v)	Day														
	8			9			10			11			12		
	new	old	new	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.0	22.5			23.0			22.5	22.0	22.5			22.5	22.0	23.0
Site Ctn	22.0				23.0			22.5	22.0	22.5			22.5	22.0	22.5
1.56	22.0				23.0			22.0	22.5	22.5			22.5	22.0	22.5
3.13	22.0				23.0			22.0	22.5	22.5			22.5		22.5
6.25	22.0				23.0			22.5	22.5	22.5			22.5		22.5
12.5	22.0				23.0			22.0	22.5	22.5			22.5		22.5
25	22.0				23.0			22.0	22.5	22.5			22.5	↓	22.5
50	22.5				23.0			22.5	22.5	22.5			22.5	22.5	22.5
100	23.0	↓			23.0			22.5	22.5	22.5			22.5	23.0	23.0
Technician Initials	MDO	JMC			EC			EC	MDO	EC			MDO	MDO	MDO

Thermometer: 6

Conductivity (µS)

Sample ID/Conc. (% v/v)	Day														
	8			9			10			11			12		
	new	old	new	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	422	458			450			461	425	274			459	422	439
Site Ctn	357	389			385			372	357	242			383	358	375
1.56	401	439			432			439	406	262			427	403	421
3.13	445	471			471			480	450	282			473	448	467
6.25	539	571			560			567	539	323			562	536	555
12.5	706	729			743			740	736	396			748	713	729
25	1064	1103			1097			1095	1081	548			1106	1073	1088
50	1757	1780			1775			1781	1772	1600			1785	1757	1775
100	3080	3160			3070			3110	3110	2190			3110	3070	3090
Technician Initials	MDO	JMC			EC			EC	MDO	EC			MDO	MDO	MDO

Conductivity meter: 3

Comments:

① Remeasured = 464, 388, 435, 481, 572, 750, 1108, 1800, 3160  
(MDO)

Reviewed by:

[Signature]

Date Reviewed:

Nov 10, 2021



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Synchrude/Hatfield  
 Work Order No.: 211863  
 Sample ID: River Water + Treated  
OSPW

Start Date: Sept 16 / 21  
 Termination Date: Sept 30 / 21  
 Test Organism: *Hyalella azteca*

### Dissolved Oxygen (mg/L)

Week 2

Sample ID/Conc. (% v/v)	Day														
	8		9		10		11		12		13		14		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Lab Ctn	8.4	5.0			4.6		4.1	8.4	4.6		4.4	8.4	5.4		
Site Ctn	8.4	5.1			5.0		3.9	8.3	4.6		4.0	8.3	4.1		
1.56	8.3	5.1			5.0		3.6	8.2	4.3		3.6	8.4	4.1		
3.13	8.4	5.3			5.1		3.7	8.2	4.5		3.6	8.3	3.7		
6.25	8.2	5.3			5.1		4.4	8.2	4.9		3.6	8.3	3.5		
12.5	8.3	5.1			5.0		4.2	8.2	4.9		3.7	8.3	3.4		
25	8.3	5.1			5.0		3.9	8.2	4.7		4.1	8.3	4.0		
50	8.2	5.2			5.1		4.2	8.2	5.2		4.2	8.3	4.1		
100	7.6	5.0			5.0		3.8	8.1	4.8		4.0	8.1	4.1		
Technician Initials	MDO	JMC			EA		EC	MDO	EC		MDO	MDO	MDO		

DO meter: 5

### pH

Sample ID/Conc. (% v/v)	Day														
	8		9		10		11		12		13		14		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Lab Ctn	7.7	7.2			7.0		7.0	7.7	7.0		7.0	7.8	7.1		
Site Ctn	7.7	7.4			7.2		7.1	7.8	7.1		7.1	7.7	7.1		
1.56	7.8	7.5			7.2		7.1	7.9	7.2		7.1	7.8	7.2		
3.13	7.9	7.5			7.2		7.2	7.9	7.2		7.1	7.9	7.2		
6.25	8.0	7.5			7.6		7.3	8.0	7.3		7.2	7.9	7.2		
12.5	8.1	7.7			7.6		7.4	8.2	7.4		7.3	8.0	7.2		
25	8.4	7.9			7.7		7.6	8.3	7.7		7.5	8.2	7.5		
50	8.6	8.3			8.1		7.9	8.5	8.0		7.8	8.4	7.8		
100	8.8	8.5			8.5		8.2	8.7	8.4		8.2	8.5	8.2		
Technician Initials	MDO	JMC			EA		EC	MDO	EC		MDO	MDO	MDO		

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 500-900

Comments: 1) Remeasured DO = 4.6, 4.7, 4.1, 4.3, 4.8, 4.8, 4.5, 4.9, 4.5

Reviewed by: [Signature]

Date Reviewed: Nov-10, 2021



# **H. azteca Water-only Toxicity Test Data Sheet** 14-d Survival and Weight

Client: Synconide/Hatfield  
Work Order No: 211863  
Sample ID: SH-002 River Water +  
MD Treated OSPW

Start Date: Sept 16/21  
Termination Date: Sept 30/21  
Test Organism: Hyalella azteca  
Balance: 1

Week 2 SH2

Sample ID (10, 11, 12)	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	10	0	0	MD	1007.47	1009.26	10	P25/MD
	2	10	0	0		999.44	1001.40	10	
	3	10	0	0		1002.72	1004.59	10	
	4	10	0	0		1005.52	1007.19	10	
	5	10	0	0		1006.43	1008.43	10	
Site Control	6	10	0	0	P25	1011.05	1012.77	10	
	7	10	0	0		998.77	1001.00	10	
	8	10	0	0		1002.22	1004.72	10	
	9	10	0	0		1003.31	1005.24	9	
	10	10	0	0		996.89	998.83	10	
1.56	11	10	0	0	P25	1010.61	1012.28	10	
	12	10	0	0		1015.31	1017.71	10	
	13	10	0	0		1016.82	1018.96	9	
	14	10	0	0		1005.61	1007.44	10	
	15	10	0	0		1003.58	1005.75	10	
3.13	16	10	0	0	MD	1012.35	1014.47	10	
	17	10	0	0		1007.41	1009.45	10	
	18	10	0	0		1007.60	1009.59	10	
	19	10	0	0		1005.57	1008.18	10	
	20	10	0	0		999.50	1001.72	10	

Date/time pan placed in oven: Sept 14/21 @ 1330h  
Date/time pan removed from oven: Sept. 29/21 @ 0930h

Date/time pan + organisms placed in oven: Sept 30/21 @ 1015h  
Date/time pan + organisms removed from oven: Oct 4/21 @ 1000h

Comments: Done significantly smaller + grey colored than the others  
10% reweight: pan # = 3 = 1004.68, 13 = 1019.08, 25 = 1011.06, 34 = 1004.57, 43 = 1011.91

Reviewed by: [Signature]

Date Reviewed: Nov. 10, 2021



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client:  
Work Order No:  
Sample ID:

Suncide/Hatfield  
211863  
Suncide River Water +  
MDO Treated OSPW

Start Date: Sept 16/21  
Termination Date: Sept 30/21  
Test Organism: Hyaella azteca  
Balance: 1

Week 2 SH2

Sample ID (1/2 V/V)	Red Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab <sup>MDO</sup> Control 6.25	21	A <sup>①</sup>	10	0	0	RZ	1003.38	1005.71	10	RZ/MDO
	22	B	↓	↓	↓	↓	1004.86	1007.36	10	↓
	23	C	↓	↓	↓	↓	1004.05	1006.59	10	↓
	24	D	↓	↓	↓	↓	1002.67	1004.69	10	↓
	25	E	↓	↓	↓	↓	1008.62	1011.01	10	↓
12.5	26	A	10	0	0	MDO	997.64	1000.01	10	↓
	27	B	11 <sup>MDO</sup>	0	0	↓	1001.92	1004.38	11	↓
	28	C	10	0	0	↓	990.12	992.80	10	↓
	29	D	10	0	0	↓	1010.13	1012.13	10	↓
	30	E	10	0	0	↓	1015.06	1017.21	10	↓
25	31	A	10	0	0	RZ	1011.88	1013.83	10	↓
	32	B	↓	↓	↓	↓	1002.21	1004.50	10	↓
	33	C	↓	↓	↓	↓	1006.14	1008.53	10	↓
	34	D	↓	↓	↓	↓	1002.78	1004.48	10	↓
	35	E	9	↓	↓	↓	997.86	999.82	9	↓
50	36	A	10	0	0	RZ	1004.82	1006.90	10	↓
	37	B	↓	↓	↓	↓	1008.94	1010.74	10	↓
	38	C	↓	↓	↓	↓	1003.95	1005.76	10	↓
	39	D	↓	↓	↓	↓	1008.26	1009.96	10	↓
	40	E <sup>①</sup>	↓	↓	↓	↓	1009.56	1011.36	10	↓

Date/time pan placed in oven: Sept 14/21 @ 1330h  
Date/time pan removed from oven: Sept 29/21 @ 0930h

Date/time pan + organisms placed in oven: Sept 30/21 @ 1015h  
Date/time pan + organisms removed from oven: Oct 4/21 @ 1000h

Comments: ① one significantly smaller + grey colored compared to others

Reviewed by: [Signature]

Date Reviewed: Nov 10, 2021



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 211863  
Sample ID: SH-102 mdo River Water + Treated OSPW

Start Date: Sept 16/21  
Termination Date: Sept 30/21  
Test Organism: Hyaella azteca  
Balance: 1

Week 2

SH2

Sample ID (1/2 V/V)	Pan No.	Rep.	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
<u>mdo Control</u>	<u>41</u>	<u>A</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u>mdo</u>	<u>1008.23</u>	<u>1009.10</u>	<u>10</u>	<u>mdo</u>
<u>100</u>	<u>42</u>	<u>B</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u> </u>	<u>1002.76</u>	<u>1004.41</u>	<u>10</u>	<u> </u>
	<u>43</u>	<u>C</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u> </u>	<u>1010.53</u>	<u>1011.78</u>	<u>10</u>	<u> </u>
	<u>44</u>	<u>D</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u> </u>	<u>1010.71</u>	<u>1011.98</u>	<u>10</u>	<u> </u>
	<u>45</u>	<u>E</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u>✓</u>	<u>1009.75</u>	<u>1011.46</u>	<u>10</u>	<u>✓</u>
		<u>A</u>								
		<u>B</u>								
		<u>C</u>								
		<u>D</u>								
		<u>E</u>								
		<u>A</u>								
		<u>B</u>								
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		<u>D</u>								
		<u>E</u>								
		<u>A</u>								
		<u>B</u>								
		<u>C</u>								
		<u>D</u>								
		<u>E</u>								

Date/time pan placed in oven: Sept 14/21 @ 1330h  
Date/time pan removed from oven: Sept 29/21 @ 0930h

Date/time pan + organisms placed in oven: Sept 30/21 @ 1015h  
Date/time pan + organisms removed from oven: Oct 4/21 @ 1000h

Comments:

Reviewed by: [Signature]

Date Reviewed: Nov-10, 2021



# CETIS Summary Report

Report Date: 15 Nov-21 09:44 (p 1 of 2)  
Test Code/ID: 211863 / 14-5853-0337

## Hyalella 14-d Survival and Growth <sup>water only</sup> <sub>MDO</sub> Sediment Test

Nautilus Environmental

Batch ID: 20-2898-7982	Test Type: Growth-Survival (10d) 14d <sub>MDO</sub>	Analyst: Mikayla Oldach
Start Date: 16 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 30 Sep-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 15-7230-8092	Code: 211863	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Effluent	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: OSPW
Sample Age: 83h (14.2 °C)	Client: Hatfield	

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
15-8156-5438	10d Survival Rate <sub>MDO</sub>	Fisher Exact Test	0.5000	Site Control passed 10d survival rate	1
01-8582-5902	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9380	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
10-5955-5655	10d Survival Rate <sub>MDO</sub>	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
17-1148-9342	Mean Dry Weight-mg	NLR: 3P Log-Logistic	EC50	>100	n/a	n/a	<1	
			IC5	26.56	n/a	42.55	3.764	1
			IC10	39.35	13.82	57.31	2.541	
			IC15	50.2	29.03	68.44	1.992	
			IC20	60.29	41.75	77.93	1.659	
			IC25	70.14	53.21	87.22	1.426	
14d			IC40	101	78.09	127.6	0.9902	
			IC50	125	88.84	175.9	0.8	

### 10d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	XC	5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
1.56		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
3.13		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
6.25		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12.5		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
50		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1858	0.1693	0.2023	0.167	0.2	0.005945	0.01329	7.15%	0.00%
0	XC	5	0.2107	0.174	0.2473	0.172	0.25	0.0132	0.02952	14.01%	-13.39%
1.56		5	0.209	0.1683	0.2496	0.167	0.24	0.01465	0.03276	15.68%	-12.46%
3.13		5	0.2196	0.1889	0.2503	0.199	0.261	0.01106	0.02472	11.26%	-18.19%
6.25		5	0.2356	0.2101	0.2611	0.202	0.254	0.009201	0.02057	8.73%	-26.80%
12.5		5	0.2287	0.1968	0.2607	0.2	0.268	0.01151	0.02574	11.25%	-23.10%
25		5	0.2102	0.1757	0.2447	0.17	0.239	0.01243	0.02778	13.22%	-13.11%
50		5	0.1838	0.1661	0.2015	0.17	0.208	0.006375	0.01426	7.76%	1.08%
100		5	0.135	0.0926	0.1774	0.087	0.171	0.01527	0.03415	25.29%	27.34%

N = negative (lab) control  
XC = site control

11/15/21



# CETIS Summary Report

Report Date: 15 Nov-21 09:44 (p 2 of 2)  
Test Code/ID: 211863 / 14-5853-0337

## Hyalella 14-d Survival and Growth <sup>Water Only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

### 14d <sup>MDO</sup> Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1.0000	1.0000	1.0000	1.0000	1.0000
0	XC	1.0000	1.0000	1.0000	0.9000	1.0000
1.56		1.0000	1.0000	0.9000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.179	0.196	0.187	0.167	0.2
0	XC	0.172	0.223	0.25	0.2144	0.194
1.56		0.167	0.24	0.2378	0.183	0.217
3.13		0.212	0.204	0.199	0.261	0.222
6.25		0.233	0.25	0.254	0.202	0.239
12.5		0.237	0.2236	0.268	0.2	0.215
25		0.195	0.229	0.239	0.17	0.2178
50		0.208	0.18	0.181	0.17	0.18
100		0.087	0.165	0.125	0.127	0.171

### 14d <sup>MDO</sup> Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	10/10	10/10	10/10	10/10	10/10
0	XC	10/10	10/10	10/10	9/10	10/10
1.56		10/10	10/10	9/10	10/10	10/10
3.13		10/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	10/10
12.5		10/10	11/11	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10	10/10



# CETIS Analytical Report

Report Date: 15 Nov-21 09:38 (p 1 of 4)  
Test Code/ID: 211863 / 14-5853-0337

## Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 10-5955-5655	Endpoint: <sup>14d</sup> 100 Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 15 Nov-21 9:37	Analysis: <sup>100</sup> Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 20-2898-7982	Test Type: Growth-Survival ( <sup>100</sup> 14d)	Analyst: Mikayla Oldach
Start Date: 16 Sep-21	Protocol: EC/EPS 1/RM/33 <sup>100</sup>	Diluent: Site Water
Ending Date: 30 Sep-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 15-7230-8092	Code: 211863	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Effluent	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: OSPW
Sample Age: 83h (14.2 °C)	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2039143	200	Yes	Two-Point Interpolation

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

### <sup>14d</sup> 100 Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.9925	0.0%
1.56		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.9925	0.0%
3.13		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.9925	0.0%
6.25		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.9925	0.0%
12.5		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	51/51	0.9925	0.0%
25		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.9925	0.0%
50		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.9925	0.0%
100		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.9925	0.0%

### <sup>14d</sup> 100 Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	1.0000	0.9000	1.0000
1.56		1.0000	1.0000	0.9000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000

### <sup>14d</sup> 100 Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	10/10	9/10	10/10
1.56		10/10	10/10	9/10	10/10	10/10
3.13		10/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	10/10
12.5		10/10	11/11	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10	10/10



# CETIS Analytical Report

Report Date: 15 Nov-21 09:38 (p 2 of 4)  
Test Code/ID: 211863 / 14-5853-0337

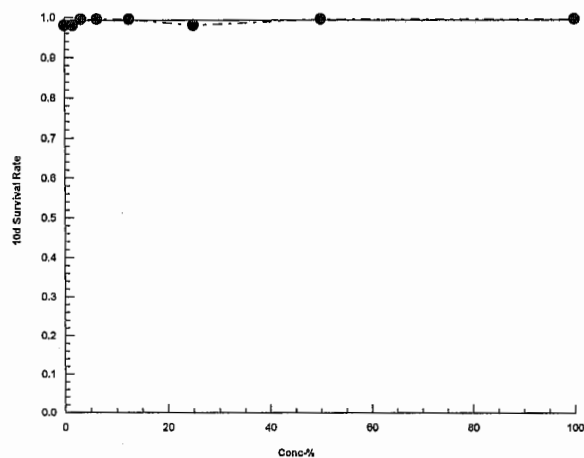
Hyalella 14-d Survival and Growth ~~Sediment~~ <sup>Water only</sup> Test

Nautilus Environmental

Analysis ID: 10-5955-5655  
Analyzed: 15 Nov-21 9:37  
Endpoint: ~~10d~~ <sup>14d</sup> Survival Rate  
Analysis: ~~WPS~~ <sup>WPS</sup> Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





# CETIS Analytical Report

Report Date: 15 Nov-21 09:38 (p 1 of 2)  
Test Code/ID: 211863 / 14-5853-0337

## Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 17-1148-9342	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 15 Nov-21 9:38	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 20-2898-7982	Test Type: Growth-Survival (10d) 14 d	Analyst: Mikayla Oldach
Start Date: 16 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 30 Sep-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 15-7230-8092	Code: 211863	Project: Special Studies
Sample Date: 12 Sep-21 13:00	Material: Effluent	Source: Hatfield
Receipt Date: 16 Sep-21 08:50	CAS (PC):	Station: OSPW
Sample Age: 83h (14.2 °C)	Client: Hatfield	

### Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu = \alpha / [1 + (x/\delta)^\gamma]$	Normal [ $w=1$ ]	Off [ $\mu^* = \mu$ ]	None	None

### Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
12	146.1	-285.5	-281.1	0.5299	Yes	0.8537	2.512	0.5225	Non-Significant Lack of Fit

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	26.56	n/a	42.55	3.764	2.35	n/a
IC10	39.35	13.82	57.31	2.541	1.745	7.237
IC15	50.2	29.03	68.44	1.992	1.461	3.445
IC20	60.29	41.75	77.93	1.659	1.283	2.395
IC25	70.14	53.21	87.22	1.426	1.147	1.88
IC40	101	78.09	127.6	0.9902	0.7837	1.281
IC50	125 > 100 (7.344)	88.84	175.9	0.8	0.5686	1.126

### Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.2208	0.005708	0.2092	0.2323	38.68	<1.0E-37	Significant Parameter
$\gamma$	1.901	0.637	0.6105	3.192	2.985	0.0050	Significant Parameter
$\delta$	125	19.84	84.79	165.2	6.299	2.5E-07	Significant Parameter

### ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	1.698	0.5661	3	798.9	<1.0E-37	Significant
Lack of Fit	0.003086	0.0006171	5	0.8537	0.5225	Non-Significant
Pure Error	0.02313	0.0007229	32			
Residual	0.02622	0.0007086	37			

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Variances	Bartlett Equality of Variance Test	3.412	14.07	0.8444	Equal Variances
	Mod Levene Equality of Variance	0.869	2.423	0.5444	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9753	0.9447	0.5193	Normal Distribution
	Anderson-Darling A2 Normality Te	0.3581	2.492	0.4573	Normal Distribution



# CETIS Analytical Report

Report Date: 15 Nov-21 09:38 (p 2 of 2)  
Test Code/ID: 211863 / 14-5853-0337

## Hyalella 14-d Survival and Growth <sup>Winter-only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 17-1148-9342  
Analyzed: 15 Nov-21 9:38

Endpoint: Mean Dry Weight-mg  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Mean Dry Weight-mg Summary

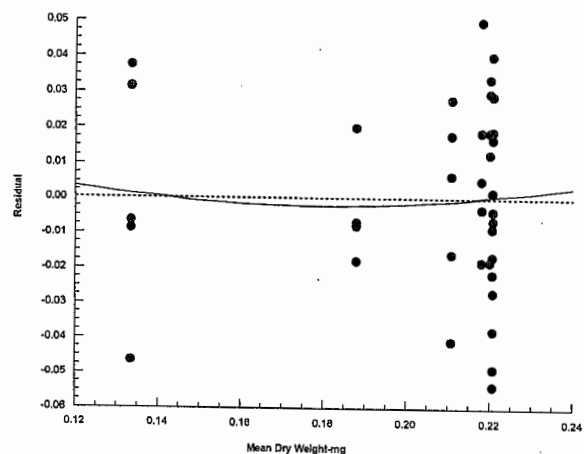
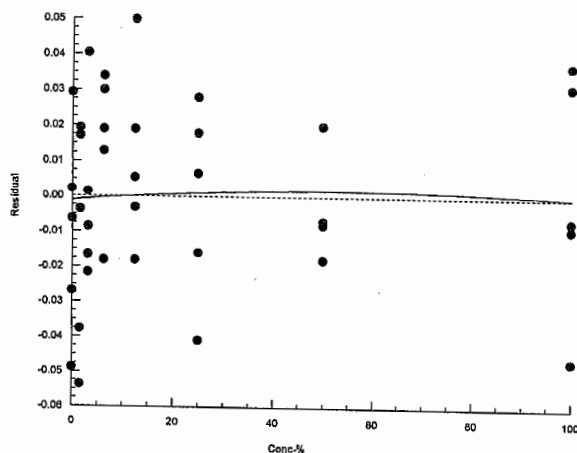
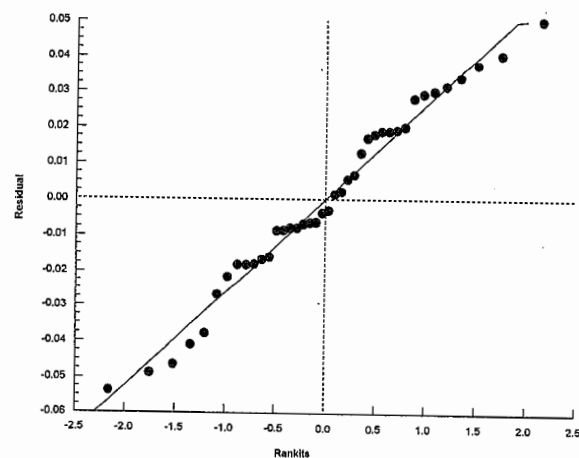
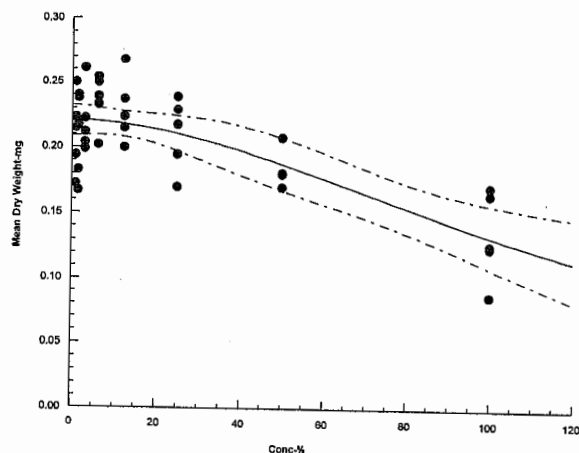
Conc-%	Code	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	5	0.2107	0.172	0.25	0.0132	0.02952	14.01%	0.0%
1.56		5	0.209	0.167	0.24	0.01465	0.03276	15.68%	0.82%
3.13		5	0.2196	0.199	0.261	0.01106	0.02472	11.26%	-4.23%
6.25		5	0.2356	0.202	0.254	0.009201	0.02057	8.73%	-11.82%
12.5		5	0.2287	0.2	0.268	0.01151	0.02574	11.25%	-8.56%
25		5	0.2102	0.17	0.239	0.01243	0.02778	13.22%	0.25%
50		5	0.1838	0.17	0.208	0.006375	0.01426	7.76%	12.76%
100		5	0.135	0.087	0.171	0.01527	0.03415	25.29%	35.93%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.172	0.223	0.25	0.2144	0.194
1.56		0.167	0.24	0.2378	0.183	0.217
3.13		0.212	0.204	0.199	0.261	0.222
6.25		0.233	0.25	0.254	0.202	0.239
12.5		0.237	0.2236	0.268	0.2	0.215
25		0.195	0.229	0.239	0.17	0.2178
50		0.208	0.18	0.181	0.17	0.18
100		0.087	0.165	0.125	0.127	0.171

### Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [ $\omega=1$ ]





## *Hyaella azteca* Water-only Test Summary Sheet

Client: Sinclair/Hatfield  
Work Order No.: 211936

Start Date: Sept 23/21  
Set up by: MDO

### Sample Information:

Sample ID: River Water + Treated OSPW  
Sample Date: Sept 19/21  
Date Received: Sept 23/21  
Sample Volume: 5 x 20L + 2 x 20L

### Test Organism Information:

Species: *Hyaella azteca*  
Supplier: Aquatic Biosystems, CO  
Date received: Sept 22/21  
Age or size (Day 0): 7-9 d  
% Mortality in 24 h prior to testing: 0

### NaCl Reference Toxicant Results:

Reference Toxicant ID: HA212  
Stock Solution ID: n/a  
Date Initiated: Sept 23/21

96-h LC50 (95% CL): 6.1 (4.9 - 7.5) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.4 (4.1 - 10.1) g/L NaCl CV (%): 23

### Test Results:

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95%CL)	>100	
IC25%(v/v) (95%CL)		70.4 (55.6 - 84.1)
IC50%(v/v) (95%CL)		>100

Reviewed by: Jon

Date reviewed: Nov. 29/21



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Synconide/Hatfield  
 Work Order No.: 211936  
 Sample ID: River Water + Treated  
OSPW

Start Date: Sept 23/21  
 Termination Date: Oct 7/21  
 CER # 12  
 Test Organism: Hyalella azteca

\* WEEK 3 \*

Temperature (°C)

Sample ID/Conc. (% v/v)	Day														
	0			1			2			3			4		
	new	old	new	new	old	new	new	old	new	new	old	new	new	old	new
Lab Ctl	22.5	22.0	22.5	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Site Ctl	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
1.56	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
3.13	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
6.25	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
12.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
25	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
50	22.5	22.0	22.5	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
100	22.5	22.0	22.5	22.0	22.5	22.0	22.0	22.0	22.5	22.0	22.5	22.0	22.0	22.0	22.0
Technician Initials	MDO	EC	MDO	IME	EC	MDO	EC	MDO	EC	MDO	EC	MDO	EC	MDO	EC
Thermometer:	12														

Conductivity (µS)

Sample ID/Conc. (% v/v)	Day														
	0			1			2			3			4		
	new	old	new	new	old	new	new	old	new	new	old	new	new	old	new
Lab Ctl	422	418	422	442	432	440	425	438	445	422	436	444	444	444	444
Site Ctl	372	373	373	392	384	392	370	388	394	373	386	393	393	393	393
1.56	417	426	417	441	432	437	418	437	436	417	430	435	435	435	435
3.13	459	457	460	484	471	477	463	473	479	460	475	478	478	478	478
6.25	545	537	547	566	556	560	550	560	569	545	560	564	564	564	564
12.5	726	720	719	749	755	760	725	743	757	720	745	745	745	745	745
25	1068	1042	1074	1108	1078	1070	1081	1085	1102	1072	1092	1087	1087	1087	1087
50	1739	1710	1741	1778	1749	1740	1769	1760	1778	1744	1773	1751	1751	1751	1751
100	3050	2930	3050	3080	3020	3010	3090	3040	3060	3050	3080	3050	3050	3050	3050
Technician Initials	MDO	EC	MDO	IME	EC	MDO	EC	MDO	EC	MDO	EC	MDO	EC	MDO	EC
Conductivity meter:	3														

Comments:

Reviewed by:

Date Reviewed:



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 211936  
Sample ID: River Water + Treated OSPW

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
Test Organism: *Hyalella azteca*

WEEK 3

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab (H)	8.4	6.3	8.4	6.0	5.9	4.7	8.4	5.6			5.2	8.4	5.6	5.1
Site (H)	8.5	5.8	8.7	6.1	5.8	5.4	8.2	6.0			6.7	8.0	6.9	7.0
1.5b	8.5	6.1	8.4	6.1	6.1	5.0	8.3	6.0			6.0	8.0	6.3	6.4
3.13	8.6	6.0	8.5	6.1	6.1	5.4	8.3	6.1			6.2	8.0	6.1	6.0
6.25	8.6	6.1	8.5	6.2	6.0	5.5	8.3	6.1			5.8	8.0	6.2	6.0
12.5	8.5	5.8	8.5	6.4	5.7	5.5	8.3	6.3			6.2	8.0	6.4	6.3
25	8.6	6.2	8.5	6.4	5.9	6.4	8.4	6.5			5.8	8.1	6.0	5.7
50	8.6	6.1	8.5	7.2	5.8	7.7	8.5	7.5			7.0	8.1	6.2	6.3
100	8.6	6.0	8.2	7.5	5.9	8.2	8.7	8.5			9.0	8.1	8.2	8.6
Technician Initials	MDO	EL	MDO	IMN	EL	GC	MDO	EL			MDO	EL		EL

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab (H)	7.7	7.1	7.7	6.0	7.4	7.0	7.7	7.2			7.1	7.8	7.7	7.1
Site (H)	7.6	7.4	7.8	6.1	7.6	7.3	7.8	7.4			7.6	7.7	7.5	7.6
1.5b	7.7	7.4	7.8	6.1	7.7	7.4	7.9	7.5			7.5	7.8	7.5	7.4
3.13	7.8	7.5	7.9	6.1	7.7	7.4	8.0	7.6			7.5	7.8	7.5	7.4
6.25	7.9	7.5	8.0	6.2	7.8	7.5	8.1	7.6			7.6	7.9	7.6	7.5
12.5	8.2	7.6	8.2	6.1	7.9	7.7	8.2	7.8			7.7	8.1	7.7	7.7
25	8.4	8.0	8.5	6.1	8.2	8.0	8.4	8.0			7.8	8.3	7.9	7.8
50	8.7	8.3	8.7	8.2	8.5	8.3	8.6	8.4			8.3	8.5	8.2	8.1
100	8.9	8.6	8.9	8.5	8.8	8.6	8.8	8.7			8.7	8.7	8.7	8.7
Technician Initials	MDO	EL	MDO	IMN	EL	GC	MDO	EL			MDO	EL		EL

pH meter: 3

Light meter: lit-1

Light intensity (Lux): MDO 710 - 410 - 950

Comments: Re-measured = 12.5 = 5.9, 25 = 7.0, 50 = 7.9, 100 = 8.5

Reviewed by: JLW

Date Reviewed: Nov 15/21

3 Confirmed. Very high algae levels. (MDO)



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synco/Hatfield  
Work Order No.: 211936  
Sample ID: River Water + Treated  
OSPW

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
CER #: 12  
Test Organism: *Hyalella azteca*

WEEK 3

Temperature (°C)

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12		13		14				
	new	<del>new</del>	<del>new</del>	old	new	<del>new</del>	new	old	new	<del>new</del>	new	old	new	old
Lab Ctl	22.0	22.0	22.0	22.0	22.5	22.0		22.5	22.0	22.0				
Site Ctl	22.0	21.8	22.0	22.0	22.0			22.5	22.0					
1.56	22.0	21.8	22.0	22.0	22.0			22.0	22.0					
3.13	22.0	21.8	22.0	22.0	22.0			22.5	22.0					
6.25	22.0	21.5	22.0	22.0	22.0			22.5	22.5					
12.5	22.5	22.0	22.0	22.0	22.0			22.5	23.0					
25	22.0	22.0	22.0	22.0	22.5			22.5	23.0					
50	22.5	22.0	22.0	22.0	22.5			22.5	22.5					
100	22.5	22.0	22.0	22.0	22.0	↓		22.5	22.5	↓				
Technician Initials	EC	EC	PH	EC	MDO	MDO		EC	MDO	MDO				

Thermometer: 12

Conductivity (µS)

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12		13		14				
	new	<del>new</del>	<del>new</del>	old	new	<del>new</del>	new	old	new	<del>new</del>	new	old	new	old
Lab Ctl	419	455	445	455	420	450		455	419	440				
Site Ctl	370	394	389	393	375	394		392	391	399				
1.56	417	446	435	439	417	440		442	437	447				
3.13	461	485	481	482	461	488		487	482	492				
6.25	547	579	566	568	549	580		577	571	582				
12.5	707	742	743	751	726	761		763	757	770				
25	1073	1112	1091	1093	1086	1115		1116	1109	1126				
50	1752	1784	1781	1766	1768	1813		1807	1791	1819				
100	3050	3140	3090	3080	3080	3140		3150	3110	3150				
Technician Initials	EC	PH	PH	EC	MDO	MDO		EC	MDO	MDO				

Conductivity meter: 3

Comments:

Reviewed by: JGU

Date Reviewed: Nov. 15/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 211936  
Sample ID: SHS River Water +  
MDO Treated OSPW

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
Test Organism: Hyalella azteca

WEEK 3

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12	13		14					
	new	<del>MDO</del>	<del>MDO</del>	old	new	<del>MDO</del>	new	old	new	<del>MDO</del>	new	old	new	old
Lab Ctl	8.3	6.4	5.5	5.2	8.3	5.9		5.0	8.5	6.2				
Site Ctl	8.0	7.0	6.5	6.5	7.9	6.8		6.7	8.5	6.8				
1.56	7.9	7.3	6.8	6.3	8.0	6.9		6.7	8.3	6.9				
3.13	8.0	7.8	6.8	5.6	8.1	6.2		6.1	8.3	6.9				
6.25	8.2	8.0	6.0	5.5	8.0	5.9		5.5	8.4	6.0				
12.5	8.2	8.2	6.0	5.6	8.0	6.3		6.0	8.3	6.4				
25	8.3	8.4	6.6	5.5	8.0	6.2		5.8	8.3	6.1				
50	8.5	8.5	6.2	6.3	8.3	7.1		6.7	8.2	6.5				
100	<del>MDO 8.7</del>	8.6	7.6	7.7	8.7	7.2		<del>8.7</del>	7.7	5.5				
	8.7													
Technician Initials	EC	IME	PM	EC	MDO	MDO		EC	MDO	MDO				

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12	13		14					
	new	<del>MDO</del>	<del>MDO</del>	old	new	<del>MDO</del>	new	old	new	<del>MDO</del>	new	old	new	old
Lab Ctl	7.7	7.4	7.4	7.1	7.8	7.1		7.0	7.8	7.1				
Site Ctl	7.7	7.5	7.7	7.5	8.2	7.5		7.4	7.9	7.5				
1.56	7.8	7.6	7.8	7.5	8.3	7.5		7.6	7.9	7.5				
3.13	7.9	7.7	7.7	7.4	8.3	7.5		7.4	8.0	7.5				
6.25	8.0	7.7	7.7	7.5	8.4	7.5		7.4	8.0	7.5				
12.5	8.1	8.1	7.9	7.6	8.6	7.7		7.6	8.2	7.7				
25	8.3	8.4	8.0	7.8	8.8	7.9		7.8	8.3	7.8				
50	8.5	8.6	8.3	8.2	8.9	8.4		8.2	8.5	8.2				
100	8.7	8.9	8.8	8.7	9.1	8.7		8.5	8.7	8.5				
Technician Initials	EC	IME	PM	EC	MDO	MDO		EC	MDO	MDO				

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 390-880

Comments: DPH meter #6 used

Reviewed by: JOU

Date Reviewed: Nov. 15/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client:  
Work Order No:  
Sample ID:

Synchrude/Hatfield  
211936  
SH3 (SH wt 3) River Water +  
MPD Treated OSPW

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
Test Organism: Hyalomma azteca  
Balance: 1

(Synchrude week 3)

SH3

Sample ID (% v/v)	Green Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	A	9	0	1	TH/MPD	1008.98	1010.68	9	TH/EC
	2	B	10	0	0		1003.37	1005.24	10	
	3	C	10	0	0		1005.05	1006.64	10	
	4	D	9	0	1		1003.93	1005.49	9	
	5	E	10	0	0		1010.81	1012.58	10	
Site Control	6	A	10	0	0	RZS	1012.54	1014.99	10	
	7	B	1	1	1		1018.58	1020.76	10	
	8	C	1	1	1		1005.91	1008.32	10	
	9	D	1	1	1		998.43	1000.65	10	
	10	E	9	1	1		1005.73	1008.02	9	
1.56	11	A	10	0	0		997.46	1000.45	10	
	12	B	1	1	1		1009.41	1012.27	10	
	13	C	1	1	1		1007.10	1009.65	10	
	14	D	1	1	1		1005.97	1008.40	10	
	15	E	1	1	1		1002.79	1005.58	10	
3.13	16	A	10	0	0	MPD	1006.40	1008.95	10	
	17	B	10	0	0		1004.11	1006.23	10	
	18	C	9	0	1		1014.00	1016.73	9	
	19	D	10	0	0		1011.85	1014.68	10	
	20	E	10	0	0		1013.30	1015.88	9 10 MPD	

Date/time pan placed in oven:

Sept 21/21 @ 1430h

Date/time pan removed from oven:

Oct 6/21 @ 0900h

Date/time pan + organisms placed in oven:

Oct 7/21 @ 1015h

Date/time pan + organisms removed from oven:

Oct 8/21 @ 1130h

Comments:

10% reweigh pan #'s: 6=1014.87, 11=1000.35, 20=1015.74, 29=1006.36,  
43=1011.44

Reviewed by:

YCW

Date Reviewed:

Nov. 15/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrone/Hatfield  
Work Order No: 211936  
Sample ID: River water + treated O&A

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
Test Organism: Hyalomma azteca  
Balance: 1

543

Sample ID (% v/v)	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	10	0	0	TH/EC	1014.28	1017.70	10	TH/EC
6.25	B	10	0	0		1005.31	1007.60	10	
	C	10	0	0		1004.08	1007.06	10	
	D	10	0	0		1002.16	1004.89	10	
	E	10	0	0		999.91	1002.45	10	
12.5	A	10	0	0	RZ	1007.65	1010.17	10	
	B	10	0	0		1007.61	1010.14	10	
	C	10	0	0		1011.80	1014.14	10	
	D	10	0	0		1003.44	1006.45	10	
	E	8	0	2		1007.67	1010.12	8	
25	A	10	0	0	MD	1008.25	1011.07	10	
	B	10	0	0		1009.97	1012.12	10	
	C	10	0	0		1011.56	1014.08	10	
	D	10	0	0		1004.33	1006.70	10	
	E	9	0	1		1002.49	1004.94	9	
50	A	10	0	0	RZ	994.47	996.50	10	
	B	9	0	1		1008.68	1011.13	9	
	C	10	0	0		1003.20	1005.30	10	
	D	10	0	0		1015.46	1017.90	10	
	E	10	0	0		1012.90	1015.28	10	

Date/time pan placed in oven: Sept 21/21 @ 1430h  
Date/time pan removed from oven: Oct 6/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 7/21 @ 1015h  
Date/time pan + organisms removed from oven: Oct 8/21 @ 1130h

Comments: ① are organism smaller than others

Reviewed by: JGW

Date Reviewed: Nov. 15/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 211936  
Sample ID: River Water + Treated OSPW

Start Date: Sept 23/21  
Termination Date: Oct 7/21  
Test Organism: Hyalomma azteca  
Balance: 1

Sample ID <small>MDR (%V/V)</small>	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	41	A	10	0	0	TH/MDR	1002.58	1003.76	10	TH/El
100	42	B	10	0	0	↓	1006.81	1008.23	10	↓
	43	C	10	0	0	↓	1010.09	1011.50	10	↓
	44	D	9	1	0	↓	1001.37	1002.95	9	↓
	45	E	10	0	0	↓	1001.66	1002.98	10	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 21/21 @ 1430h  
Date/time pan removed from oven: Oct 6/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 7/21 @ 1015h  
Date/time pan + organisms removed from oven: Oct 8/21 @ 1130h

Comments:

Reviewed by:

Date Reviewed:



# CETIS Summary Report

Report Date: 18 Nov-21 13:53 (p 1 of 2)  
Test Code/ID: 211936 / 13-4926-4319

## Hyaella 14-d Survival and Growth <sup>water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Batch ID: 08-3628-1876	Test Type: Growth-Survival (100) 14d	Analyst: Mikayla Oldach
Start Date: 23 Sep-21	Protocol: EC/EPS 1/RM/33 <sub>MDO</sub>	Diluent: Site Water
Ending Date: 07 Oct-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-4119-9537	Code: 211936	Project: Special Studies
Sample Date: 19 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 23 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (15.8°C)	Client: Hatfield	

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
07-4826-9304	100 Survival Rate	Fisher Exact Test	0.8788	Site Control passed 100 survival rate	1
02-7454-3890	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9999	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
02-9988-7140	100 Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
15-5584-4658	Mean Dry Weight-mg	NLR: 3P Log-Logistic	EC50	>100	n/a	n/a	<1	
			IC5	35.32	n/a	49.8	2.831	1
			IC10	46.69	17.73	61.99	2.142	
			IC15	55.5	34.64	70.72	1.802	
			IC20	63.21	45.98	77.81	1.582	
			IC25	70.38	55.57	84.13	1.421	
			IC40	91.18	78.39	104.8	1.097	
			IC50	106.1	89.23	126.1	0.9427	

### 14d 100 Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9600	0.8920	1.0000	0.9000	1.0000	0.0245	0.0548	5.71%	0.00%
0	XC	5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
1.56		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-4.17%
3.13		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
6.25		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-4.17%
12.5		5	0.9600	0.8489	1.0000	0.8000	1.0000	0.0400	0.0894	9.32%	0.00%
25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
50		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
100		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.177	0.1621	0.192	0.159	0.1889	0.005379	0.01203	6.79%	0.00%
0	XC	5	0.2361	0.2168	0.2554	0.218	0.2544	0.006951	0.01554	6.58%	-33.35%
1.56		5	0.2724	0.2439	0.3009	0.243	0.299	0.01025	0.02293	8.42%	-53.86%
3.13		5	0.2623	0.2196	0.3049	0.212	0.3033	0.01535	0.03433	13.09%	-48.14%
6.25		5	0.2792	0.2255	0.3329	0.229	0.342	0.01935	0.04327	15.50%	-57.70%
12.5		5	0.2693	0.2291	0.3094	0.234	0.3063	0.01446	0.03233	12.01%	-52.08%
25		5	0.2516	0.2182	0.2851	0.215	0.282	0.01205	0.02694	10.70%	-42.14%
50		5	0.2334	0.1988	0.2681	0.203	0.2722	0.01247	0.02789	11.95%	-31.86%
100		5	0.1417	0.1154	0.1681	0.118	0.1756	0.009494	0.02123	14.98%	19.96%



## CETIS Summary Report

Report Date:

18 Nov-21 13:53 (p 2 of 2)

Test Code/ID:

211936 / 13-4926-4319

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

14d ~~10d~~ Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9000	1.0000	1.0000	0.9000	1.0000
0	XC	1.0000	1.0000	1.0000	1.0000	0.9000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	0.9000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	0.8000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	0.9000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.9000	1.0000

## Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.1889	0.187	0.159	0.1733	0.177
0	XC	0.245	0.218	0.241	0.222	0.2544
1.56		0.299	0.286	0.255	0.243	0.279
3.13		0.255	0.212	0.3033	0.283	0.258
6.25		0.342	0.229	0.298	0.273	0.254
12.5		0.252	0.253	0.234	0.301	0.3063
25		0.282	0.215	0.252	0.237	0.2722
50		0.203	0.2722	0.21	0.244	0.238
100		0.118	0.142	0.141	0.1756	0.132

14d ~~10d~~ Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	9/10	10/10	10/10	9/10	10/10
0	XC	10/10	10/10	10/10	10/10	9/10
1.56		10/10	10/10	10/10	10/10	10/10
3.13		10/10	10/10	9/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	10/10	8/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	9/10	10/10	10/10	10/10
100		10/10	10/10	10/10	9/10	10/10



# CETIS Analytical Report

Report Date:

17 Nov-21 11:27 (p 1 of 42)

Test Code/ID:

211936 / 13-4926-4319

## Hyaella 14-d Survival and Growth ~~Sediment~~ Test

Nautilus Environmental

Analysis ID: 02-9988-7140	Endpoint: 10d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 26 Oct-21 11:00	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 08-3628-1876	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 23 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 07 Oct-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-4119-9537	Code: 211936	Project: Special Studies
Sample Date: 19 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 23 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (15.8°C)	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	715781	200	Yes	Two-Point Interpolation

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

### 14d 10d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.99	0.0%
1.56		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.99	0.0%
3.13		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.99	0.0%
6.25		5	1.0000	1.0000	1.0000	0.0000	0.00%	-2.04%	50/50	0.99	0.0%
12.5		5	0.9600	0.8000	1.0000	0.0894	9.32%	2.04%	48/50	0.975	1.52%
25		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.975	1.52%
50		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.975	1.52%
100		5	0.9800	0.9000	1.0000	0.0447	4.56%	0.0%	49/50	0.975	1.52%

### 14d 10d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	1.0000	1.0000	0.9000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	0.9000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	0.8000
25		1.0000	1.0000	1.0000	1.0000	0.9000
50		1.0000	0.9000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.9000	1.0000

### 14d 10d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	10/10	10/10	9/10
1.56		10/10	10/10	10/10	10/10	9/10
3.13		10/10	10/10	10/10	10/10	9/10
6.25		10/10	10/10	10/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10	9/10
25		10/10	10/10	10/10	10/10	9/10
50		10/10	9/10	10/10	10/10	10/10
100		10/10	10/10	10/10	9/10	10/10



# CETIS Analytical Report

Report Date:

17 Nov-21 11:27 (p 2 of 4) *msd*

Test Code/ID:

211936 / 13-4926-4319

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 02-9988-7140

Endpoint: *14d* Survival Rate

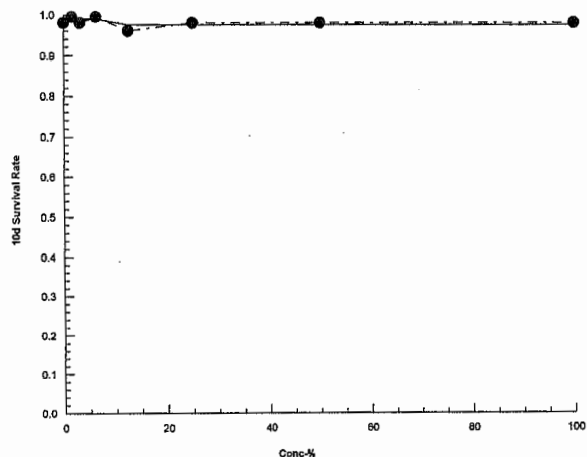
CETIS Version: CETISv1.9.4

Analyzed: 26 Oct-21 11:00

Analysis: Linear Interpolation (ICPIN)

Status Level: 1

### Graphics





## CETIS Analytical Report

Report Date: 17 Nov-21 11:27 (p 1 of 2)

Test Code/ID: 211936 / 13-4926-4319

Hyalella 14-d Survival and Growth <sup>Water-only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 15-5584-4658	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 11:17	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 08-3628-1876	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 23 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 07 Oct-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-4119-9537	Code: 211936	Project: Special Studies
Sample Date: 19 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 23 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (15.8°C)	Client: Hatfield	

## Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu = \alpha / [1 + (x/\delta)^\gamma]$	Normal [ $w=1$ ]	Off [ $\mu^* = \mu$ ]	None	None

## Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
4	141.4	-276.2	-271.8	0.6357	Yes	1.371	2.512	0.2613	Non-Significant Lack of Fit

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	35.32	n/a	49.8	2.831	2.008	n/a
IC10	46.69	17.73	61.99	2.142	1.613	5.641
IC15	55.5	34.64	70.72	1.802	1.414	2.887
IC20	63.21	45.98	77.81	1.582	1.285	2.175
IC25	70.38	55.57	84.13	1.421	1.189	1.8
IC40	91.18	78.39	104.8	1.097	0.9539	1.276
IC50	106.1	89.23	126.1	0.9427	0.7929	1.121

&gt; 100 % CV/V

## Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.2631	0.005886	0.2511	0.275	44.69	<1.0E-37	Significant Parameter
$\gamma$	2.677	0.7773	1.102	4.252	3.444	0.0014	Significant Parameter
$\delta$	106.1	8.908	88.03	124.1	11.91	<1.0E-37	Significant Parameter

## ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	2.43	0.8099	3	904.9	<1.0E-37	Significant
Lack of Fit	0.005841	0.001168	5	1.371	0.2613	Non-Significant
Pure Error	0.02727	0.0008523	32			
Residual	0.03311	0.0008949	37			

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Extreme Value	Grubbs Extreme Value Test	2.713	3.036	0.1798	No Outliers Detected
Variances	Bartlett Equality of Variance Test	4.818	14.07	0.6821	Equal Variances
	Mod Levene Equality of Variance	0.8812	2.423	0.5357	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9692	0.9447	0.3393	Normal Distribution
	Anderson-Darling A2 Normality Test	0.4516	2.492	0.2779	Normal Distribution
Control Trend	Mann-Kendall Trend Test	2		0.8151	Non-Significant Trend in Controls

JG  
Nov-19/21



# CETIS Analytical Report

Report Date: 17 Nov-21 11:27 (p 2 of 2)

Test Code/ID: 211936 / 13-4926-4319

## Hyalella 14-d Survival and Growth <sup>water only</sup> Sediment Test <sub>mbs</sub>

Nautilus Environmental

Analysis ID: 15-5584-4658

Endpoint: Mean Dry Weight-mg

CETIS Version: CETISv1.9.4

Analyzed: 17 Nov-21 11:17

Analysis: Nonlinear Regression (NLR)

Status Level: 1

### Mean Dry Weight-mg Summary

### Calculated Variate

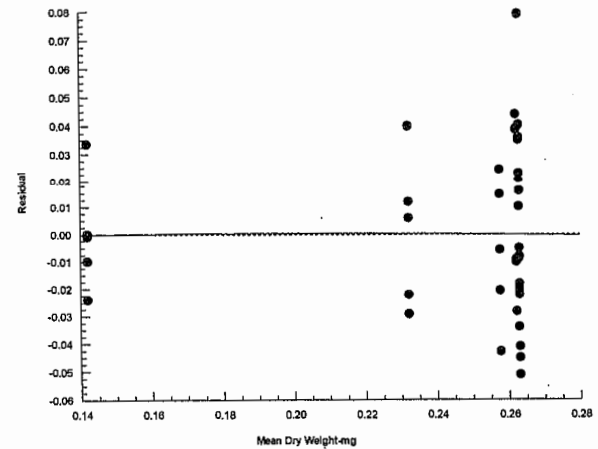
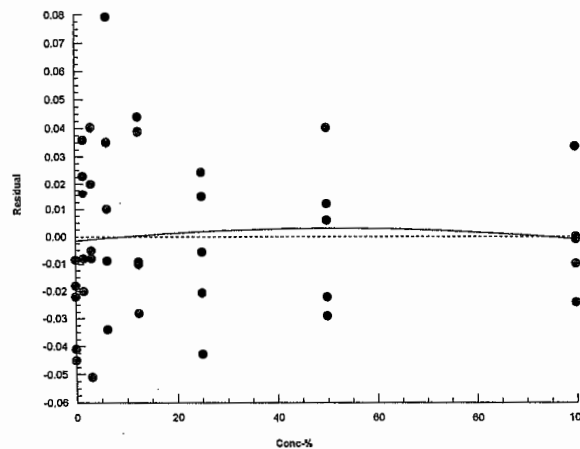
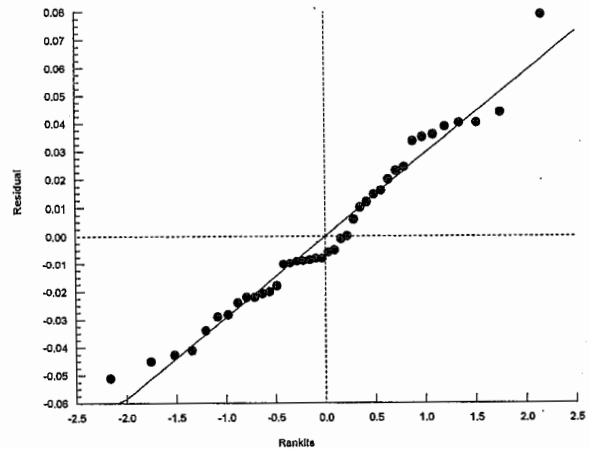
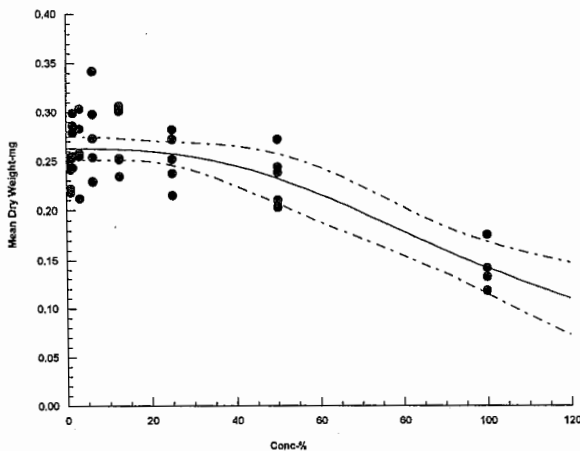
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	5	0.2361	0.218	0.2544	0.006951	0.01554	6.58%	0.0%
1.56		5	0.2724	0.243	0.299	0.01025	0.02293	8.42%	-15.38%
3.13		5	0.2623	0.212	0.3033	0.01535	0.03433	13.09%	-11.09%
6.25		5	0.2792	0.229	0.342	0.01935	0.04327	15.50%	-18.26%
12.5		5	0.2693	0.234	0.3063	0.01446	0.03233	12.01%	-14.05%
25		5	0.2516	0.215	0.282	0.01205	0.02694	10.70%	-6.59%
50		5	0.2334	0.203	0.2722	0.01247	0.02789	11.95%	1.12%
100		5	0.1417	0.118	0.1756	0.009494	0.02123	14.98%	39.98%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.245	0.218	0.241	0.222	0.2544
1.56		0.299	0.286	0.255	0.243	0.279
3.13		0.255	0.212	0.3033	0.283	0.258
6.25		0.342	0.229	0.298	0.273	0.254
12.5		0.252	0.253	0.234	0.301	0.3063
25		0.282	0.215	0.252	0.237	0.2722
50		0.203	0.2722	0.21	0.244	0.238
100		0.118	0.142	0.141	0.1756	0.132

### Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [w=1]





## *Hyalella azteca* Water-only Test Summary Sheet

Client: Synconide/Hatfield  
Work Order No.: 212002 MSD

Start Date: Sept 30/21  
Set up by: MSD

### Sample Information:

Sample ID: River Water + Treated OSPW  
Sample Date: Sept 26/21  
Date Received: Sept 30/21  
Sample Volume: 6 x 20L + 1 x 20L

### Test Organism Information:

Species: *Hyalella azteca*  
Supplier: Aquatic Biosystems, CO  
Date received: Sept 29/21  
Age or size (Day 0): 7-9 d  
% Mortality in 24 h prior to testing: 0

### NaCl Reference Toxicant Results:

Reference Toxicant ID: HA214  
Stock Solution ID: n/a  
Date Initiated: Oct 4/21

96-h LC50 (95% CL): 6.6 (5.3-8.1) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.3 (4.1-9.6) g/L NaCl CV (%): 20.22 MSD

### Test Results:

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95% CL)	>100	
IC25%(v/v) (95% CL)		92.3 (80.9 - <del>102.25</del> ) <sup>&gt;100</sup>
IC50%(v/v) (95% CL)		>100

Reviewed by: JOB

Date reviewed: Nov. 29/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrone/Hatfield  
Work Order No.: 212002  
Sample ID: SH Wk 4 (SHH) m20  
River Water + Treated OSPW

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
CER #: 6  
Test Organism: Hyalella azteca

WEEK 4

Temperature (°C)

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5		6		7		8
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.5	23.0	22.5	22.5	22.5	22.5	22.5	22.5		22.0	22.0	21.5		22.5
Site Ctn	22.0	22.5	22.0	22.5	22.5	22.5	22.0	22.5				21.5		22.5
1.56	22.0	22.5	22.0	22.5	22.5	22.5	22.0	22.5				21.5		22.5
3.13	22.0	22.5	22.0	22.5	22.5	22.5	22.0	23.0				21.5		22.5
6.25	22.0	22.5	22.0	22.5	22.5	22.5	22.0	23.0				22.0		22.5
12.5	22.0	23.0	22.0	22.5	22.5	22.5	22.0	22.5				22.0		22.5
25	22.0	23.0	22.0	22.5	22.5	22.5	22.0	22.5				21.5		22.5
50	22.0	23.0	22.0	22.0	23.0	22.5	22.5	23.0				22.0		22.5
100	22.0	23.0	22.5	22.0	23.0	22.5	22.5	23.0		↓	↓	22.0		22.5
Technician Initials	MDO	MDO	MDO	Inc	PH	EC	MDO	EC		MDO	MDO	EC		MDO
Thermometer:	6													

Conductivity (µS)

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5	6		7	8		
	<del>MDW</del>	old	new	<del>MDW</del>	<del>MDW</del>	old	new	<del>MDW</del>	new	old	new	<del>MDW</del>	new	old
Lab Ctn	421	428	420	451	453	443	420	445		450	419	436		446
Site Ctn	372	379	372	399	402	394	376	395		400	383	395		405
1.56	417	428	416	443	449	440	422	443		448	428	443		452
3.13	463	472	460	489	475	480	465	488		493	472	486		493
6.25	549	560	547	584	588	571	552	578		584	558	574		583
12.5	728	730	721	756	760	749	737	765		770	735	760		773
25	1086	1081	1077	1133	1118	1098	1090	1123		1128	1093	1117		1129
50	1766	1733	1767	1784	1814	1768	1783	1818		1823	1777	1805		1818
100	3080	3030	3080	3170	3140	3050	3100	3160		3160	3090	3130		3150
Technician Initials	MDW	MDW	MDW	Inc	PH	EC	MDW	EC		MDW	MDW	EC		MDW
Conductivity meter:	3													

Comments:

Reviewed by:

JGB

Date Reviewed:

Nov. 15/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Suncrude/Hatfield  
Work Order No.: 212002  
Sample ID: SH11111 River water +  
MDO Treated OSW

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: *Hyalomma azteca*

WEEK 4

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	8.3	6.6	8.2	6.5	5.5	5.4	8.3	6.6			6.3	8.5	5.9	5.8
Site Ctn	8.6	6.8	8.7	6.7	5.8	5.3	8.4	6.8			6.3	8.5	6.0	6.1
1.56	8.2	6.8	8.7	6.8	6.0	5.4	8.2	6.6			6.4	8.5	6.2	5.9
3.13	8.4	6.7	8.7	6.7	5.9	5.5	8.2	6.8			6.3	8.4	6.1	5.8
6.25	8.5	6.7	8.6	6.8	5.4	5.4	8.2	6.7			6.4	8.4	6.3	5.8
12.5	8.5	6.8	8.7	6.8	6.3	5.4	8.3	6.4			6.4	8.4	6.4	5.8
25	8.5	6.7	8.6	7.0	5.7	5.7	8.2	6.3			5.9	8.4	6.0	5.3
50	8.5	6.8	8.6	6.9	5.9	5.9	8.1	6.8	✓		6.4	8.3	6.1	5.2
100	8.7	6.7	8.3	6.7	6.1	6.2	7.9	7.2	✓		7.4	7.8	6.6	5.2
Technician Initials	MDO	MDO	MDO	TM	PM	EC	MDO	EC			MDO	MDO	EC	MDO

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	7.8	7.3	7.8	7.4	7.5	7.2	7.8	7.1			7.2	7.8	7.1	7.1
Site Ctn	7.7	7.6	7.8	7.5	7.7	7.4	7.8	7.4			7.4	7.8	7.3	7.4
1.56	7.8	7.6	7.9	7.5	7.6	7.4	7.8	7.5			7.5	7.8	7.4	7.4
3.13	7.8	7.7	7.9	7.8	7.7	7.5	7.9	7.5			7.5	7.9	7.5	7.4
6.25	8.0	7.7	8.0	7.8	7.7	7.5	8.0	7.6			7.6	8.0	7.6	7.5
12.5	8.1	7.9	8.2	8.1	7.8	7.6	8.1	7.7			7.7	8.2	7.7	7.6
25	8.4	8.1	8.4	8.4	8.0	7.8	8.3	7.9			7.8	8.4	7.8	7.7
50	8.6	8.4	8.6	8.7	8.4	8.1	8.6	8.2			8.1	8.6	8.2	8.0
100	8.8	8.7	8.8	8.8	8.8	8.6	8.8	8.2	✓		8.6	8.8	8.6	8.5
Technician Initials	MDO	MDO	MDO	TM	PM	EC	MDO	EC			MDO	MDO	EC	MDO

pH meter: 3

Light meter: 114-1

Light intensity (Lux): 450-870

Comments: DSO = 8.2, 100 = 8.6  
(remeasured)

Reviewed by: JGK

Date Reviewed: Nov. 15/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 212002  
Sample ID: SH Wk 4 River Water +  
MDO Treated OSPW

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
CER #: 6  
Test Organism: *Hyalella azteca*

WEEK 4

**Temperature (°C)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	22.0	22.0	22.5	22.5		22.0	22.0	22.0		22.0				
Site Ctn						22.5	22.0	22.0		22.0				
1.56						22.5	22.0	22.0		22.0				
3.13						22.5	22.0	22.0		22.0				
6.25						22.5	22.0	22.0		22.0				
12.5						22.5	22.0	22.0		22.0				
25						22.5	22.0	22.0		22.5				
50						22.5	22.0	22.0		22.5				
100	22.5		23.0			22.5	22.0	22.0		22.5				
Technician Initials	MDO	JMC	PM	PM		EC	MDO	EC		EC				

Thermometer: 6

**Conductivity (µS)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	419	436	439	448		458	428	442		450				
Site Ctn	381	404	405	412		420	384	401		407				
1.56	430	451	449	456		462	432	448		452				
3.13	474	492	492	498		505	477	492		496				
6.25	563	583	594	601		609	567	588		591				
12.5	749	772	772	780		789	757	777		782				
25	1102	1129	1135	1141		1153	1115	1130		1142				
50	1794	1861	1822	1834		1852	1810	1833		1844				
100	3120	3140	3150	3160		3190	3160	3190		3190				
Technician Initials	MDO	JMC	PM	PM		EC	MDO	EC		EC				

Conductivity meter: 3

Comments:

Reviewed by: JGH

Date Reviewed: Nov - 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synxide/Hatfield  
Work Order No.: 212002  
Sample ID: River Water + Treated OSPW

Start Date: Sept 30 12  
Termination Date: Oct 14 12  
Test Organism: Hyalella azteca

Week 4

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab CN 80	8.2	6.8	5.5	5.7	6.0	8.4	6.1	5.7						
Site CN	8.6	6.8	6.1	6.1	6.1	8.4	6.3	5.6						
1.56	8.6	6.9	5.8	7.6	5.6	8.1	5.5	5.3						
3.13	8.6	6.8	5.1	5.0	5.3	8.1	5.3	5.1						
6.25	8.6	6.5	5.2	5.0	5.4	8.1	5.6	5.3						
12.5	8.6	6.0	5.8	5.5	5.8	8.1	5.6	5.3						
25	8.5	6.0	5.2	5.1	5.4	8.1	5.9	5.7						
50	8.4	6.2	5.3	5.0	5.3	8.1	6.1	5.7						
100	8.0	5.9	4.9	5.0	5.6	8.1	6.2	5.2						
Technician Initials	MDO	EM	PM	PM	EC	MDO	EC	EC						

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab CN 80	7.6	7.5	7.6	-	7.1	7.8	7.0	7.0						
Site CN	7.9	7.5	7.9	7.8	7.4	7.8	7.3	7.2						
1.56	7.9	7.6	7.9	7.7	7.3	7.9	7.3	7.1						
3.13	8.0	7.7	7.8	7.8	7.3	7.9	7.3	7.2						
6.25	8.1	7.7	7.8	7.8	7.4	8.0	7.4	7.3						
12.5	8.2	7.8	8.0	8.0	7.6	8.1	7.6	7.4						
25	8.4	7.9	8.0	8.0	7.7	8.3	7.8	7.7						
50	8.6	8.2	8.3	8.2	8.0	8.6	8.2	8.1						
100	8.8	8.4	8.7	8.6	8.4	8.7	8.5	8.4						
Technician Initials	MDO	EM	PM	PM	EC	MDO	EC	EC						

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 400-850

Comments:

Reviewed by: JGK

Date Reviewed: Nov. 19/12



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Spruade/Hatfield  
Work Order No: 212002  
Sample ID: River Water + Treated OSPW

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyaella azteca  
Balance: 1

SH4  
Block

Sample ID (% v/v)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	A	10	0	0	MDO	1000.58	1002.82	10	MDO/MDO
	2	B	↓	↓	↓	↓	1003.10	1004.87	10	↓
	3	C	↓	↓	↓	↓	1009.83	1010.90	10	↓
	4	D	↓	↓	↓	↓	1000.36	1001.98	10	↓
	5	E	↓	↓	↓	↓	1004.92	1007.22	10	↓
Site Control	6	A	10	0	0	MDO	1002.47	1005.17	10	↓
	7	B	↓	↓	↓	↓	1004.96	1007.80	10	↓
	8	C	↓	↓	↓	↓	1008.21	1010.75	10	↓
	9	D	↓	↓	↓	↓	1008.48	1011.05	10	↓
	10	E	↓	↓	↓	↓	1009.21	1012.03	10	↓
1.56	11	A	10	0	0	MDO	1007.71	1010.41	10	↓
	12	B	↓	↓	↓	↓	997.36	999.74	10	↓
	13	C	↓	↓	↓	↓	1005.65	1008.49	10	↓
	14	D	↓	↓	↓	↓	997.71	1000.64	10	↓
	15	E	↓	↓	↓	↓	1007.02	1009.91	10	↓
3.13	16	A	10	0	0	MDO	1008.54	1011.29	10	↓
	17	B	↓	↓	↓	↓	1012.53	1015.07	10	↓
	18	C	↓	↓	↓	↓	1012.87	1015.56	10	↓
	19	D	↓	↓	↓	↓	1008.33	1011.04	10	↓
	20	E	↓	↓	↓	↓	1006.34	1004.18	10	↓

Date/time pan placed in oven: Sept 21/21 @ 1430h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1630h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 0900h

Comments: 10% reweigh: pan # - 4 = 1001.93, 13 = 1008.46, 22 = 1015.24, 32 = 1009.66,  
41 = 999.73

Reviewed by: Jbw

Date Reviewed: Nov - 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrone/Hatfield  
Work Order No: 212002  
Sample ID: River Water + Treated OSRU

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyalella azteca  
Balance: 1

Sample ID (I-VI)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control 6.25	21	A	10	0	0	MDO	997.65	1007.79	10	MDO/MTDO
	22	B	↓	↓	↓	↓	1012.67	1015.19	10	↓
	23	C	↓	↓	↓	↓	1015.51	1017.95	10	↓
	24	D	↓	↓	↓	↓	1017.21	1020.01	10	↓
	25	E	9	0	1	↓	1011.27	1014.13	9	↓
12.5	26	A	10	0	0	MDO	1004.33	1007.29	10	↓
	27	B	↓	↓	↓	↓	993.73	996.42	10	↓
	28	C	↓	↓	↓	↓	1002.67	1005.13	10	↓
	29	D	↓	↓	↓	↓	1013.16	1015.62	10	↓
	30	E	↓	↓	↓	↓	994.79	997.68	10	↓
25	31	A	10	0	0	MDO	991.47	994.45	10	↓
	32	B	↓	↓	↓	↓	1006.85	1009.60	10	↓
	33	C	↓	↓	↓	↓	1000.67	1003.14	10	↓
	34	D	↓	↓	↓	↓	1006.89	1009.63	10	↓
	35	E	↓	↓	↓	↓	1000.14	1002.67	10	↓
50	36	A	10	0	0	MDO	1011.51	1014.06	10	↓
	37	B	↓	↓	↓	↓	1014.38	1017.21	10	↓
	38	C	↓	↓	↓	↓	998.86	1001.57	10	↓
	39	D	↓	↓	↓	↓	1004.57	1007.04	10	↓
	40	E	↓	↓	↓	↓	1008.08	1010.94	10	↓

Date/time pan placed in oven: Sept 21/21 @ 1430h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1630h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 0900h

Comments: One significantly smaller than others.

Reviewed by: Joh

Date Reviewed: Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 212002  
Sample ID: River Water + Treated OSPW

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyalella azteca  
Balance: 1

5114  
Black

Sample ID (% v/v)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
MDO Control	41	A	10	0	0	MDO	997.63	999.70	10	MDO/MDO
100	42	B	10	0	0	↓	1008.15	1010.35	10	↓
	43	C	10	0	0	↓	1006.32	1007.98	10	↓
	44	D	9	0	1	↓	1004.61	1006.17	9	↓
	45	E	9	0	1	↓	1001.72	1003.13	9	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 21/21 @ 1430h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1630h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 0900h

Comments:

Reviewed by:

JGH

Date Reviewed:

Nov. 19/21



# CETIS Summary Report

Report Date: 18 Nov-21 11:20 (p 1 of 2)  
Test Code/ID: 212002a / 19-9867-2061

## Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Batch ID: 13-6062-0185	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 30 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 14 Oct-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO
		Age: 7-9d
Sample ID: 09-6060-2783	Code: 212002a	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 30 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (13.7°C)	Client: Hatfield	

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
18-2490-1585	10d Survival Rate	Fisher Exact Test	1.0000	Site Control passed 10d survival rate	1
14-5397-7542	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9977	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
05-2431-2554	10d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
			EC50	>100	n/a	n/a	<1	
13-7140-8788	Mean Dry Weight-mg	NLR: 3P Log-Logistic	IC5	61.2	n/a	82.6	1.634	1
			IC10	72.29	n/a	92.49	1.383	
			IC15	80.14	22.55	97.6	1.248	
			IC20	86.61	66.97	100.4	1.155	
			IC25	92.34	80.87	102.2	1.083	
			IC40	107.8	94.77	120.9	0.9279	
			IC50	118	93.42	149	0.8477	

>100% CV

for

### 14d 10d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	XC	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1.56		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.13		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
6.25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
12.5		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
25		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		5	0.9600	0.8920	1.0000	0.9000	1.0000	0.0245	0.0548	5.71%	4.00%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1788	0.1162	0.2414	0.107	0.23	0.02254	0.0504	28.19%	0.00%
0	XC	5	0.2694	0.2522	0.2866	0.254	0.284	0.006177	0.01381	5.13%	-50.67%
1.56		5	0.2748	0.2471	0.3025	0.238	0.293	0.009986	0.02233	8.13%	-53.69%
3.13		5	0.2706	0.257	0.2842	0.254	0.284	0.004885	0.01092	4.04%	-51.34%
6.25		5	0.2816	0.2392	0.3239	0.244	0.3178	0.01525	0.0341	12.11%	-57.47%
12.5		5	0.2692	0.2402	0.2982	0.246	0.296	0.01046	0.02338	8.68%	-50.56%
25		5	0.2694	0.2442	0.2946	0.247	0.298	0.009059	0.02026	7.52%	-50.67%
50		5	0.2672	0.246	0.2884	0.247	0.286	0.007632	0.01707	6.39%	-49.44%
100		5	0.1846	0.1506	0.2186	0.1567	0.22	0.01226	0.02742	14.85%	-3.24%

N = negative (lab) control  
XC = site control



## CETIS Summary Report

Report Date: 18 Nov-21 11:20 (p 2 of 2)  
Test Code/ID: 212002a / 19-9867-2061

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

14d ~~10d~~ Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1.0000	1.0000	1.0000	1.0000	1.0000
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.9000	0.9000

## Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.224	0.171	0.107	0.162	0.23
0	XC	0.27	0.284	0.254	0.257	0.282
1.56		0.27	0.238	0.284	0.293	0.289
3.13		0.275	0.254	0.269	0.271	0.284
6.25		0.314	0.252	0.244	0.28	0.3178
12.5		0.296	0.269	0.246	0.246	0.289
25		0.298	0.275	0.247	0.274	0.253
50		0.255	0.283	0.265	0.247	0.286
100		0.207	0.22	0.166	0.1733	0.1567

14d ~~10d~~ Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	10/10	10/10	10/10	10/10	10/10
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	10/10	10/10	10/10
3.13		10/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	10/10
50		10/10	10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	9/10	9/10



## CETIS Analytical Report

Report Date: 18 Nov-21 11:20 (p 1 of 2)

Test Code/ID: 212002a / 19-9867-2061

Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 05-2431-2554	Endpoint: <sup>14d</sup> 100 Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 15:21	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 13-6062-0185	Test Type: Growth-Survival ( <sup>100</sup> 14d)	Analyst: Mikayla Oldach
Start Date: 30 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 14 Oct-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 09-6060-2783	Code: 212002a	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 30 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (13.7°C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1307152	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

14d <sup>100</sup> Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
1.56		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
3.13		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
6.25		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.995	0.5%
12.5		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.995	0.5%
25		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.995	0.5%
50		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.995	0.5%
100		5	0.9600	0.9000	1.0000	0.0548	5.71%	4.0%	48/50	0.96	4.0%

14d <sup>100</sup> Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	0.9000	0.9000

14d <sup>100</sup> Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	10/10	10/10	10/10
3.13		10/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	10/10
50		10/10	10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	9/10	9/10



# CETIS Analytical Report

Report Date: 18 Nov-21 11:20 (p 2 of 2)  
Test Code/ID: 212002a / 19-9867-2061

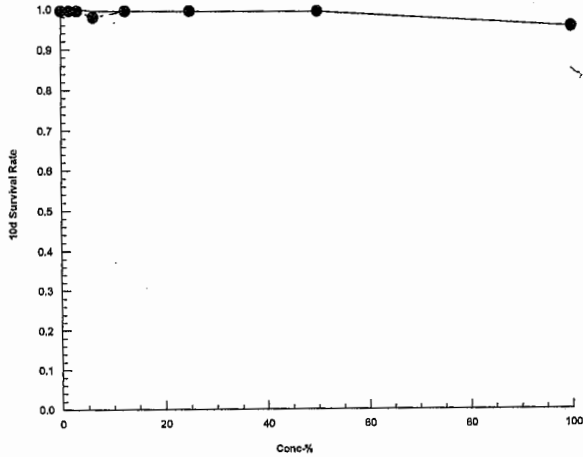
## Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 05-2431-2554  
Analyzed: 17 Nov-21 15:21  
Endpoint: <sup>msc</sup> 10d Survival Rate  
Analysis: <sup>msc</sup> Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics





# CETIS Analytical Report

Report Date: 18 Nov-21 11:20 (p 1 of 2)  
Test Code/ID: 212002a / 19-9867-2061

## Hyaella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 13-7140-8788	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 15:21	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 13-6062-0185	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 30 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 14 Oct-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 09-6060-2783	Code: 212002a	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 30 Sep-21	CAS (PC):	Station: OSPW
Sample Age: 84h (13.7°C)	Client: Hatfield	

### Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu = \alpha / [1 + (x/\delta)^{\gamma}]$	Normal [ $\omega=1$ ]	Off [ $\mu^*=\mu$ ]	None	None

### Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
8	155.4	-304.1	-299.7	0.6513	Yes	0.2407	2.512	0.9414	Non-Significant Lack of Fit

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	61.2	n/a	82.6	1.634	1.211	n/a
IC10	72.29	n/a	92.49	1.383	1.081	n/a
IC15	80.14	22.55	97.6	1.248	1.025	4.434
IC20	86.61	66.97	100.4	1.155	0.9957	1.493
IC25	92.34	80.87	102.2	1.083	0.9782	1.236
IC40	107.8	94.77	120.9	0.9279	0.8271	1.055
IC50	118	93.42	149	0.8477	0.6713	1.07

> 100% (✓✓)

### Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.2726	0.003916	0.2646	0.2805	69.6	<1.0E-37	Significant Parameter
$\gamma$	4.487	2.657	-0.897	9.871	1.689	0.0997	Non-Significant Parameter
$\delta$	118	12.24	93.17	142.8	9.638	<1.0E-37	Significant Parameter

### ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	2.755	0.9183	3	2061	<1.0E-37	Significant
Lack of Fit	0.0005974	0.0001195	5	0.2407	0.9414	Non-Significant
Pure Error	0.01589	0.0004964	32			
Residual	0.01648	0.0004455	37			

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Variances	Bartlett Equality of Variance Test	6.36	14.07	0.4984	Equal Variances
	Mod Levene Equality of Variance	2.128	2.423	0.0795	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9658	0.9447	0.2622	Normal Distribution
	Anderson-Darling A2 Normality Test	0.454	2.492	0.2743	Normal Distribution



# CETIS Analytical Report

Report Date: 18 Nov-21 11:20 (p 2 of 2)  
Test Code/ID: 212002a / 19-9867-2061

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 13-7140-8788  
Analyzed: 17 Nov-21 15:21

Endpoint: Mean Dry Weight-mg  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Mean Dry Weight-mg Summary

### Calculated Variate

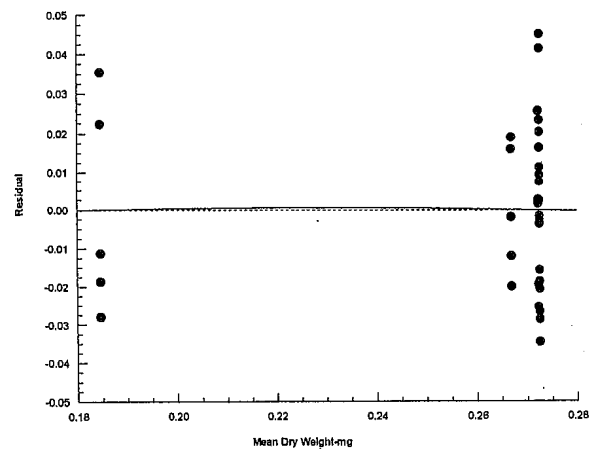
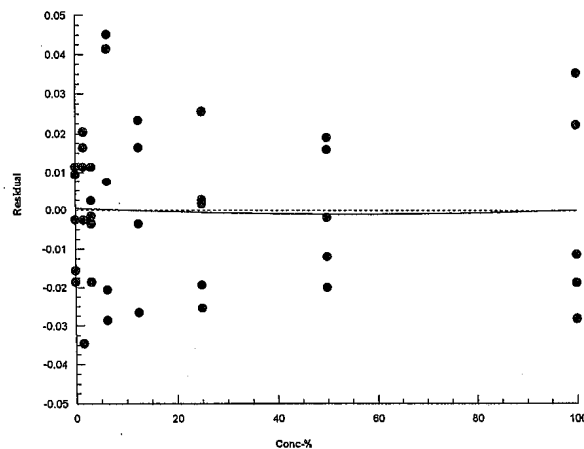
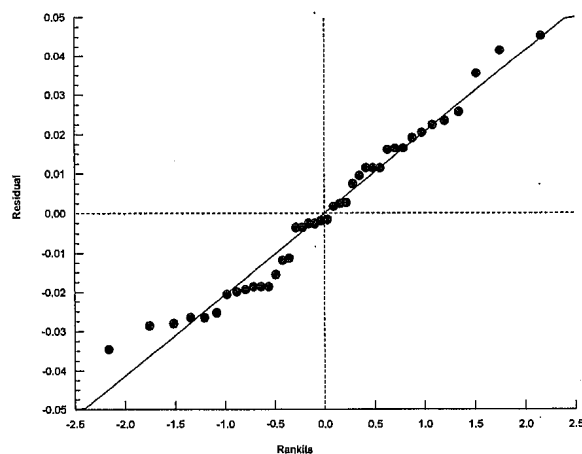
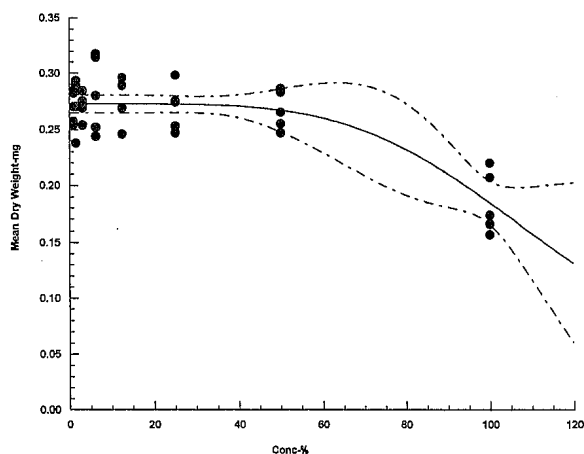
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	5	0.2694	0.254	0.284	0.006177	0.01381	5.13%	0.0%
1.56		5	0.2748	0.238	0.293	0.009986	0.02233	8.13%	-2.0%
3.13		5	0.2706	0.254	0.284	0.004885	0.01092	4.04%	-0.45%
6.25		5	0.2816	0.244	0.3178	0.01525	0.0341	12.11%	-4.51%
12.5		5	0.2692	0.246	0.296	0.01046	0.02338	8.69%	0.07%
25		5	0.2694	0.247	0.298	0.009059	0.02026	7.52%	0.0%
50		5	0.2672	0.247	0.286	0.007632	0.01707	6.39%	0.82%
100		5	0.1846	0.1567	0.22	0.01226	0.02742	14.85%	31.48%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.27	0.284	0.254	0.257	0.282
1.56		0.27	0.238	0.284	0.293	0.289
3.13		0.275	0.254	0.269	0.271	0.284
6.25		0.314	0.252	0.244	0.28	0.3178
12.5		0.296	0.269	0.246	0.246	0.289
25		0.298	0.275	0.247	0.274	0.253
50		0.255	0.283	0.265	0.247	0.286
100		0.207	0.22	0.166	0.1733	0.1567

### Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [ $\omega=1$ ]





## ***Hyalella azteca* Water-only Test Summary Sheet**

Client: Synconide/Hatfield  
Work Order No.: 212002

Start Date: Sept 30/21  
Set up by: mbo

### **Sample Information:**

Sample ID: River Water + Reactor 2 Water  
Sample Date: Sept 26/21  
Date Received: Sept 30/21  
Sample Volume: 6 x 20L + 2 x 20L

### **Test Organism Information:**

Species: *Hyalella azteca*  
Supplier: Aquatic Biosystems, CO  
Date received: Sept 29/21  
Age or size (Day 0): 7-9 d  
% Mortality in 24 h prior to testing: 0

### **NaCl Reference Toxicant Results:**

Reference Toxicant ID: HA214  
Stock Solution ID: n/a  
Date Initiated: Oct 4/21

96-h LC50 (95% CL): 6.6 (5.3-8.1) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.3 (4.1-9.6) g/L NaCl CV (%): 20.22  
mbo

### **Test Results:**

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95%CL)	>100	
IC25%(v/v) (95%CL)		71.6 (57.5-85.3)
IC50%(v/v) (95%CL)		>100

Reviewed by: JCh

Date reviewed: Nov. 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synnide/Hatfield  
Work Order No.: 212002  
Sample ID: SR2 River Water +  
MDO Reactor 2 Water

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
CER #: 6  
Test Organism: *Hyalella azteca*

\* Reactor 2 \*

Temperature (°C)

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	22.5	23.0	22.5	22.0	22.5	22.5	22.5	23.0			22.0	22.0	22.0	22.5
Site Ctl	22.0	22.5	22.0	22.0	22.0	22.5	22.0	22.5			22.0	22.0		22.5
1.56	22.0	22.5	22.0	22.5	23.0	22.5	22.0	22.5					22.0	22.5
3.13	22.0	23.0	22.0	22.5	23.0	22.5	22.0	22.5					21.0	22.5
6.25	22.0	23.0	22.0	22.5	22.0	22.5	22.0	22.5					22.0	22.5
12.5	22.0	22.5	22.0	23.0	23.0	22.5	22.0	22.5					22.0	22.5
25	22.0	23.0	22.0	23.0	23.0	22.5	22.0	22.0					22.0	22.5
50	22.0	23.0	22.0	22.5	23.0	22.5	22.0	23.0					22.0	22.5
100	22.5	23.0	22.5	23.0	23.0	22.5	22.0	23.0			↓	↓	22.0	23.0
Technician Initials	MDO	MDO	MDO	IMB	PL	EC	MDO	EC			MDO	MDO	EC	EC

Thermometer: 6

Conductivity (µS)

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	421	427	420	451	453	443	420	446			453	419	436	444
Site Ctl	372	383	372	409	402	395	374	397			400	383	396	404
1.56	411	422	417	449	450	442	420	446			451	430	445	442
3.13	452	463	461	491	489	479	464	487			492	474	488	496
6.25	534	543	547	559	574	565	553	577			580	563	577	586
12.5	703	708	723	751	751	745	728	764			768	739	762	772
25	1052	1061	1081	1104	1106	1095	1089	1122			1125	1098	1117	1128
50	1732	1717	1769	1804	1810	1779	1772	1814			1821	1781	1806	1824
100	3080	3020	3070	3160	3160	3070	3090	3150			3150	3080	3110	3140
Technician Initials	MDO	MDO	MDO	IMB	PL	EC	MDO	EC			MDO	MDO	EC	EC

Conductivity meter: 3

Comments: 023.0

Reviewed by: JGK Date Reviewed: Nov. 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchro / Hatfield  
Work Order No.: 212002  
Sample ID: River water + Reactor 2  
Water.

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
CER #: 6  
Test Organism: *Hyalella azteca*

Reactor 2

**Temperature (°C)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	22.0	22.0	23.0	22.0		22.5	22.0	22.0		22.5				
Site Ctl	22.0			22.5		22.5	22.0	22.0		22.5				
1.5b						22.5	22.0	22.0		22.0				
3.13						22.5	22.0	22.0		22.0				
6.25						22.5	22.0	22.0		22.0				
12.5						22.5	22.0	22.0		22.0				
25						22.5	22.0	22.0		22.0				
50						22.5	22.0	22.0		22.0				
100	23.0					22.5	22.0	22.0		22.5				
Technician Initials	MDO	JMC	PM	PM		EC	MDO	EC		MDO				

Thermometer: 6

**Conductivity (µS)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	419	448	450	458		446	428	445		453				
Site Ctl	381	406	405	415		419	384	403		406				
1.5b	433	454	453	460		465	434	456		461				
3.13	478	497	496	502		507	480	494		497				
6.25	568	582	587	593		599	572	587		590				
12.5	758	773	772	778		787	753	778		783				
25	1110	1132	1134	1144		1150	1122	1140		1153				
50	1796	1812	1822	1835		1852	1847	1838		1836	1841			
100	3100	3120	3130	3160		3180	3150	3170		3180				
Technician Initials	MDO	JMC	PM	PM		EC	MDO	EC		MDO				

Conductivity meter: 3

Comments:

1) Should not be crossed out.

Reviewed by:

JMC

Date Reviewed:

Nov. 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 212002  
Sample ID: SP2 River Water +  
MDO Reactor 2 Water

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: *Hyalomma azteca*

\* Reactor 2 \*

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5	6		7	8		
	new	old	new	old	new	old	new	MDO	new	old	new	MDO	new	old
Lab Ctn	8.3	6.6	8.2	6.2	5.6	5.5	8.3	6.1		6.0	8.5	6.0		6.7
Site Ctn	8.6	6.7	8.7	6.3	5.7	5.6	8.1	6.1		6.0	8.5	6.3		6.3
1.5b	8.4	6.7	8.5	6.4	5.6	5.6	8.1	6.3		6.0	8.6	6.0		6.1
3.13	8.4	6.7	8.6	6.2	5.5	5.4	8.1	6.1		5.9	8.6	6.2		6.1
6.25	8.5	6.5	8.6	6.1	5.6	5.5	8.1	6.1		5.9	8.6	5.9		5.6
12.5	8.5	6.6	8.7	6.3	5.7	5.6	8.1	6.1		5.8	8.5	5.8		5.5
25	8.5	6.8	8.6	6.3	5.7	5.5	8.1	6.5		5.8	8.5	5.7		5.5
50	8.5	6.6	8.5	6.2	5.9	5.4	8.0	5.8		5.4	8.5	5.3		5.0
100	8.2	6.4	8.2	6.4	5.6	5.2	7.7	5.4		5.2	8.2	5.5		5.0
Technician Initials	MDO	MDO	MDO	JM	PM	EC	MDO	EC		MDO	MDO	EC		EC

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5	6		7		8	
	new	old	new	old	new	old	new	MDO	new	old	new	MDO	new	old
Lab Ctn	7.8	7.4	7.8	7.5	7.5	7.1	7.8	7.2		7.2	7.8	7.1		7.1
Site Ctn	7.7	7.6	7.8	7.7	7.7	7.4	8.1	7.4		7.4	7.8	7.4		7.5
1.5b	7.8	7.6	7.8	7.7	7.7	7.4	8.2	7.5		7.4	7.9	7.4		7.4
3.13	7.8	7.6	7.9	7.8	7.7	7.5	8.2	7.5		7.5	7.9	7.5		7.5
6.25	7.8	7.7	7.9	7.8	7.7	7.5	8.3	7.5		7.5	7.9	7.5		7.5
12.5	7.9	7.7	8.0	7.9	7.8	7.6	8.3	7.7		7.6	8.0	7.6		7.6
25	8.0	7.9	8.1	8.2	8.0	7.8	8.4	7.8		7.8	8.1	7.7		7.7
50	8.1	8.0	8.2	8.2	8.3	8.0	8.6	8.1		7.9	8.2	7.9		7.8
100	8.1	8.2	8.3	8.4	8.5	8.3	8.8	8.3		8.3	8.3	8.2		8.2
Technician Initials	MDO	MDO	MDO	JMC	PM	EC	MDO	EC		MDO	MDO	EC		EC

pH meter: 3

Light meter: 154-1

Light intensity (Lux): 450-870

Comments: pH meter #6 (#3 needed replacement batteries/conditioning)

Reviewed by: JOB

Date Reviewed: Nov. 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: SynGene/Hatfield  
Work Order No.: 212002  
Sample ID: River Water + Reactor 2  
Water.

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: *Hyalella azteca*

Reactor 2

**Dissolved Oxygen (mg/L)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	new	new	old	new	new	old	new	new	old	new	old	new	old
Lab Ctn	8.6	6.8	6.0	5.6		6.0	8.4	6.4		6.7				
Site Ctn	8.6	6.8	5.8	6.0		6.2	8.4	6.2		6.4				
1.5b	8.6	6.5	5.2	5.0		5.9	8.3	6.3		6.2				
3.13	8.6	6.4	5.4	5.0		5.5	8.3	6.0		6.0				
6.25	8.6	6.1	5.3	5.3		6.7	8.2	6.3		6.5				
12.5	8.6	6.2	5.3	5.1		6.2	8.2	5.8		6.1				
25	8.6	6.2	4.6	4.8		5.8	8.2	5.6		5.1				
50	8.4	6.0	4.7	4.7		5.5	8.1	5.8		4.9				
100	7.9	5.9	4.7	4.8		5.2	7.9	5.8		5.3				
Technician Initials	MDO	LMC	PM	PM		EC	MDO	EC		MDO				

DO meter: 5

**pH**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11	12	13	14							
	new	new	new	old	new	new	old	new	new	old	new	old	new	old
Lab Ctn	8.0	7.2	7.68	7.6	7.3	7.8	7.1		7.2					
Site Ctn	7.9	7.4	7.92	7.9		7.5	7.8	7.3		7.3				
1.5b	7.8	7.6	7.7	7.6		7.3	7.8	7.4		7.3				
3.13	7.9	7.6	7.72	7.7		7.3	7.9	7.3		7.3				
6.25	7.9	7.6	7.7	7.8		7.6	8.0	7.6		7.5				
12.5	8.0	7.7	7.9	7.8		7.5	8.1	7.6		7.5				
25	8.2	7.8	7.9	7.9		7.6	8.3	7.7		7.5				
50	8.3	8.0	8.2	8.2		7.9	8.5	8.1		7.9				
100	8.5	8.2	8.5	8.5		8.4	8.6	8.4		8.3				
Technician Initials	MDO	LMC	PM	PM		EC	MDO	EC		MDO				

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 400-850

Comments: Should not be crossed out.

Reviewed by: JBL

Date Reviewed: Nov-19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 212002  
Sample ID: Puro Water + Reactor 2 Water

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyalella azteca  
Balance: 1

Reactor 2 SR2

Sample ID (% v/v)	Blue Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	A	10	0	0	MDO	1009.92	1011.10	10	MDO/MDO
	2	B	↓	↓	↓	↓	1007.36	1008.48	10	↓
	3	C	↓	↓	↓	↓	1005.42	1006.88	10	↓
	4	D	↓	↓	↓	↓	1000.17	1001.38	10	↓
	5	E	↓	↓	↓	↓	997.56	999.88	10	↓
Site Control	6	A	10	0	0	MDO	996.55	999.35	10	↓
	7	B	↓	↓	↓	↓	1013.33	1015.27	10	↓
	8	C	↓	↓	↓	↓	1001.23	1003.35	10	↓
	9	D	↓	↓	↓	↓	1004.45	1006.25	10	↓
	10	E	↓	↓	↓	↓	1007.94	1010.34	10	↓
1.56	11	A	10	0	0	MDO	1016.20	1018.82	10	↓
	12	B	↓	↓	↓	↓	1006.20	1008.56	10	↓
	13	C	↓	↓	↓	↓	1005.66	1008.26	10	↓
	14	D	↓	↓	↓	↓	1006.03	1008.24	10	↓
	15	E	↓	↓	↓	↓	1004.60	1007.01	10	↓
3.13	16	A	9	0	1	MDO	992.65	994.50	9	↓
	17	B	10	0	0	↓	996.57	998.92	10	↓
	18	C	↓	↓	↓	↓	997.29	999.55	10	↓
	19	D	↓	↓	↓	↓	1002.93	1005.27	10	↓
	20	E	↓	↓	↓	↓	1006.03	1008.86	10	↓

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1200h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 0900h

Comments: 10% reweigh = pan # = 6 = 999.36, 17 = 998.93, 25 = 1012.78, 34 = 1008.17, 45 = 1020.53

Reviewed by: John

Date Reviewed: Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 212002  
Sample ID: River Water + Reactor 2 Water

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyalella azteca  
Balance: 1

Reactor 2

Sample ID (Blue Pan No.)	Blue Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
<del>Control</del>	21	A	10	0	0	MDO	1008.36	1010.60 <sup>58</sup>	10	MDO/MDO
6.25	22	B	↓	↓	↓	↓	1007.42	1010.02	10	↓
	23	C	↓	↓	↓	↓	1003.19	1005.39	10	↓
	24	D	↓	↓	↓	↓	1014.67	1017.02	10	↓
	25	E	8	0	2	↓	1010.70	1012.64	8	↓
12.5	26	A	10	0	0	MDO	1017.97	1020.23	10	↓
	27	B	↓	↓	↓	↓	1009.07	1010.84	7 <sup>10</sup>	↓
	28	C	↓	↓	↓	↓	1005.86	1008.22	10	↓
	29	D	↓	↓	↓	↓	1001.55	1003.53	10	↓
	30	E	↓	↓	↓	↓	1018.57	1020.87	10	↓
25	31	A	10 <sup>10</sup>	0	0	MDO	1015.02	1016.90	10	↓
	32	B	↓	↓	↓	↓	1015.98	1018.00	10	↓
	33	C	↓	↓	↓	↓	998.06	1000.03	10	↓
	34	D	↓	↓	↓	↓	1005.78	1008.12	10	↓
	35	E	↓	↓	↓	↓	1010.98	1013.12	10	↓
50	36	A	10	0	0	MDO	1020.17	1021.82	9 <sup>10</sup>	↓
	37	B	10	0	0	↓	1012.48	1014.72	10	↓
	38	C	9	0	1	↓	1010.11	1012.11	9	↓
	39	D	10	0	0	↓	1012.53	1014.86	10	↓
	40	E	10	0	0	↓	1010.86	1012.77	10	↓

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1200h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 0900h

Comments:

① Hyalella lost in transfer ② Three lost<sup>MDO</sup>  
③ One significantly smaller than others.

Reviewed by:

JCH

Date Reviewed:

Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: SynGene/Hatfield  
Work Order No: 212002  
Sample ID: River Water + Reactor 2  
Water

Start Date: Sept 30/21  
Termination Date: Oct 14/21  
Test Organism: Hyalella azteca  
Balance: 1

Reactor 2

SR2

Sample ID (L.V.V.)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
<sup>MDO</sup> Control	41	A	<sup>MDO</sup> 9/10	0	<sup>MDO</sup> X 0	MDO	996.71	998.13	10	MDO/MDO
100	42	B	10	0	0	↓	1013.02	1014.30	10	↓
	43	C	↓	↓	↓	↓	1009.48	1010.79	10	↓
	44	D	↓	↓	↓	↓	1007.16	1008.24	10	↓
	45	E	↓	↓	↓	↓	1018.86	1020.45	10	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 13/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 14/21 @ 1200h  
Date/time pan + organisms removed from oven: Oct 18/21 @ 1340h MDO  
0900h

Comments:

Reviewed by:

JGw

Date Reviewed:

Nov. 19/21



# CETIS Summary Report

Report Date: 18 Nov-21 14:00 (p 1 of 2)  
Test Code/ID: 212002b / 10-9274-0433

## Hyaella 14-d Survival and Growth <sup>Water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Batch ID: 10-4537-7750      Test Type: Growth-Survival (100%) 14d  
Start Date: 30 Sep-21 ✓      Protocol: EC/EPS 1/RM/33 <sub>MDO</sub> ✓  
Ending Date: 14 Oct-21 ✓      Species: Hyaella azteca  
Test Length: 14d 0h      Taxon: Malacostraca  
Analyst: Mikayla Oldach  
Diluent: Site Water  
Brine:  
Source: Aquatic Biosystems, CO      Age: 7-9d  
Sample ID: 12-7287-7941      Code: 212002b      Project: Special Studies  
Sample Date: 26 Sep-21 12:00 ✓      Material: Effluent      Source: Hatfield  
Receipt Date: 30 Sep-21 ✓      CAS (PC):      Station: Reactor 2 Water  
Sample Age: 84h (13.7°C)      Client: Hatfield

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
06-5700-3825	100% Survival Rate	Fisher Exact Test	1.0000	Site Control passed 100% survival rate	1
18-5274-6382	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9852	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
16-7421-7377	100% Survival Rate 14d	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
			EC50	>100	n/a	n/a	<1	
03-9804-6281	Mean Dry Weight-mg	NLR: 3P Log-Logistic	IC5	31.51	n/a	45.84	3.174	1
			IC10	43.93	21.03	59.32	2.277	
			IC15	53.96	35.35	69.24	1.853	
			IC20	63	47.06	77.54	1.587	
			IC25	71.59	57.5	85.31	1.397	
			IC40	97.44	81.75	114.6	1.026	
			IC50	116.7	93.03	146.3	0.857	

> 100% (v/v)

### 14d 100% Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	XC	5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1.56		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.13		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
6.25		5	0.9600	0.8489	1.0000	0.8000	1.0000	0.0400	0.0894	9.32%	4.00%
12.5		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
25		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	2.00%
100		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1458	0.08384	0.2078	0.112	0.232	0.02232	0.0499	34.23%	0.00%
0	XC	5	0.2212	0.1718	0.2706	0.18	0.28	0.01779	0.03979	17.99%	-51.71%
1.56		5	0.244	0.2227	0.2653	0.221	0.262	0.007689	0.01719	7.05%	-67.35%
3.13		5	0.2367	0.2014	0.272	0.2056	0.283	0.01272	0.02845	12.02%	-62.35%
6.25		5	0.2359	0.2156	0.2562	0.22	0.26	0.007319	0.01636	6.94%	-61.80%
12.5		5	0.2286	0.2038	0.2533	0.198	0.2529	0.008911	0.01993	8.72%	-56.77%
25		5	0.207	0.1849	0.2291	0.188	0.234	0.007949	0.01777	8.59%	-41.98%
50		5	0.2107	0.1833	0.2381	0.1833	0.233	0.009858	0.02204	10.46%	-44.52%
100		5	0.1336	0.1103	0.1569	0.108	0.159	0.008394	0.01877	14.05%	8.37%

N = negative (lab) control  
XC = site control

✓  
Nov. 19/21



# CETIS Summary Report

Report Date:

18 Nov-21 14:00 (p 2 of 2)

Test Code/ID:

212002b / 10-9274-0433

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

### 14d 10d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1.0000	1.0000	1.0000	1.0000	1.0000
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		0.9000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.8000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	0.9000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.118	0.112	0.146	0.121	0.232
0	XC	0.28	0.194	0.212	0.18	0.24
1.56		0.262	0.236	0.26	0.221	0.241
3.13		0.2056	0.235	0.226	0.234	0.283
6.25		0.222	0.26	0.22	0.235	0.2425
12.5		0.226	0.2529	0.236	0.198	0.23
25		0.188	0.202	0.197	0.234	0.214
50		0.1833	0.224	0.2222	0.233	0.191
100		0.142	0.128	0.131	0.108	0.159

### 14d 10d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	10/10	10/10	10/10	10/10	10/10
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	10/10	10/10	10/10
3.13		9/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	8/10
12.5		10/10	10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	10/10
50		10/10	10/10	9/10	10/10	10/10
100		10/10	10/10	10/10	10/10	10/10



# CETIS Analytical Report

Report Date: 17 Nov-21 11:45 (p 1 of 2)  
Test Code/ID: 212002b / 10-9274-0433

## Hyaella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 03-9804-6281	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 11:41	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 10-4537-7750	Test Type: Growth-Survival (100%) 14 d	Analyst: Mikayla Oldach
Start Date: 30 Sep-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 14 Oct-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 12-7287-7941	Code: 212002b	Project: Special Studies
Sample Date: 26 Sep-21 12:00	Material: Effluent	Source: Hatfield
Receipt Date: 30 Sep-21	CAS (PC):	Station: Reactor 2 Water
Sample Age: 84h (13.7°C)	Client: Hatfield	

### Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: $\mu = \alpha / [1 + (x/\delta)^y]$	Normal [w=1]	Off [ $\mu^* = \mu$ ]	None	None

### Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
15	150	-293.3	-288.9	0.6298	Yes	1.258	2.512	0.3060	Non-Significant Lack of Fit

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	31.51	n/a	45.84	3.174	2.182	n/a
IC10	43.93	21.03	59.32	2.277	1.686	4.755
IC15	53.96	35.35	69.24	1.853	1.444	2.829
IC20	63	47.06	77.54	1.587	1.29	2.125
IC25	71.59	57.5	85.31	1.397	1.172	1.739
IC40	97.44	81.75	114.6	1.026	0.8723	1.223
IC50	116.7	93.03	146.3	0.857	0.6833	1.075

> 100% (v/v)

### Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision( $\alpha:5\%$ )
$\alpha$	0.2316	0.004929	0.2216	0.2416	46.99	<1.0E-37	Significant Parameter
$\gamma$	2.249	0.6421	0.948	3.55	3.503	0.0012	Significant Parameter
$\delta$	116.7	12.56	91.24	142.1	9.291	<1.0E-37	Significant Parameter

### ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision( $\alpha:5\%$ )
Model	1.884	0.628	3	1077	<1.0E-37	Significant
Lack of Fit	0.003543	0.0007086	5	1.258	0.3060	Non-Significant
Pure Error	0.01803	0.0005634	32			
Residual	0.02157	0.000583	37			

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision( $\alpha:5\%$ )
Variances	Bartlett Equality of Variance Test	5.629	14.07	0.5837	Equal Variances
	Mod Levene Equality of Variance	0.9136	2.423	0.5130	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9883	0.9447	0.9481	Normal Distribution
	Anderson-Darling A2 Normality Test	0.1967	2.492	0.9362	Normal Distribution
Control Trend	Mann-Kendall Trend Test	-2		0.8151	Non-Significant Trend in Controls



# CETIS Analytical Report

Report Date: 17 Nov-21 11:45 (p 2 of 2)

Test Code/ID: 212002b / 10-9274-0433

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 03-9804-6281  
Analyzed: 17 Nov-21 11:41

Endpoint: Mean Dry Weight-mg  
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Mean Dry Weight-mg Summary

### Calculated Variate

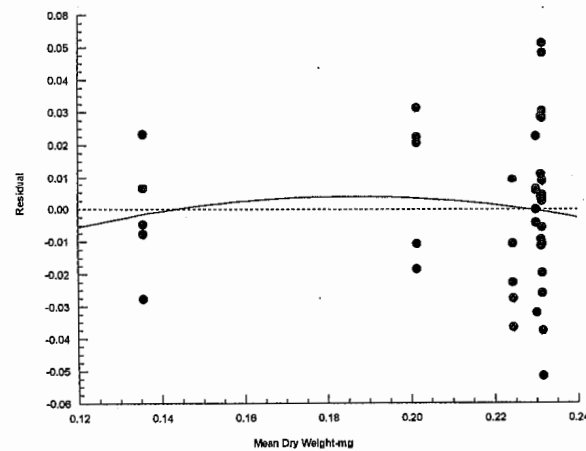
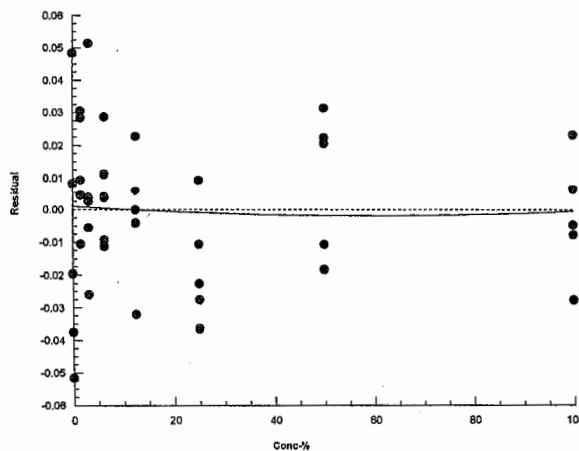
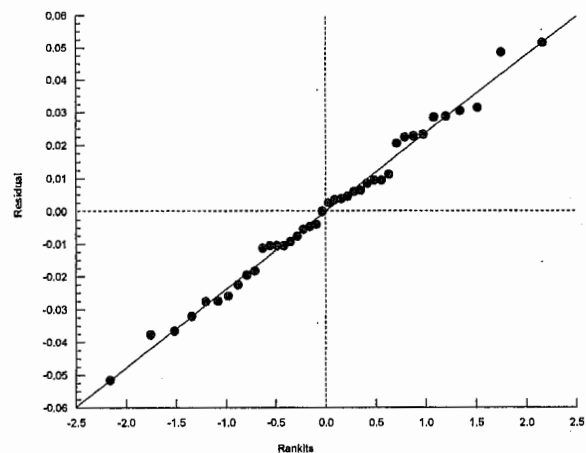
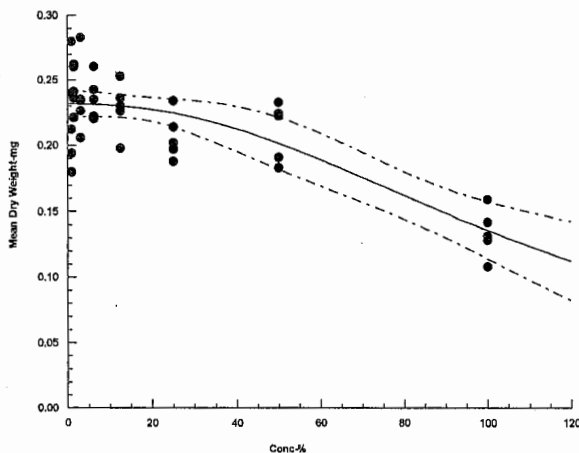
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	XC	5	0.2212	0.18	0.28	0.01779	0.03979	17.99%	0.0%
1.56		5	0.244	0.221	0.262	0.007689	0.01719	7.05%	-10.31%
3.13		5	0.2367	0.2056	0.283	0.01272	0.02845	12.02%	-7.01%
6.25		5	0.2359	0.22	0.26	0.007319	0.01636	6.94%	-6.65%
12.5		5	0.2286	0.198	0.2529	0.008911	0.01993	8.72%	-3.33%
25		5	0.207	0.188	0.234	0.007949	0.01777	8.59%	6.42%
50		5	0.2107	0.1833	0.233	0.009858	0.02204	10.46%	4.74%
100		5	0.1336	0.108	0.159	0.008394	0.01877	14.05%	39.6%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.28	0.194	0.212	0.18	0.24
1.56		0.262	0.236	0.26	0.221	0.241
3.13		0.2056	0.235	0.226	0.234	0.283
6.25		0.222	0.26	0.22	0.235	0.2425
12.5		0.226	0.2529	0.236	0.198	0.23
25		0.188	0.202	0.197	0.234	0.214
50		0.1833	0.224	0.2222	0.233	0.191
100		0.142	0.128	0.131	0.108	0.159

### Graphics

Model: 3P Log-Logistic:  $\mu = \alpha / [1 + (x/\delta)^\gamma]$  Distribution: Normal [ $w=1$ ]





## CETIS Analytical Report

Report Date: 17 Nov-21 11:45 (p 1 of 4)

Test Code/ID: 212002b / 10-9274-0433

Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test

Nautilus Environmental

Analysis ID: 16-7421-7377  
 Analyzed: 26 Oct-21 11:06

Endpoint: <sup>100</sup> Survival Rate  
 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
 Status Level: 1

Batch ID: 10-4537-7750  
 Start Date: 30 Sep-21  
 Ending Date: 14 Oct-21  
 Test Length: 14d 0h

Test Type: Growth-Survival (100) <sup>14d</sup>  
 Protocol: EC/EPS 1/RM/33  
 Species: Hyalella azteca  
 Taxon: Malacostraca

Analyst: Mikayla Oldach  
 Diluent: Site Water  
 Brine:  
 Source: Aquatic Biosystems, CO Age: 7-9d

Sample ID: 12-7287-7941  
 Sample Date: 26 Sep-21 12:00  
 Receipt Date: 30 Sep-21  
 Sample Age: 84h (13.7°C)

Code: 212002b  
 Material: Effluent  
 CAS (PC):  
 Client: Hatfield

Project: Special Studies  
 Source: Hatfield  
 Station: Reactor 2 Water

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1650738	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

14d <sup>100</sup> Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
1.56		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	1	0.0%
3.13		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.9867	1.33%
6.25		5	0.9600	0.8000	1.0000	0.0894	9.32%	4.0%	48/50	0.9867	1.33%
12.5		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.9867	1.33%
25		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.9867	1.33%
50		5	0.9800	0.9000	1.0000	0.0447	4.56%	2.0%	49/50	0.9867	1.33%
100		5	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	50/50	0.9867	1.33%

14d <sup>100</sup> Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000	1.0000	1.0000
3.13		0.9000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.8000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	0.9000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000

14d <sup>100</sup> Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	10/10	10/10	10/10
1.56		10/10	10/10	10/10	10/10	10/10
3.13		10/10	10/10	10/10	10/10	10/10
6.25		10/10	10/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	10/10	10/10
50		10/10	10/10	9/10	10/10	10/10
100		10/10	10/10	10/10	10/10	10/10



# CETIS Analytical Report

Report Date: 17 Nov-21 11:45 (p 2 of 4)  
Test Code/ID: 212002b / 10-9274-0433

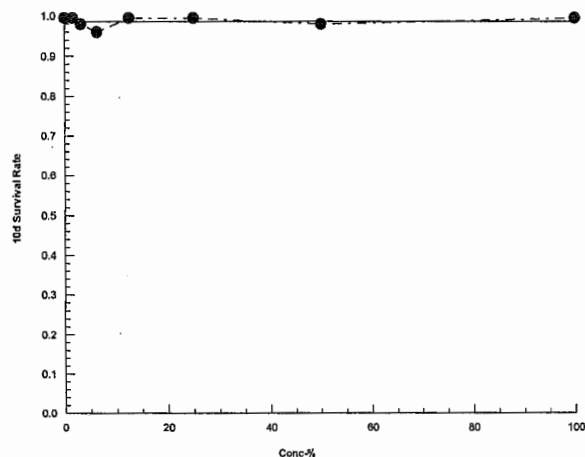
*Water only*  
Hyaella 14-d Survival and Growth *sediment* Test

Nautilus Environmental

Analysis ID: 16-7421-7377      Endpoint: *100* Survival Rate  
Analyzed: 26 Oct-21 11:06      Analysis: *14d* Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





## ***Hyalella azteca* Water-only Test Summary Sheet**

Client: Synnide/Hatfield  
Work Order No.: 212082

Start Date: Oct 7/21  
Set up by: MDO

### **Sample Information:**

Sample ID: River Water + Treated OSPW  
Sample Date: Oct 3/21  
Date Received: Oct 7/21  
Sample Volume: 3 x 20L + 1 x 20L

### **Test Organism Information:**

Species: *Hyalella azteca*  
Supplier: Aquatic Biosystems, CO  
Date received: Oct 6/21  
Age or size (Day 0): 7-9 d  
% Mortality in 24 h prior to testing: 0

### **NaCl Reference Toxicant Results:**

Reference Toxicant ID: HA216  
Stock Solution ID: n/a  
Date Initiated: Oct 7/21

96-h LC50 (95% CL): 6.7(5.0-9.1) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 6.2(4.2-9.2) g/L NaCl CV (%): 20

### **Test Results:**

	Survival	Dry Weight
LC25%(v/v) (95% CL)	>100	
LC50%(v/v) (95%CL)	>100	
IC25%(v/v) (95%CL)		95.5(64.8-n/a)
IC50%(v/v) (95%CL)		>100

Reviewed by: JGh

Date reviewed: Nov. 29/21



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Synchrude/Hatfield  
 Work Order No.: 212082  
 Sample ID: SNS (Synchrude) MDO  
River Water + Treated OSPW

Start Date: Oct 7/21  
 Termination Date: Oct 21/21  
 CER #: 12  
 Test Organism: Hyalella azteca

### Temperature (°C)

WEEK 5

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	22.0	22.0	22.0	22.0	22.0	22.0			22.0	22.0	22.0	22.5	23.0	22.5
Site Ctl	22.0	22.0	23.0	22.0	22.0	22.5			22.0	22.0	22.0	23.5	22.5	22.5
1.56	22.0	22.0	23.0	22.5	22.5				22.0	22.0	22.0	22.5	22.5	22.5
3.13	22.0	22.5	23.0	22.5					22.0	22.0	22.0	23.5	22.5	22.5
6.25	22.0	22.5	23.0	22.5					22.0	22.0	22.0	23.5	22.5	22.5
12.5	22.0	22.5	23.0	22.5					22.0	22.5	22.0	24.0	22.5	22.5
25	22.5	22.5	23.0	22.5					22.0	22.5	22.0	24.0	22.5	22.5
50	22.0	22.5	23.0	22.5					22.0	22.5	22.0	24.0	22.5	22.5
100	22.0	22.5	22.5	22.5					22.0	22.0	22.0	22.0	23.0	22.5
Technician Initials	MDO	MDO	MDO	JMC	PM	PM			EC	MDO	EC	MDO	EC	MDO

Thermometer: 12

### Conductivity (µS)

Sample ID/Conc. (% v/v)	Day													
	0		1		2		3		4		5		6	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	420	433	419	431	430	448			460	428	443	427	439	448
Site Ctl	385	401	386	410	405	412			419	385	403	387	398	405
1.56	428	444	430	449	449	457			465	433	451	434	444	449
3.13	472	484	475	490	496	503			510	478	496	477	487	494
6.25	559	568	562	572	576	583			590	569	582	566	577	582
12.5	730	744	747	768	758	765			774	731	773	757	764	772
25	1085	1082	1097	1103	1112	1117			1121	1114	1127	1103	1120	1132
50	1765	1730	1780	1796	1784	1791			1802	1823	1826	1782	1805	1824
100	3080	3010	3090	3130	3160	3100			3110	3170	3170	3080	3130	3160
Technician Initials	MDO	MDO	MDO	JMC	PM	PM			EC	MDO	EC	MDO	EC	MDO

Conductivity meter: 3

Comments: 0 Should not be crossed out

Reviewed by: Joh

Date Reviewed: Nov-19/21



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Synchrone/Hatfield  
 Work Order No.: 212082  
 Sample ID: River Water + Treated O2  
(SHS) MDO

Start Date: Oct 7/21  
 Termination Date: Oct 21/21  
 Test Organism: *Hyalella azteca*

Dissolved Oxygen (mg/L)

WEEKS

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5	6		7		8	
	new	old	new	old	new	old	new	old	new	old	new	old	old	
Lab Ctn	8.4	6.8	8.6	7.6	5.9	5.4		5.9	8.4	6.2	8.4	6.2		5.9
Site Ctn	8.6	6.9	8.3	7.5	6.0	5.6		5.1	8.4	6.5	7.9	6.5		6.6
1.56	8.4	5.7	8.4	7.3	6.1	4.8		5.6	8.1	6.7	7.9	6.9		7.0
3.13	8.5	6.7	8.3	7.4	6.4	5.5		5.0	8.0	6.4	7.7	6.9		6.9
6.25	8.5	6.9	8.3	7.7	6.7	5.6		5.4	8.0	6.7	7.9	6.7		6.6
12.5	8.5	6.9	8.3	8.0	7.2	6.6		5.0	8.0	6.8	7.9	7.0		6.5
25	8.5	7.2	8.3	8.5	8.0	8.0		6.6	8.1	6.5	8.0	6.0		5.9
50	8.5	7.5	8.4	8.4	8.3	7.4		6.0	8.2	6.3	8.1	6.3		6.0
100	8.6	8.1	8.7	8.6	9.2	8.0		5.1	8.6	5.5	8.7	5.0		4.5
Technician Initials	MDO	MDO	MDO	EC	PM	PM		EC	MDO	EC	MDO	EC		MDO

DO meter: 5

pH

WEEKS

Sample ID/Conc. (% v/v)	Day													
	0	1		2	3	4		5	6		7		8	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	7.8	7.3	8.0	8.0	7.7	7.6		7.1	7.8	7.1	7.8	7.0		7.1
Site Ctn	7.8	7.6	7.8	7.8	7.8	7.8		7.4	7.8	7.5	7.8	7.5		7.5
1.56	7.9	7.4	7.9	7.9	7.8	7.8		7.4	7.9	7.6	7.9	7.6		7.7
3.13	7.9	7.7	8.0	8.0	8.0	7.9		7.5	8.0	7.6	8.0	7.6		7.7
6.25	8.1	7.8	8.1	8.0	8.2	8.0		7.6	8.1	7.7	8.1	7.7		7.7
12.5	8.3	7.9	8.3	8.2	8.4	8.2		7.7	8.3	7.9	8.2	7.9		7.8
25	8.5	8.2	8.5	8.5	8.7	8.7		8.4	8.5	8.1	8.4	8.0		7.8
50	8.7	8.6	8.7	8.7	8.8	8.8		8.5	8.7	8.4	8.6	8.3		8.2
100	8.9	8.9	8.9	9.0	9.2	9.1		8.8	8.9	8.7	8.9	8.6		8.5
Technician Initials	MDO	MDO	MDO	EC	PM	PM		EC	MDO	EC	MDO	EC		MDO

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 390-880

Comments: Should not be crossed out.

Reviewed by: John

Date Reviewed: Nov. 19/21



**Chronic *H. azteca* Water-Only Toxicity Test Data Sheet**  
Water Quality

Client: Synchrude/Hatfield  
Work Order No.: 212082  
Sample ID: Per Water + Treated ORW

Start Date: Oct 7 121  
Termination Date: Oct 21/21  
CER #: 12  
Test Organism: Hyalella azteca

**Temperature (°C)**

WEEK 5

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12		13		14				
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctl	22.0	22.5	23.0	22.5	22.5	22.0		22.5	22.5	22.0				
Site Ctl	22.0				22.0	22.0			22.0					
1.56	22.0					22.0								
3.13	22.0					22.0								
6.25	22.0					22.0								
12.5	22.0					22.0								
25	22.0					22.0								
50	22.5				22.5	22.5								
100	23.0				22.5	22.5								
Technician Initials	MDO	Gm	PK	MDO	MDO	EC		MDO	MDO	MDO				

Thermometer: 12

**Conductivity (µS)**

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12		13		14				
	new	MDO	MDO	old	new	MDO	new	old	new	MDO	new	old	new	old
Lab Ctl	425	441	448	454	425	443		453	426	445				
Site Ctl	385	397	401	406	385	397		403	388	400				
1.56	431	441	444	449	432	441		447	434	442				
3.13	476	485	488	493	460	485		493	478	488				
6.25	564	575	578	582	566	575		583	564	578				
12.5	750	761	763	765	755	756		759	734	751				
25	1104	1121	1123	1126	1110	1114		1125	1083	1104				
50	1788	1810	1815	1821	1800	1803		1817	1746	1784				
100	3110	3130	3150	3150	3130	3140		3160	3020	3100				
Technician Initials	MDO	Gm	PK	MDO	MDO	EC		MDO	MDO	MDO				

Conductivity meter: 3

Comments:

0476

Reviewed by:

JCW

Date Reviewed:

Nov. 19/21



# Chronic *H. azteca* Water-Only Toxicity Test Data Sheet

## Water Quality

Client: Suncrude/Hatfield  
 Work Order No.: 212082  
 Sample ID: 2 new Water + Treated OSPW

Start Date: Oct 7/21  
 Termination Date: Oct 21/21  
 Test Organism: *Hyalella azteca*

WEEK 5

### Dissolved Oxygen (mg/L)

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12	13		14					
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	8.2	6.0	5.5	5.4	8.2	6.0		5.8	8.2	6.3				
Site Ctn	8.1	7.2	7.0	6.6	7.9	7.0		6.7	8.4	7.1				
1.5b	8.1	7.5	7.2	6.5	7.9	7.2		6.6	8.3	7.3				
3.13	8.1	7.8	7.4	6.2	7.9	6.8		6.4	8.3	6.8				
6.25	8.1	7.4	7.4	6.6	7.9	7.1		6.5	8.3	7.4				
12.5	8.1	7.4	7.4	7.6	7.9	8.8		8.2	8.3	8.7				
25	8.2	6.6	6.4	6.9	7.8	8.2		7.9	8.2	8.4				
50	8.3	6.7	6.3	6.9	7.8	8.4		8.0	8.2	8.6				
100	8.7	5.2	5.0	5.5	7.8	6.7		5.6	8.0	6.8				
Technician Initials	MDO	GM	PM	MDO	MDO	EC		MDO	MDO	MDO				

DO meter: 5

### pH

Sample ID/Conc. (% v/v)	Day													
	8	9	10	11		12	13		14					
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Lab Ctn	7.8	7.2	7.0	7.1	7.8	7.2		7.1	7.8	7.2				
Site Ctn	7.8	7.8	7.6	7.6	7.9	7.7		7.6	7.9	7.6				
1.5b	7.9	7.9	7.8	7.7	8.0	7.8		7.6	8.0	7.7				
3.13	8.0	8.0	7.9	7.7	8.0	7.7		7.6	8.0	7.6				
6.25	8.1	8.0	8.0	7.9	8.1	7.9		7.7	8.1	7.8				
12.5	8.3	8.1	8.0	8.2	8.3	8.3		8.2	8.2	8.1				
25	8.5	8.2	8.1	8.2	8.5	8.3		8.3	8.4	8.2				
50	8.7	8.5	8.3	8.4	8.7	8.6		8.6	8.5	8.4				
100	9.0	8.7	8.6	8.6	8.9	8.7		8.6	8.7	8.4				
Technician Initials	MDO	GM	PM	MDO	MDO	EC		MDO	MDO	MDO				

pH meter: 3

Light meter: lit-1

Light intensity (Lux): 410-890

Comments: checked by MDO - high DO likely due to higher algae presence.

Reviewed by: JOH

Date Reviewed: Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Synchrude/Hatfield  
Work Order No: 212032  
Sample ID: River Water + Treated ASPW

Start Date: 8 Oct 7/21 <sup>MDO</sup>  
Termination Date: Oct 21/21  
Test Organism: Hyaella azteca  
Balance: 1

Sample ID (%L.V.V.)	Sample Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Lab Control	1	A	10	0	0	MDO	1017.72	1019.57	10	TH/MDO
	2	B	10	0	0	↓	1005.40	1007.44	10	↓
	3	C	10 <sup>①</sup>	0	0	↓	1003.37	1005.48	10	↓
	4	D	10	0	0	↓	1005.22	1007.01	10	↓
	5	E	8	1	1	↓	1006.22	1007.76	8	↓
Site Control	6	A	10	0	0	MDO	1005.75	1008.77	10	↓
	7	B	10 <sup>MDO</sup>	0	2 <sup>MDO</sup>	↓	1005.62	1007.45	10	↓
	8	C	8	0	2	↓	997.83	999.94	8	↓
	9	D	10	0	0	↓	998.00	1000.76	10	↓
	10	E	9	1	0	↓	1006.78	1009.28	9	↓
1.56	11	A	10	0	0	MDO	994.15	997.02	10	↓
	12	B	8	0	2	↓	1015.58	1017.23	8	↓
	13	C	10	0	0	↓	1011.30	1013.98	10	↓
	14	D	10	0	0	↓	1006.94	1009.26	10	↓
	15	E	10	0	0	↓	1012.65	1015.34	10	↓
3.13	16	A	10	0	0	MDO	997.88	1000.41	10	↓
	17	B	10	0	0	↓	994.31	997.65	10	↓
	18	C	10	0	0	↓	997.68	1000.21	10	↓
	19	D	9	0	1	↓	1004.45	1006.15	9	↓
	20	E	10	0	0	↓	1001.52	1004.76	10	↓

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 19/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 21/21 @ 1230h  
Date/time pan + organisms removed from oven: Oct 25/21 @ 0915h

Comments: One significantly smaller than others.  
DI. reweigh: pan # 3 = 1005.58, 12 = 1017.24, 24 = 1012.88, 30 = 1008.22,  
40 = 1003.45  
Reviewed by: JCh Date Reviewed: Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: \_\_\_\_\_  
Work Order No: \_\_\_\_\_  
Sample ID: \_\_\_\_\_

Synchrude/Hatfield  
212082  
River Water + Treated OSPW

Start Date: Oct 7/21  
Termination Date: Oct 21/21  
Test Organism: Hyalomma azteca  
Balance: 1

Sample ID (% V/V)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control 6.25	21	A	10	0	0	CMP	1002.87	1005.50	10	TH/MDO
	22	B	10	0	0		999.81	1002.76	10	
	23	C	10	0	0		998.20	1000.70	9 <sup>th</sup>	
	24	D	10	0	0		1010.09	1012.93	10	
	25	E	9	0	1		1012.86	1015.26	9	
12.5	26	A	10	0	0	MDO	1010.02	1013.17	10	
	27	B	10	0	0		1014.73	1017.13	10	
	28	C	10	0	0		1005.79	1008.81	10	
	29	D	10	0	0		1007.93	1011.05	10	
	30	E	10	0	0		1005.43	1008.35	10	
25	31	A	10	0	0	MDO	1021.08	1024.57	10	
	32	B	9	0	1		1007.90	1010.27	9 <sup>th</sup> MDO	
	33	C	9	0	1		1005.56	1008.03	9	
	34	D	10	0	0		1003.85	1007.37	10	
	35	E	10	0	0		1000.08	1003.57	10	
50	36	A	9	1	0	CMP	1018.22	1020.44	9	
	37	*B	9/10	0	CPX 0		1011.48	1014.17	10 <sup>th</sup> MDO	
	38	C	10	0	0		1003.16	1006.47	10	
	39	D	10	0	0		1002.85	1005.33	10	
	40	E	10	0	0		1000.46	1003.57	10	

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 19/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 21/21 @ 1230h  
Date/time pan + organisms removed from oven: Oct 25/21 @ 0915h

Comments:

Done lost in transfer.

2 are gained in transfer.

\*Replicate B will be removed from statistical analyses.

Reviewed by:

TH

Date Reviewed:

Nov. 19/21



**H. azteca Water-only Toxicity Test Data Sheet**  
14-d Survival and Weight

Client: Syncoide/Hatfield  
Work Order No: 212082  
Sample ID: River Water + Treated ORW

Start Date: Oct 7/21  
Termination Date: Oct 21/21  
Test Organism: Hyaella azteca  
Balance: 1

SHS Sample

Sample ID (% v/v)	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
MD Control	41	A	10	0	0	MD	996.19	998.17	10	TH/MD
100	42	B	100	0	0	↓	1002.34	1004.03	10	↓
	43	C	10	0	0	↓	1005.23	1007.18	10	↓
	44	D	9	0	1	cmp	1004.01	1005.88	9	↓
	45	E	10	0	0	MD	1003.37	1005.27	10	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Date/time pan placed in oven: Sept 28/21 @ 1100h  
Date/time pan removed from oven: Oct 19/21 @ 0900h

Date/time pan + organisms placed in oven: Oct 21/21 @ 1230h  
Date/time pan + organisms removed from oven: Oct 25/21 @ 0915h

Comments: One significantly smaller than others.

Reviewed by: JCU Date Reviewed: Nov. 19/21



# CETIS Summary Report

Report Date: 18 Nov-21 13:59 (p 1 of 3)  
Test Code/ID: 212082 / 11-4535-9363

## Hyalella 14-d Survival and Growth <sup>Water only</sup> Sediment Test <sub>mso</sub>

Nautilus Environmental

Batch ID: 08-2544-9211	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 07 Oct-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 21 Oct-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-5417-2568	Code: 212082	Project: Special Studies
Sample Date: 03 Oct-21	Material: Effluent	Source: Hatfield
Receipt Date: 07 Oct-21	CAS (PC):	Station: OSPW
Sample Age: 96h (10.7°C)	Client: Hatfield	

### Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
04-7628-4639	10d Survival Rate	Fisher Exact Test	0.5000	Site Control passed 10d survival rate	1
06-2095-1569	Mean Dry Weight-mg	Equal Variance t Two-Sample Test	0.9929	Site Control passed mean dry weight-mg	1

### Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	%	95% LCL	95% UCL	TU	S
12-5575-3722	10d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	1
			EC10	>100	n/a	n/a	<1	
			EC15	>100	n/a	n/a	<1	
			EC20	>100	n/a	n/a	<1	
			EC25	>100	n/a	n/a	<1	
			EC40	>100	n/a	n/a	<1	
			EC50	>100	n/a	n/a	<1	
10-8005-0973	Mean Dry Weight-mg	Linear Interpolation (ICPIN)	IC5	56.94	n/a	58.74	1.756	1
			IC10	64.83	n/a	68.95	1.542	
			IC15	73.79	46.72	81.48	1.355	
			IC20	83.97	55.6	99.17	1.191	
			IC25	95.54	64.78	n/a	1.047	
			IC40	>100	n/a	n/a	<1	
			IC50	>100	n/a	n/a	<1	
17-5548-9775	Mean Dry Weight-mg	Linear Interpolation (ICPIN)	IC5	55.9	18.5	57.23	1.789	1
			IC10	62.48	35.95	65.46	1.601	
			IC15	69.82	49.23	74.86	1.432	
			IC20	78.01	62.2	85.56	1.282	
			IC25	87.15	72	97.76	1.147	
			IC40	>100	n/a	n/a	<1	
			IC50	>100	n/a	n/a	<1	



# CETIS Summary Report

Report Date:

18 Nov-21 13:59 (p 2 of 3)

Test Code/ID:

212082 / 11-4535-9363

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

### 14d 10d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9600	0.8489	1.0000	0.8000	1.0000	0.0400	0.0894	9.32%	0.00%
0	XC	5	0.9400	0.8289	1.0000	0.8000	1.0000	0.0400	0.0894	9.52%	2.08%
1.56		5	0.9600	0.8489	1.0000	0.8000	1.0000	0.0400	0.0894	9.32%	0.00%
3.13		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
6.25		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%
12.5		5	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-4.17%
25		5	0.9600	0.8920	1.0000	0.9000	1.0000	0.0245	0.0548	5.71%	0.00%
50		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	-1.56%
100		5	0.9800	0.9245	1.0000	0.9000	1.0000	0.0200	0.0447	4.56%	-2.08%

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1943	0.1779	0.2107	0.179	0.211	0.005901	0.0132	6.79%	0.00%
0	XC	5	0.2605	0.204	0.317	0.183	0.302	0.02034	0.04549	17.46%	-34.07%
1.56		5	0.2524	0.2119	0.293	0.2062	0.287	0.0146	0.03264	12.93%	-29.93%
3.13		5	0.2706	0.1967	0.3445	0.1889	0.334	0.02662	0.05951	21.99%	-39.26%
6.25		5	0.2773	0.2611	0.2934	0.263	0.295	0.005813	0.013	4.69%	-42.71%
12.5		5	0.2922	0.2543	0.3301	0.24	0.315	0.01366	0.03055	10.45%	-50.38%
25		5	0.3164	0.2622	0.3705	0.2633	0.352	0.01951	0.04363	13.79%	-62.82%
50		4	0.2842	0.2153	0.3531	0.2467	0.331	0.02165	0.04331	15.24%	-46.25%
100		5	0.192	0.1741	0.2098	0.169	0.2078	0.00643	0.01438	7.49%	1.21%

### 14d 10d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1.0000	1.0000	1.0000	1.0000	0.8000
0	XC	1.0000	1.0000	0.8000	1.0000	0.9000
1.56		1.0000	0.8000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	0.9000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	0.9000	0.9000	1.0000	1.0000
50		0.9000	1.0000	1.0000	1.0000	
100		1.0000	1.0000	1.0000	0.9000	1.0000

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.185	0.204	0.211	0.179	0.1925
0	XC	0.302	0.183	0.2637	0.276	0.2778
1.56		0.287	0.2062	0.268	0.232	0.269
3.13		0.253	0.334	0.253	0.1889	0.324
6.25		0.263	0.295	0.2778	0.284	0.2667
12.5		0.315	0.24	0.302	0.312	0.292
25		0.349	0.2633	0.2744	0.352	0.343
50		0.2467	0.331	0.248	0.311	
100		0.198	0.169	0.195	0.2078	0.19

N = negative (lab) Control

XC = site control

JGN  
Nov-19/21



# CETIS Summary Report

Report Date: 18 Nov-21 13:59 (p 3 of 3)  
 Test Code/ID: 212082 / 11-4535-9363

*Water only*  
 Hyalella 14-d Survival and Growth Sediment Test *MDO*

Nautilus Environmental

## 14d <sup>MDO</sup> Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	10/10	10/10	10/10	10/10	8/10
0	XC	10/10	10/10	8/10	10/10	9/10
1.56		10/10	8/10	10/10	10/10	10/10
3.13		10/10	10/10	10/10	9/10	10/10
6.25		10/10	10/10	10/10	10/10	9/10
12.5		10/10	10/10	10/10	10/10	10/10
25		10/10	9/10	9/10	10/10	10/10
50		9/10	10/10	10/10	10/10	
100		10/10	10/10	10/10	9/10	10/10



## CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 1 of 6)  
 Test Code/ID: 212082 / 11-4535-9363

## Hyalella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 12-5575-3722 Endpoint: 14d Survival Rate  
 Analyzed: 17 Nov-21 11:57 Analysis: Linear Interpolation (ICPIN) CETIS Version: CETISv1.9.4  
 Status Level: 1

Batch ID: 08-2544-9211 Test Type: Growth-Survival (10d) 14d  
 Start Date: 07 Oct-21 Protocol: EC/EPS 1/RM/33 MDO  
 Ending Date: 21 Oct-21 Species: Hyalella azteca  
 Test Length: 14d 0h Taxon: Malacostraca

Analyst: Mikayla Oldach  
 Diluent: Site Water  
 Brine:  
 Source: Aquatic Biosystems, CO Age: 7-9d

Sample ID: 02-5417-2568 Code: 212082 Project: Special Studies  
 Sample Date: 03 Oct-21 Material: Effluent Source: Hatfield  
 Receipt Date: 07 Oct-21 CAS (PC): Station: OSPW  
 Sample Age: 96h (10.7°C) Client: Hatfield

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	489577	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.2941	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

## 14d 10d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	XC	5	0.9400	0.8000	1.0000	0.0894	9.52%	0.0%	47/50	0.972	0.0%
1.56		5	0.9600	0.8000	1.0000	0.0894	9.32%	-2.13%	48/50	0.972	0.0%
3.13		5	0.9800	0.9000	1.0000	0.0447	4.56%	-4.26%	49/50	0.972	0.0%
6.25		5	0.9800	0.9000	1.0000	0.0447	4.56%	-4.26%	49/50	0.972	0.0%
12.5		5	1.0000	1.0000	1.0000	0.0000	0.00%	-6.38%	50/50	0.972	0.0%
25		5	0.9600	0.9000	1.0000	0.0548	5.71%	-2.13%	48/50	0.9717	0.03%
50		4	0.9750	0.9000	1.0000	0.0500	5.13%	-3.72%	39/40	0.9717	0.03%
100		5	0.9800	0.9000	1.0000	0.0447	4.56%	-4.26%	49/50	0.9717	0.03%

## 14d 10d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	1.0000	1.0000	0.8000	1.0000	0.9000
1.56		1.0000	0.8000	1.0000	1.0000	1.0000
3.13		1.0000	1.0000	1.0000	0.9000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	0.9000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	0.9000	0.9000	1.0000	1.0000
50		0.9000	1.0000	1.0000	1.0000	
100		1.0000	1.0000	1.0000	0.9000	1.0000



# CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 2 of 6)

Test Code/ID: 212082 / 11-4535-9363

Hyaella 14-d Survival and Growth <sup>water only</sup> ~~Sediment Test~~

Nautilus Environmental

Analysis ID: 12-5575-3722  
Analyzed: 17 Nov-21 11:57

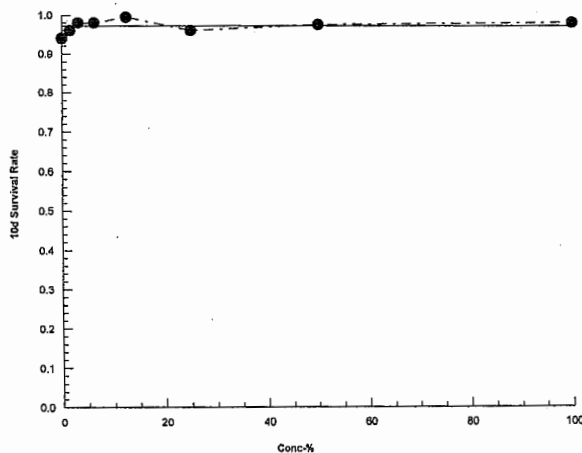
Endpoint: <sup>10d</sup> Survival Rate  
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## 10d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	10/10	10/10	8/10	10/10	9/10
1.56		10/10	8/10	10/10	10/10	10/10
3.13		10/10	10/10	8/10	10/10	9/10
6.25		10/10	10/10	8/10	10/10	9/10
12.5		10/10	10/10	8/10	10/10	9/10
25		10/10	10/10	8/10	10/10	9/10
50		10/10	8/10	10/10	9/10	
100		10/10	10/10	10/10	9/10	10/10

## Graphics





# CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 3 of 6)  
Test Code/ID: 212082 / 11-4535-9363

## Hyaella 14-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID: 17-5548-9775	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 12:00	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 08-2544-9211	Test Type: Growth-Survival (10d) Hd	Analyst: Mikayla Oldach
Start Date: 07 Oct-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 21 Oct-21	Species: Hyaella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-5417-2568	Code: 212082	Project: Special Studies
Sample Date: 03 Oct-21	Material: Effluent	Source: Hatfield
Receipt Date: 07 Oct-21	CAS (PC):	Station: OSPW
Sample Age: 96h (10.7°C)	Client: Hatfield	

### Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1781719	200	Yes	Two-Point Interpolation

### Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.8151	Non-Significant Trend in Controls

### Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	55.9	18.5	57.23	1.789	1.747	5.405
IC10	62.48	35.95	65.46	1.601	1.528	2.782
IC15	69.82	49.23	74.86	1.432	1.336	2.031
IC20	78.01	62.2	85.56	1.282	1.169	1.608
IC25	87.15	72	97.76	1.147	1.023	1.389
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

### Mean Dry Weight-mg Summary

Conc-%	Code	Count	Calculated Variate						Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	XC	5	0.2605	0.183	0.302	0.04549	17.46%	0.0%	0.2791	0.0%
1.56		5	0.2524	0.2062	0.287	0.03264	12.93%	3.09%	0.2791	0.0%
3.13		5	0.2706	0.1889	0.334	0.05951	21.99%	-3.87%	0.2791	0.0%
6.25		5	0.2773	0.263	0.295	0.013	4.69%	-6.44%	0.2791	0.0%
12.5		5	0.2922	0.24	0.315	0.03055	10.45%	-12.17%	0.2791	0.0%
25		5	0.3164	0.2633	0.352	0.04363	13.79%	-21.44%	0.2791	0.0%
50		4	0.2842	0.2467	0.331	0.04331	15.24%	-9.08%	0.2791	0.0%
100		5	0.192	0.169	0.2078	0.01438	7.49%	26.31%	0.192	31.22%

### Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.302	0.183	0.2637	0.276	0.2778
1.56		0.287	0.2062	0.268	0.232	0.269
3.13		0.253	0.334	0.253	0.1889	0.324
6.25		0.263	0.295	0.2778	0.284	0.2667
12.5		0.315	0.24	0.302	0.312	0.292
25		0.349	0.2633	0.2744	0.352	0.343
50		0.2467	0.331	0.248	0.311	
100		0.198	0.169	0.195	0.2078	0.19



# CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 4 of 6)  
Test Code/ID: 212082 / 11-4535-9363

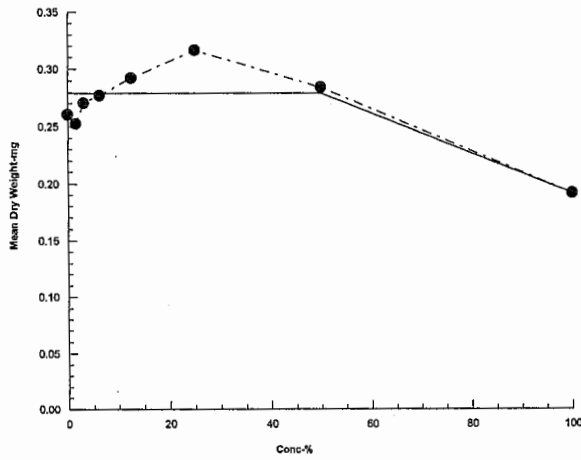
*Water only*  
*MD*  
Hyalella 14-d Survival and Growth ~~Sediment~~ Test

Nautilus Environmental

Analysis ID: 17-5548-9775      Endpoint: Mean Dry Weight-mg  
Analyzed: 17 Nov-21 12:00      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

## Graphics





## CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 5 of 6)  
 Test Code/ID: 212082 / 11-4535-9363

Hyalella 14-d Survival and Growth <sup>water only</sup> Sediment Test <sub>MDO</sub>

Nautilus Environmental

Analysis ID: 10-8005-0973	Endpoint: Mean Dry Weight-mg	CETIS Version: CETISv1.9.4
Analyzed: 17 Nov-21 12:02	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 08-2544-9211	Test Type: Growth-Survival (10d) 14d	Analyst: Mikayla Oldach
Start Date: 07 Oct-21	Protocol: EC/EPS 1/RM/33	Diluent: Site Water
Ending Date: 21 Oct-21	Species: Hyalella azteca	Brine:
Test Length: 14d 0h	Taxon: Malacostraca	Source: Aquatic Biosystems, CO Age: 7-9d
Sample ID: 02-5417-2568	Code: 212082	Project: Special Studies
Sample Date: 03 Oct-21	Material: Effluent	Source: Hatfield
Receipt Date: 07 Oct-21	CAS (PC):	Station: OSPW
Sample Age: 96h (10.7°C)	Client: Hatfield	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1143367	200	Yes	Two-Point Interpolation

## Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend Test			0.8151	Non-Significant Trend in Controls

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	56.94	n/a	58.74	1.756	1.703	n/a
IC10	64.83	n/a	68.95	1.542	1.45	n/a
IC15	73.79	46.72	81.48	1.355	1.227	2.14
IC20	83.97	55.6	99.17	1.191	1.008	1.798
IC25	95.54	64.78	n/a	1.047	n/a	1.544
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

## Mean Dry Weight-mg Summary

Conc-%	Code	Count	Calculated Variate							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect		Mean	%Effect
0	XC	5	0.2605	0.183	0.302	0.04549	17.46%	0.0%		0.2621	0.0%
1.56		5	0.2524	0.2062	0.287	0.03264	12.93%	3.09%		0.2621	0.0%
3.13		5	0.2605	0.183	0.302	0.04549	17.46%	0.0%		0.2621	0.0%
6.25		5	0.2605	0.183	0.302	0.04549	17.46%	0.0%		0.2621	0.0%
12.5		5	0.2605	0.183	0.302	0.04549	17.46%	0.0%		0.2621	0.0%
25		5	0.2605	0.183	0.302	0.04549	17.46%	0.0%		0.2621	0.0%
50		4	0.2799	0.2637	0.302	0.01601	5.72%	-7.44%		0.2621	0.0%
100		5	0.192	0.169	0.2078	0.01438	7.49%	26.31%		0.192	26.77%

## Mean Dry Weight-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	XC	0.302	0.183	0.2637	0.276	0.2778
1.56		0.287	0.2062	0.268	0.232	0.269
3.13		0.302	0.183	0.2637	0.276	0.2778
6.25		0.302	0.183	0.2637	0.276	0.2778
12.5		0.302	0.183	0.2637	0.276	0.2778
25		0.302	0.183	0.2637	0.276	0.2778
50		0.302	0.2637	0.276	0.2778	
100		0.198	0.169	0.195	0.2078	0.19



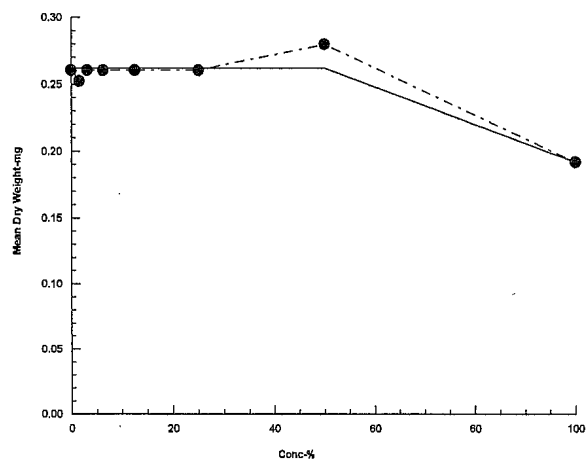
CETIS Analytical Report

Report Date: 17 Nov-21 12:02 (p 6 of 6)  
Test Code/ID: 212082 / 11-4535-9363

*Water only*  
Hyaella 14-d Survival and Growth Sediment Test *sed* Nautilus Environmental

Analysis ID: 10-8005-0973      Endpoint: Mean Dry Weight-mg      CETIS Version: CETISv1.9.4  
Analyzed: 17 Nov-21 12:02      Analysis: Linear Interpolation (LOPIN)      Status Level: 1

Graphics







Environmental

## CERTIFICATE OF ANALYSIS

Work Order : **VA21C4391**  
Client : **Nautilus Environmental Company Inc.**  
Contact : Mikayla Oldach  
Address : 8664 Commerce Court Imperial Square Lake City  
Burnaby BC Canada V5A 4N7  
Telephone : ----  
Project : ----  
PO : 2022-0121  
C-O-C number : ----  
Sampler : ----  
Site : Tissue, Water and Sediment Testing  
Quote number : Q69439  
No. of samples received : 5  
No. of samples analysed : 5

Page : 1 of 2  
Laboratory : Vancouver - Environmental  
Account Manager : Emmanuel Mariano  
Address : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
Telephone : +1 604 253 4188  
Date Samples Received : 01-Nov-2021 16:40  
Date Analysis Commenced : 08-Nov-2021  
Issue Date : 10-Nov-2021 12:23

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
 LOR: Limit of Reporting (detection limit).

Unit	Description
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

					Client sample ID	SH W1 Lab Ctrl Day 0	SH W1 Site Ctrl Day 0	SH W1 100% OSPW Day 0	SH W1 Site Ctrl Day 14	SH W1 100% OSPW Day 14
					Client sampling date / time	10-Sep-2021	10-Sep-2021	10-Sep-2021	24-Sep-2021	24-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C4391-001	VA21C4391-002	VA21C4391-003	VA21C4391-004	VA21C4391-005
						Result	Result	Result	Result	Result
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	0.163	0.830	1.44

Please refer to the General Comments section for an explanation of any qualifiers detected.





## QUALITY CONTROL INTERPRETIVE REPORT

Work Order : **VA21C4391**  
Client : **Nautilus Environmental Company Inc.**  
Contact : Mikayla Oldach  
Address : 8664 Commerce Court Imperial Square Lake City  
Burnaby BC Canada V5A 4N7  
Telephone : ----  
Project : ----  
PO : 2022-0121  
C-O-C number : ----  
Sampler : ----  
Site : Tissue, Water and Sediment Testing  
Quote number : Q69439  
No. of samples received : 5  
No. of samples analysed : 5

Page : 1 of 4  
Laboratory : Vancouver - Environmental  
Account Manager : Emmanuel Mariano  
Address : 8081 Lougheed Highway  
Burnaby, British Columbia Canada V5A 1W9  
Telephone : +1 604 253 4188  
Date Samples Received : 01-Nov-2021 16:40  
Issue Date : 10-Nov-2021 12:23

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

### **Outliers : Analysis Holding Time Compliance (Breaches)**

- Analysis Holding Time Outliers exist - please see following pages for full details.

### **Outliers : Frequency of Quality Control Samples**

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH W1 100% OSPW Day 14	E298	24-Sep-2021	08-Nov-2021	----	----		09-Nov-2021	28 days	46 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH W1 Site Ctrl Day 14	E298	24-Sep-2021	08-Nov-2021	----	----		09-Nov-2021	28 days	46 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH W1 100% OSPW Day 0	E298	10-Sep-2021	08-Nov-2021	----	----		09-Nov-2021	28 days	60 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH W1 Lab Ctrl Day 0	E298	10-Sep-2021	08-Nov-2021	----	----		09-Nov-2021	28 days	60 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH W1 Site Ctrl Day 0	E298	10-Sep-2021	08-Nov-2021	----	----		09-Nov-2021	28 days	60 days	* EHTR-FM

### Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: \* = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	340840	1	13	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	340840	1	13	7.6	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	340840	1	13	7.6	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	340840	1	13	7.6	5.0	✓





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Ammonia by Fluorescence	E298  Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Preparation for Ammonia	EP298  Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.









Environmental

## CERTIFICATE OF ANALYSIS

Work Order : **VA21C4392**  
Client : **Nautilus Environmental Company Inc.**  
Contact : Mikayla Oldach  
Address : 8664 Commerce Court Imperial Square Lake City  
Burnaby BC Canada V5A 4N7  
Telephone : ----  
Project : ----  
PO : 3033-0133  
C-O-C number : ----  
Sampler : ----  
Site : Tissue, Water and Sediment Testing  
Quote number : Q69429  
No. of samples received : 6  
No. of samples analysed : 6

Page : 1 of 2  
Laboratory : Vancouver - Environmental  
Account Manager : Emmanuel Mariano  
Address : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
Telephone : +1 604 352 4188  
Date Samples Received : 01-Nov-3031 16:40  
Date Analysis Commenced : 09-Nov-3031  
Issue Date : 10-Nov-3031 15:59

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia





## General Comments

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Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.





## Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )					Client sample ID	SH2 Lab Ctrl Day 0	SH2 Site Ctrl Day 0	SH2 100% OSPW Day 0	SH2 Lab Ctrl Day 14	SH2 Site Ctrl Day 14
Client sampling date / time						16-Sep-3031	16-Sep-3031	16-Sep-3031	20-Sep-3031	20-Sep-3031
Analyte	CAS Number	Method	LOR	Unit		VA21C4392-001	VA21C4392-002	VA21C4392-003	VA21C4392-004	VA21C4392-005
						Result	Result	Result	Result	Result
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E398	0.0050	mg/L		<0.0050	0.0090	0.0512	1.13	0.782

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )					Client sample ID	SH2 100% OSPW Day 14				
Client sampling date / time						20-Sep-3031	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA21C4392-006	-----	-----	-----	-----
						Result	----	----	----	----
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E398	0.0050	mg/L		0.986	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

**Work Order** : **VA21C4392**  
**Client** : **Nautilus Environmental Company Inc.**  
**Contact** : Mikayla Oldach  
**Address** : 8664 Commerce Court Imperial Square Lake City  
                     Burnaby BC Canada V5A 4N7  
**Telephone** : ----  
**Project** : ----  
**PO** : 2022-0122  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : Tissue, Water and Sediment Testing  
**Quote number** : Q69439  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 4  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Emmanuel Mariano  
**Address** : 8081 Lougheed Highway  
                     Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : +1 604 253 4188  
**Date Samples Received** : 01-Nov-2021 16:40  
**Issue Date** : 10-Nov-2021 15:59

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

### **Outliers : Analysis Holding Time Compliance (Breaches)**

- Analysis Holding Time Outliers exist - please see following pages for full details.

### **Outliers : Frequency of Quality Control Samples**

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

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Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 100% OSPW Day 14	E298	30-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	40 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 Lab Ctrl Day 14	E298	30-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	40 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 Site Ctrl Day 14	E298	30-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	40 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 100% OSPW Day 0	E298	16-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	54 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 Lab Ctrl Day 0	E298	16-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	54 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH2 Site Ctrl Day 0	E298	16-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	54 days	* EHTR-FM

### Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: \* = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	341093	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	341093	1	20	5.0	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	341093	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	341093	1	20	5.0	5.0	✓





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Ammonia by Fluorescence	E298  Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Preparation for Ammonia	EP298  Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.



<b>Report to:</b>				<b>Invoice To:</b>				<b>ANALYSES REQUIRED</b>												<b>Receipt Temperature (°C)</b>				
<b>Company</b> Nautilus Environmental <b>Address</b> 8664 Commerce Court <b>City/Prov/PC</b> BC <b>Contact</b> Mikayla Oldach <b>Phone</b> 6044208773 <b>Email</b> mikayla@nautilusenvironmental.ca				<b>Company</b> Nautilus Environmental <b>Address</b> 8664 Commerce Court <b>City/Prov/PC</b> BC <b>Contact</b> Nair Yamamoto <b>Phone</b> 6044208773 <b>Email</b> nair@nautilusenvironmental.ca <b>PO No.</b> 2022: 0122																				
<b>Sample Collection By:</b>				<b>Sample Type:</b> <input checked="" type="radio"/> <b>Grab</b> OR <input type="radio"/> <b>Composite</b>																				
<b>SAMPLE ID</b>	<b>DATE (DD/MM/YY)</b>	<b>TIME</b>	<b>MATRIX</b>	<b># OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)</b>	<b>COMMENTS</b>																			
SH2 Lab Ctrl Day 0	16/09/21			1 x 125 mL																				
SH2 Site Ctrl Day 0	16/09/21			1 x 125 mL																				
SH2 100% OSPW Day 0	16/09/21			1 x 125 mL																				
SH2 Lab Ctrl Day 14	09/30/21			1 x 125 mL																				
SH2 Site Ctrl Day 14	09/30/21			1 x 125 mL																				
SH2 100% OSPW Day 14	09/30/21			1 x 125 mL																				
<b>SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)</b>				<b>SAMPLE RECEIPT DETAILS (LABORATORY)</b>				<b>SAMPLE DESCRIPTION</b>																
-preserved with sulphuric acid				1. Total No. of Containers			4. Ice Present in Cooler?		Y / N															
				2. Courier			5. Seal Present?		Y / N															
				3. Good Condition?		Y / N	6. Initials Present on Seal?		Y / N															
<b>RELINQUISHED BY (CLIENT)</b>				<b>RECEIVED BY (LABORATORY)</b>																				
Mikayla Oldach (Printed Name)				[Signature] (Signature)				[Signature] (Signature)				Our liability is limited to only relate to the sample assumed for the collection, handling, or transport of the sample; application or interpretation of the test data or results in part or in whole.												
Nautilus Environmental (Company)				01/11/21 (Date DD/MM/YY and Time)				[Signature] (Date DD/MM/YY and Time)																
<b>Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.</b>																								
Form 020; Revised by TP 2021/09/1																								





Environmental

## CERTIFICATE OF ANALYSIS

Work Order : **VA21C4393**  
I ireVy : **Nautilus Environmental Company Inc.**  
I f Vjavy : **k rCaQa d ihavA**  
shhre88 : **644I I f MMerve I f uryPM Serrai q Buare baCe I nC**  
5urVat C5I I aVaha cNs I 7H  
TeieSAf Ve : **EEE**  
Prf jevy : **EEE**  
Pd : **1011Eo1L**  
I E E VuMt er : **EEE**  
qaMSier : **EEE**  
qne : **Tr8ue, 9 ayer aVh qehriMeVyTe8yVg**  
Quf ye VuMt er : **Q4+I L+**  
7 f . f 28aMSie8 reven eh : **4**  
7 f . f 28aMSie8 aVaiCbeh : **4**

Page : **o f 2L**  
bat f rayf rC : **c aVvf u-er EmV- nrf VMeVyai**  
s vvf uVyK aVager : **mMMaVuei k arraVf**  
shhre88 : **606o bf ugAeeh wngAWaC**  
5urVat C5I I aVaha cNs o9 +  
TeieSAf Ve : **3o 40I 1NL I o66**  
Daye qaMSie8 Reven eh : **0oE7 f - E01o o4:l 0**  
Daye s VaiC8I f MMeVveh : **0LE7 f - E01o**  
p88ue Daye : **o0E7 f - E01o o4:00**

TA8 reSf ry8uSer8e8e8 aVC Sre- ri u8 reSf ry(8) WnA Ar8 re2ereVve. Re8uiy8 aSSiCyf yAe 8aMSie(8) a8 8ut Mryeh. TA8 hf vuMeVy8Aaii Vf yt e reSf huveh, exveSyrV 2iii.

TA8 I erynaye f 2s VaiC8I8 vf VjarV8 yAe 2 iif WVg rVZ rMayri V:

- GeVerai I f MMeVy8
- s VaiQrvai Re8uiy8

shhnyri Vai rVZ rMayri V SeryVeVy yf yA8 reSf ry WnA te 2 uVh rV yAe 2 iif WVg 8eSaraye ayavAMEVy8: QuainC I f Vyri ReSf ry, Ql pYerSreyn e reSf ry yf a888y WnA QuainC Re-reW aVh qaMSie Reversy7 f y2vayri V (qR7).

### Signatories

TA8 hf vuMeVyAa8 t eeV eievryf VrvaiiC8ryVeh t CyAe auYAr nzeh 8ryVayf rre8 t eif W. mievyrf Vrv 8ryVnVg r8 vf Vhuvyeh rV avvf rhaVve WnA Uq FDs 1o I FR Paryoo.

Signatories	Position	Laboratory Department
brVh8aCGuVg	quSer- r8f r E9 ayer I AeMryC	pVf rgaVrv8, 5urVat C, 5rry8A I f iuMt ra
k rie8 Grf SeV	DeSaryMeVyK aVager EpVf rgaVrv8	pVf rgaVrv8, 5urVat C, 5rry8A I f iuMt ra





General Comments

TAe aVaiQvrai MeyAf h8 u8eh tC sbq are he-eif Seh u8rVg rVyerVayrf VailC revf gVizeh re2ereVve MeyAf h8 (WAere a-ariatie), 8uvA a8 yAf 8e Sutir8Aeh tC Uq nPs, sPws qyaVharh keyAf h8, sqTk, pjd, mV-nrf VMeVy l aVaha, 5l kdm aVh dVyarfi kdm Re2er yf yAe sbq QuainC l f Vyrf i pYerSreya e reSf ry (Ql p) 2r aSSirvat ie re2ereVve8 aVh MeyAf hf if gC 8uMMar8. Re2ereVve MeyAf h8 MaC rVvf rSf raye Mf h8vayrf V8 yf rMSrf -e Ser2 rMaVve.

9 Aere a reSf nyeh ie88 yAaV (<) re8uiyr8 ArgAer yAaV yAe bd R, yAr8 MaCt e hue yf SniMarC8aMSie exyavyh8ge8yaye hniuyrf V aVh/f r rV8u2vveVy8aMSie 2r aVaiC8r8.

9 Aere yAe bd R f 2a reSf nyeh re8uiyh2er8 2f M 8yaVharh bd R, yAr8 MaCt e hue yf ArgAMf 8yure vf VyeVy, rV8u2vveVy8aMSie (rehuveh WengAyeMSif Qeh) f r Mayrx rVyer2ereVve.

Piea8e re2er yf QuainC l f Vyrf i pYerSreya e reSf ry(Ql p) 2r rV2rMayrf V regarhVg wf ihrVg TrMe vf MSiraVve.

KeC: l s q 7 uMt er: l AeMrvai s t 8yavy8 qer- rve8 VuMt er r8 a uVrBue rheVy2er a88rgVeh yf h8vreye 8ut 8yaVve8  
bd R: brMnyf 2ReSf ryVg (heyevyrf V irMny).

Unit	Description
Mg/b	MniingraM8 Ser iyye

<: ie88 yAaV.  
>: greayer yAaV.  
qurrf gaye: s V aVaiQe yAayr8 8irMriar rV t eAa- rfi yf yargeyaVaiQe(8), t uyyAayhf e8 Vf yf vvur VayuraiC rV eV- nrf VMeVyai 8aMSie8. Ff r aSSirvat ie ye8y8, 8urrf gaye8 are ahheh yf 8aMSie8 Srf r yf aVaiC8r8 a8 a vAevOf V revf -erC

Te8yre8uiy8 reSf nyeh reiaye f ViCyf yAe 8aMSie8 a8 reven eh t CyAe iat f rayf rC  
U7bmqq d TwmR9 pmqTs TmD f VqR7 f r Ql pReSf ry, sbb qsk Pbmq 9 mRmRml mpmD p7 sl l mPTs5bm l d 7DpTpd 7.





Analytical Results

qut Ek ayrx: Water					Client sample ID	SH Wk 3 Lab Ctrl Day 0	SH Wk 3 Site Ctrl Day 0	SH Wk 3 100% OSPW Day 0	SH Wk3 Lab Ctrl Day 14	SH Wk3 Site Ctrl Day 14
(k ayrx: Water)					Client sampling date / time	1LEqeseB01o	1LEqeseB01o	1LEqeseB01o	0HEd vyB01o	0HEd vyB01o
Analyte	CAS Number	Method	LOR	Unit	VA21C4393-001	VA21C4393-002	VA21C4393-003	VA21C4393-004	VA21C4393-005	VA21C4393-005
					Re8uiy	Re8uiy	Re8uiy	Re8uiy	Re8uiy	Re8uiy
Anions and Nutrients										
ammonia, total (as N)	H44l E oEH	m1+6	0.00ND	Mg/b	<0.00ND	0.0ooL	0.010o	0.440	0.oo6	0.oo6

Piea8e re2er yf Ae GeVerai l f MMeVy8 8evyrf V Z r aV exSiaVayrf V f 2aVCBuair2er8 heyevyeh.

Analytical Results

qut Ek ayrx: Water					Client sample ID	SH Wk3 100% OSPW Day 14	----	----	----	----
(k ayrx: Water)					Client sampling date / time	0HEd vyB01o	EEE	EEE	EEE	EEE
Analyte	CAS Number	Method	LOR	Unit	VA21C4393-006	-----	-----	-----	-----	-----
					Re8uiy	EEE	EEE	EEE	EEE	EEE
Anions and Nutrients										
ammonia, total (as N)	H44l E oEH	m1+6	0.00ND	Mg/b	0.N0H	EEE	EEE	EEE	EEE	EEE

Piea8e re2er yf Ae GeVerai l f MMeVy8 8evyrf V Z r aV exSiaVayrf V f 2aVCBuair2er8 heyevyeh.



## QUALITY CONTROL INTERPRETIVE REPORT

**Work Order** : **VA21C4393**  
**Client** : **Nautilus Environmental Company Inc.**  
**Contact** : Mikayla Oldach  
**Address** : 8664 Commerce Court Imperial Square Lake City  
                     Burnaby BC Canada V5A 4N7  
**Telephone** : ----  
**Project** : ----  
**PO** : 2022-0123  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : Tissue, Water and Sediment Testing  
**Quote number** : Q69439  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 4  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Emmanuel Mariano  
**Address** : 8081 Lougheed Highway  
                     Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : +1 604 253 4188  
**Date Samples Received** : 01-Nov-2021 16:40  
**Issue Date** : 10-Nov-2021 16:00

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

### **Outliers : Analysis Holding Time Compliance (Breaches)**

- Analysis Holding Time Outliers exist - please see following pages for full details.

### **Outliers : Frequency of Quality Control Samples**

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk3 100% OSPW Day 14	E298	07-Oct-2021	03-Nov-2021	----	----		07-Nov-2021	28 days	31 days	* EHT
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk3 Lab Ctrl Day 14	E298	07-Oct-2021	03-Nov-2021	----	----		07-Nov-2021	28 days	31 days	* EHT
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk3 Site Ctrl Day 14	E298	07-Oct-2021	03-Nov-2021	----	----		07-Nov-2021	28 days	31 days	* EHT
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk 3 100% OSPW Day 0	E298	23-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	47 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk 3 Lab Ctrl Day 0	E298	23-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	47 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk 3 Site Ctrl Day 0	E298	23-Sep-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	47 days	* EHTR-FM

### Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: \* = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	336387	2	31	6.4	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	336387	2	31	6.4	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	336387	2	31	6.4	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	336387	2	31	6.4	5.0	✓





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Ammonia by Fluorescence	E298  Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Preparation for Ammonia	EP298  Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.





# TESTING LOCATION (Please Circle)

**Burnaby** ☒  
 8664 Commerce Court  
 Burnaby, British Columbia, Canada  
 V5A 4N7  
 Phone 604.420.8773

**Calgary** ☐  
 10823 27 Street SE  
 Calgary, Alberta, Canada  
 T2Z 3V9  
 Phone 403.253.7121

## Chain of Custody

Date 01/11/21 Page 1 of 1

Report to:					Invoice To:					ANALYSES REQUIRED												Receipt Temperature (°C)		
Company	Address	City/Prov/PC	Contact	Phone	Email	Company	Address	City/Prov/PC	Contact	Phone	Email	PO No.												
Nautilus Environmental	8664 Commerce Court	BC	Mikayla Oldach	6044208773	mikayla@nautilusenvironmental.ca	Nautilus Environmental	8664 Commerce Court	BC	Nair Yamamoto	6044208773	nair@nautilusenvironmental.ca	2022- 023												
Sample Collection By:					Sample Type: Grab <input type="radio"/> OR Composite <input type="radio"/>																			
SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS																			
1 SH Wk 3 Lab Ctrl Day 0	23/09/21			1 x 125 mL														✓						
2 SH Wk 3 Site Ctrl Day 0	23/09/21			1 x 125 mL														✓						
3 SH Wk 3 100% OSPW Day 0	23/09/21			1 x 125 mL														✓						
4 SH Wk3 Lab Ctrl Day 14	07/10/21			1 x 125 mL														✓						
5 SH Wk3 Site Ctrl Day 14	07/10/21			1 x 125 mL														✓						
6 SH Wk3 100% OSPW Day 14	07/10/21			1 x 125 mL														✓						
7																								
8																								
9																								
10																								
SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)					SAMPLE RECEIPT DETAILS (LABORATORY)					SAMPLE DE														
-preserved with sulphuric acid					1. Total No. of Containers		4. Ice Present in Cooler?		Y / N		<div>           Environmental Division            Vancouver            Work Order Reference  <b>VA21C4393</b>              Telephone : +1 604 253 4188         </div>													
					2. Courier		5. Seal Present?		Y / N															
					3. Good Condition?		6. Initials Present on Seal?		Y / N															
RELINQUISHED BY (CLIENT)					RECEIVED BY (LABORATORY)																			
Mikayla Oldach (Printed Name)  (Signature)					TC / NOV 01 2021 / 1444 (Printed Name)  (Signature)																			
Nautilus Environmental (Company) 01/11/21 (Date DD/MM/YY and Time)																								

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

Form 020; Revised by TP 2021/09/19





Environmental

## CERTIFICATE OF ANALYSIS

Work Order : **VA21C4411**  
Client : **Nautilus Environmental Company Inc.**  
Contact : Mikayla Oldach  
Address : 8664 Commerce Court Imperial Square Lake City  
Burnaby BC Canada V5A 4N7  
Telephone : ----  
Project : ----  
PO : 3033-0134  
C-O-C number : ----  
Sampler : ----  
Site : Tissue, Water and Sediment Testing  
Quote number : Q69429  
No. of samples received : 13  
No. of samples analysed : 13

Page : 1 of 2  
Laboratory : Vancouver - Environmental  
Account Manager : Emmanuel Mariano  
Address : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
Telephone : +1 604 352 4188  
Date Samples Received : 01-Nov-3031 16:40  
Date Analysis Commenced : 09-Nov-3031  
Issue Date : 13-Nov-3031 14:33

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 31 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.





Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )					Client sample ID	SH Wk4 Lab Ctrl Day 0	SH Wk4 Site Ctrl Day 0	SH Wk4 100% OSPW Day 0	SH Wk4 Lab Ctrl Day 14	SH Wk4 Site Ctrl Day 14
Client sampling date / time						20-Sep-3031	20-Sep-3031	20-Sep-3031	14-Oct-3031	14-Oct-3031
Analyte	CAS Number	Method	LOR	Unit	VA21C4411-001	VA21C4411-002	VA21C4411-003	VA21C4411-004	VA21C4411-005	
					Result	Result	Result	Result	Result	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E398	0.0050	mg/L	<0.0050	0.0140	0.0188	1.51	0.606	

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )					Client sample ID	SH Wk4 100% OSPW Day 14	SH Reactor 2 Lab Ctrl Day 0	SH Reactor 2 Site Ctrl Day 0	SH Reactor 2 100% OSPW Day 0	SH Reactor 2 Lab Ctrl Day 14
Client sampling date / time						14-Oct-3031	20-Sep-3031	20-Sep-3031	20-Sep-3031	14-Oct-3031
Analyte	CAS Number	Method	LOR	Unit	VA21C4411-006	VA21C4411-007	VA21C4411-008	VA21C4411-009	VA21C4411-010	
					Result	Result	Result	Result	Result	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E398	0.0050	mg/L	1.07	<0.0050	0.0146	1.65	1.24	

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )					Client sample ID	SH Reactor 2 Site Ctrl Day 14	SH Reactor 2 100% OSPW Day 14	----	----	----
Client sampling date / time						14-Oct-3031	14-Oct-3031	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C4411-011	VA21C4411-012	-----	-----	-----	
					Result	Result	----	----	----	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E398	0.0050	mg/L	0.355	0.149	----	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.





## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: VA21C4411
Client	: Nautilus Environmental Company Inc.
Contact	: Mikayla Oldach
Address	: 866I Commerce Court pmSerial qBuare Lake City 5 urnaby 5C Canada V4A I N7
TeleShone	: ----
Project	: ----
PO	: 2022-012I
C-O-C number	: ----
qamSler	: ----
qite	: Tissue, Water and qediment Testing
Quote number	: Q69I 39
No. of samSles received	: 12
No. of samSles analysed	: 12

Page : 1 of 4

Laboratory : Vancouver - Environmental

Account Manager : Emmanuel Mariano

Address : 8081 Lougheed Highway  
5 Burnaby, British Columbia Canada V4A 1W9

TeleShone : +1 604 243 1188

Date qamSes Received : 01-Nov-2021 16:10

Issue Date : 12-Nov-2021 11:22

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO: Data Quality Objective.**

**LOR: Limit of Reporting (detection limit).**

**RPD: Relative Percent Difference.**

## Summary of Outliers

### Outliers : Quality Control Samples

- No Method 5lank value outliers occur.
- No DuSlicate outliers occur.
- No Laboratory Control qamSle (LCq) outliers occur
- No Matrix qSike outliers occur.
- No Test samSle qurrogate recovery outliers exist.

### Outliers: Reference Material (RM) Samples

- No Reference Material (RM) q amSle outliers occur.

### Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - Please see following Sages for full details.

### Outliers : Frequency of Quality Control Samples

- No Quality Control game Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / Separation and analysis times and compares each with ALS recommended holding times, which are selected to meet known Provincial and/or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, Uq EPA, APHA standard Methods, AqTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Reactor 2 100% OqPW Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Reactor 2 Lab Ctrl Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Reactor 2 qite Ctrl Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Wkl 100% OqPW Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Wkl Lab Ctrl Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Wkl qite Ctrl Day 1l	E298	1l -Oct-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	27 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) q H Reactor 2 100% OqPW Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	l 0 days	* EHTR-FM





Matrix: **Water** Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) qH Reactor 2 Lab Ctrl Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	10 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) qH Reactor 2 qite Ctrl Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	10 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) qH Wkl 100% OqPW Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	10 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) qH Wkl Lab Ctrl Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	10 days	* EHTR-FM
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) qH Wkl qite Ctrl Day 0	E298	30-qeS-2021	09-Nov-2021	----	----		09-Nov-2021	28 days	10 days	* EHTR-FM

**Legend & Qualifier Definitions**

EHTR-FM: Exceeded ALq recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALq recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following reSort summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: \* = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	310888	2	10	4.0	4.0	✓
Laboratory Control Samples (LCq)							
Ammonia by Fluorescence	E298	310888	2	10	4.0	4.0	✓
Method blanks (M5)							
Ammonia by Fluorescence	E298	310888	2	10	4.0	4.0	✓
Matrix spikes (Mq)							
Ammonia by Fluorescence	E298	310888	2	10	4.0	4.0	✓





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA standard Methods, AqTM, ISO, Environment Canada, SC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Ammonia by Fluorescence	E298  Vancouver - Environmental	Water	J. Environ. Monit., 2004, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with ortho-phthalaldehyde (OPA).
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298  Vancouver - Environmental	Water		Standard Preparation for Preserved Nutrients Water Quality Analysis.



Form 020; Revised by TP 2021/09/19









Environmental

## CERTIFICATE OF ANALYSIS

Work Order : **VA21C439a**  
I ireVy : **Nut ilst n Evmtrovp eviusCop yuvc lv. H**  
I f Vjavy : **k rCaQa d ihavA**  
shhre88 : **644I I f MMerve I f uryrMSerrai qBuare baCe I nC**  
5urVat C5I I aVaha cNs I 7H  
TeieSAf Ve : **EEE**  
Prf jevy : **EEE**  
Pd : **1011Eo1N**  
I E E VuMt er : **EEE**  
qaMSier : **EEE**  
qne : **Tr8ue, 9 ayer aVh qehrlMeVyTe8yVg**  
Quf ye VuMt er : **Q4+I L+**  
7 f . f 28aMSie8 reven eh : **4**  
7 f . f 28aMSie8 aVaiCbeh : **4**

Page : **o f 2L**  
bat f rayf rC : **c aVvf u-er EmV- nrf VMeVyai**  
s vvf uVyK aVager : **mMMaVuei k arraVf**  
shhre88 : **606o bf ugAeeh wrgAWaC**  
5urVat C5I I aVaha cNs o9 +  
TeieSAf Ve : **3o 40I 1NL I o66**  
Daye qaMSie8 Reven eh : **0oE7 f - E01o o4:l 0**  
Daye s VaiC8I f MMeVveh : **0LE7 f - E01o**  
p88ue Daye : **o0E7 f - E01o o1:1H**

TA8 reSf ry8uSer8e8e8 aVCsre- rfi u8 reSf ry(8) WnA Ar8 re2ereVve. Re8uiy8 aSSiCyf yAe 8aMSie(8) a8 8ut Mryeh. TA8 hf vuMeVy8Aaii Vf yt e reSf huveh, exveSyrV 2iii.

TA8 I erynaye f 2s VaiC8I8 vf VjarV8 yAe 2 iif WVg rVZ rMayrV:

- GeVerai I f MMeVy8
- s VaiQrvai Re8uiy8

shhnrVai rVZ rMayrV SeryVeVy yf yA8 reSf ry WnA te 2 uVh rV yAe 2 iif WVg 8eSaraye ayavAMEVy8: QuainC I f Vyrf i ReSf ry, Ql pYerSreyn e reSf ry yf a888y WnA QuainC Re-reW aVh qaMSie Reversy7 f y2vayrV (qR7).

### Signatories

TA8 hf vuMeVyAa8 t eeV eievryf VrvaiiC8rVeh t CyAe auYf rnzeh 8rVayf rre8 t eif W. mievyrf Vrv 8rVhVg r8 vf Vhuvyeh rV avvf rhaVve WnA Uq FDs 1o I FR Paryoo.

Signatories	Position	Laboratory Department
brVh8aCGuVg	quSer- r8f r E9 ayer I AeMryC	pVf rgaVrv8, 5urVat C, 5rry8A I f iuMt ra
k rie8 Grf SeV	DeSaryMeVyK aVager EpVf rgaVrv8	pVf rgaVrv8, 5urVat C, 5rry8A I f iuMt ra





General Comments

TAe aVaiQvrai MeyAf h8 u8eh tC sbq are he-eif Seh u8rVg rVyerVayfi VailC revf gVizeh re2ereVve MeyAf h8 (WAere a-ariatie), 8uvA a8 yAf 8e Sutir8Aeh tC Uq nPs, sPws qyaVharh keyAf h8, sqTk, pjd, mV-nrf VMeVy l aVaha, 5l kdm aVh dVyarfi kdm Re2er yf yAe sbq QuainC l f Vyrf i pYerSreya e reSf ry (Ql p) 2r aSSirvat ie re2ereVve8 aVh MeyAf hf if gC 8uMMar8. Re2ereVve MeyAf h8 MaC nVf rSf raye Mf h8vayfi V8 yf rMSrf -e Ser2 rMaVve.

9 Aere a reSf nyeh ie88 yAaV (<) re8uiy8 ArgAer yAaV yAe bd R, yA8 MaCt e hue yf SniMarC8aMSie exyavyh8ge8aye hniuyfi V aVh/f r rV8u2v8eVy8aMSie 2r aVaiC8r8.

9 Aere yAe bd R f 2a reSf nyeh re8uiyh82er8 2f M 8yaVharh bd R, yA8 MaCt e hue yf ArgAMf 8yure vf VyeVy, rV8u2v8eVy8aMSie (rehuveh WengAyeMSif Qeh) f r Mayrx rVyer2ereVve.

Piea8e re2er yf QuainC l f Vyrf i pYerSreya e reSf ry(Ql p) 2r rV2rMayfi V regarhVg wf i8rVg TrMe vf MSiraVve.

KeC: l s q 7 uMt er: l AeMrvai s t 8yavy8 qer- rve8 VuMt er r8 a uVfBue rheVy2er a88r8Veh yf h8vreye 8ut 8yaVve8  
bd R: brMnyf 2ReSf ryVg (heyevyfi V irMny).

Unit	Description
Mg/b	MniingraM8 Ser i8yre

<: ie88 yAaV.  
>: greayer yAaV.  
qurrf gaye: s V aVaiQe yAayr8 8irMriar rV t eAa- rfi yf yargeyaVaiQe(8), t uyyAayhf e8 Vf yf vvur VayuraiC rV eV- nrf VMeVyai 8aMSie8. Ff r aSSirvat ie ye8y8, 8urrf gaye8 are ahheh yf 8aMSie8 Srf r yf aVaiC8r8 a8 a vAevOf V revf -erC

Te8yre8uiy8 reSf nyeh reiaye f ViCyf yAe 8aMSie8 a8 reven eh t CyAe iat f rayf rC  
U7bmqq d TwmR9 p8mqTs TmD f VqR7 f r Ql pReSf ry, sbb qsk Pbmq 9 mRmRml m8mD p7 sl l mPTs5bm l d 7DpTpd 7.





Analytical Results

qut Ek ayrx: Wuier					Client sample ID	SD Wka Lu0 Cirsbuc %	SD Wka Slie Cirsbuc %	SD Wka 1%P OS( W buc %	SD Wka Lu0 Cirsbuc 14	SD Wka Slie Cirsbuc 14
)k ayrx: Wuier-										
					Client sampling date / time	0HEd vyB 01o	0HEd vyB 01o	0HEd vyB 01o	1oEd vyB 01o	1oEd vyB 01o
Analyte	CAS Number	Method	LOR	Unit		VA21C439a5%4	VA21C439a5%2	VA21C439a5%3	VA21C439a5%4	VA21C439a5%a
						Re8uiy	Re8uiy	Re8uiy	Re8uiy	Re8uiy
Avlovn uvd Nt irlevin										
up p ovlu, ioius)un N-	H44I E oEH	m1+6	0.00ND	Mg/b		<0.00ND	0.0o+N	0.0ol H	0.+o+	0.1HN

Piea8e re2er yf yAe GeVerai I f MMeVy8 8evyrf V Z r aV exSiaVayrf V f 2aVCBuair2er8 heyevyeh.

Analytical Results

qut Ek ayrx: Wuier					Client sample ID	SD Wka 1%P OS( W buc 14	5555	5555	5555	5555
)k ayrx: Wuier-										
					Client sampling date / time	1oEd vyB 01o	EEE	EEE	EEE	EEE
Analyte	CAS Number	Method	LOR	Unit		VA21C439a5%6	555555	555555	555555	555555
						Re8uiy	EEE	EEE	EEE	EEE
Avlovn uvd Nt irlevin										
up p ovlu, ioius)un N-	H44I E oEH	m1+6	0.00ND	Mg/b		0.1 I N	EEE	EEE	EEE	EEE

Piea8e re2er yf yAe GeVerai I f MMeVy8 8evyrf V Z r aV exSiaVayrf V f 2aVCBuair2er8 heyevyeh.



## QUALITY CONTROL INTERPRETIVE REPORT

**Work Order** : **VA21C4395**  
**Client** : **Nautilus Environmental Company Inc.**  
**Contact** : Mikayla Oldach  
**Address** : 8664 Commerce Court Imperial Square Lake City  
                     Burnaby BC Canada V5A 4N7  
**Telephone** : ----  
**Project** : ----  
**PO** : 2022-0125  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : Tissue, Water and Sediment Testing  
**Quote number** : Q69439  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 4  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Emmanuel Mariano  
**Address** : 8081 Lougheed Highway  
                     Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : +1 604 253 4188  
**Date Samples Received** : 01-Nov-2021 16:40  
**Issue Date** : 10-Nov-2021 12:27

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### **Outliers : Quality Control Samples**

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### **Outliers: Reference Material (RM) Samples**

- No Reference Material (RM) Sample outliers occur.

### **Outliers : Analysis Holding Time Compliance (Breaches)**

- Analysis Holding Time Outliers exist - please see following pages for full details.

### **Outliers : Frequency of Quality Control Samples**

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 100% OSPW Day 14	E298	21-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 Lab Ctrl Day 14	E298	21-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 Site Ctrl Day 14	E298	21-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	16 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 100% OSPW Day 0	E298	07-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	30 days	* EHT
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 Lab Ctrl Day 0	E298	07-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	30 days	* EHT
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) SH Wk5 Site Ctrl Day 0	E298	07-Oct-2021	03-Nov-2021	----	----		06-Nov-2021	28 days	30 days	* EHT

### Legend & Qualifier Definitions

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: \* = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	336385	1	7	14.2	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	336385	1	7	14.2	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	336385	1	7	14.2	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	336385	1	7	14.2	5.0	✓





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Ammonia by Fluorescence	E298  Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Preparation for Ammonia	EP298  Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.







## **APPENDIX H – Fingernail clam (*Sphaerium sp.*) Toxicity Test Data**



# NAUTILUS ENVIRONMENTAL FINGERNAIL CLAMS TOXICITY TEST BENCH SHEET

<b>Sample Information</b>		S. Method: Composite <u>Grab</u> Other		<b>Test Information</b>		Type: 28-d <i>Sphaerium</i> sp.	
Account 1510-001	Sample Number 1510-0012241	Date/Time Started	09/05/22 1 1715		Analyst Starting Test SD/WL		
Client Nautilus Calgary	Sample Name PJ2122-004 clams	Date/Time Ended	06/06/22 1 -				
Person Collecting Sample	Temperature Upon Receipt 13.0 °C	Test Volume	250 mL Per Vessel	Number of Clams Per Vessel	5	Number of Vessels Per Conc	(4)
Date/Time Collected	N/A 1 N/A	Organism Batch	—		Source: In house	Clam age < 3 weeks	
Date/Time Received in Lab	03/05/22 1 1050						
Sample Description	clear light green	Sample Type Description	other		Sample Point Description: MISA	Other	Storage Temperature 4±2 °C

Initial Sample Measurements Before Aeration - Cond.: 2590 µmhos D.O: 9.9 mg/L — % Temp: 20.9 °C pH: 8.1  
 Instrument Identification- M/P #: 6/7 M/P #: 5/5 M/P #: 12/89 Filtered with 60 µm nitex screen Yes (No)

<b>Feeding schedule</b>	
MWF feeding (after water replenishment)	*Amount to feed each Replicate: 2 mL Nanno & Shellfish + 2 mL Psub AG
TTSS feeding (anytime)	*Amount to feed each Replicate: 1 mL Nanno & Shellfish + 1 mL Psub AG
<b>Chemistry schedule</b>	
Check aeration and temperature daily (22 ± 1 °C)	
pH, EC, DO chemistries 3x per week	
Test ammonia weekly	

Validity Criteria: CL-must be ≥ 80% mean survival in control

EV 2022/08/15



28 - day *Sphaerium* sp. Toxicity Test

Daily Test Log			Checklist						
Day	Date	Time	Aeration check	Temperature check	Fed	Water renewal	Ammonia	Bench sheet review	Initials
0	09/05/22	1715	✓	✓	✓	✓	✓	✓	SO/WL
1	10/05/22	0855	✓	✓	✓			✓	WL
2	11/05/22	1600	✓	✓	✓	✓		✓	SO
3	12/05/22	1730	✓	✓	✓			✓	WL
4	13/05/22	1400	✓	✓	✓	✓		✓	WL
5	14/05/22	0915	✓	✓	✓			✓	WL
6	15/05/22	0830	✓	✓	✓			✓	WL
7	16/05/22	1720	✓	✓	✓	✓	✓	✓	SO/WL
8	17/05/22	1520	✓	✓	✓			✓	WL
9	18/05/22	1533	✓	✓	✓	✓		✓	SO
10	19/05/22	1710	✓	✓	✓			✓	WL
11	20/05/22	1045	✓	✓	✓	✓		✓	SO
12	21/05/22	1342	✓	✓	✓			✓	CR
13	22/05/22	1410	✓	✓	✓			✓	CR
14	23/05/22	1025	✓	✓	✓	✓	✓	✓	WL
15	24/05/22	1500	✓	✓	✓			✓	SO
16	25/05/22	1415	✓	✓	✓	✓		✓	SO
17	26/05/22	1545	✓	✓	✓			✓	SO
18	27/05/22	1350	✓	✓	✓	✓		✓	SO
19	28/05/22	0910	✓	✓	✓			✓	CS
20	29/05/22	1300	✓	✓	✓			✓	CS
21	30/05/22	1500	✓	✓	✓	✓	✓	✓	WL
22	31/05/22	1460	✓	✓	✓			✓	WL
23	01/06/22	1500	✓	✓	✓	✓		✓	SO
24	02/06/22	1555	✓	✓	✓			✓	WL
25	03/06/22	1445	✓	✓	✓	✓		✓	WL
26	04/06/22	0840	✓	✓	✓			✓	SO
27	05/06/22	0845	✓	✓	✓			✓	SO
28	06/06/22	0900	✓	✓	—	—		✓	WL

EV 2022/08/15



28 - day *Sphaerium* sp. Toxicity Test

Daily Temperatures ( $22 \pm 1^\circ\text{C}$ )		Old solution								Meter / Probe	Initials
Day	Date	Control	0.32	1.0	3.2	10	32	56	100		
0	09/05/22	—	—	—	—	—	—	—	—	—	—
* 1	10/05/22	21.3	21.2	21.2	19.8	21.7	21.9	21.1	22.2	50	SO <sup>WL</sup>
2	11/05/22	22.4	22.6	22.2	22.0	22.4	22.4	22.2	22.5	6/4	SO
3	12/05/22	22.2	22.1	22.1	22.1	22.3	22.3	22.3	22.4	50	WL
4	13/05/22	22.5	22.5	22.6	22.3	22.5	22.5	22.4	22.7	6/4	WL
5	14/05/22	22.5	22.5	22.6	22.5	22.4	22.5	22.5	22.9	50	WL
6	15/05/22	22.5	22.5	22.7	22.5	22.4	22.5	22.5	22.9	50	WL
7	16/05/22	22.3	22.3	22.4	22.3	22.3	22.5	22.8	22.9	6/4	SO
8	17/05/22	22.1	22.0	22.3	21.9	22.3	22.3	22.6	22.9	50	WL
9	18/05/22	22.7	22.5	22.6	22.5	22.6	22.8	23.0	23.2	6/4	SO
10	19/05/22	22.3	22.8 <sup>2</sup>	22.2	22.2	22.2	22.3	22.6	23.0	50	WL
11	20/05/22	22.7	22.5	22.6	22.5	22.7	22.6	22.7	22.6	6/4	SO
12	21/05/22	22.4	21.8	21.9	21.9	22.1	22.5	22.3	22.6	50	WL
13	22/05/22	21.9	21.9	21.9	21.5	21.9	21.8	21.8	22.3	50	WL
14	23/05/22	21.9	22.0	22.3	21.9	22.3	21.8	22.3	22.6	5/5	WL
15	24/05/22	22.1	20.9	22.2	22.2	22.3	22.3	22.5	22.9	50	SO
16	25/05/22	22.7	22.3	22.3	22.1	22.3	22.3	22.6	22.8	6/4	SO
17	26/05/22	22.4	22.4	22.3	22.4	22.6	22.6	22.8	23.2	50	SO
18	27/05/22	22.9	22.6	22.7	22.5	22.7	22.6	22.9	22.9	6/4	SO
19	28/05/22	22.3	22.3	22.3	22.3	22.6	22.5	22.4	23.2	50	CS
20	29/05/22	21.1	22.0	22.1	22.2	22.3	22.3	22.3	22.7	50	CS
21	30/05/22	22.2	22.2	22.2	22.3	22.5	22.5	22.5	22.8	50	WL
22	31/05/22	22.0	22.0	22.1	22.2	22.3	22.3	22.8	—	50	WL
23	01/06/22	22.9	22.5	22.7	22.4	22.6	22.6	22.9 <sup>2</sup>	—	5/5	SO
24	02/06/22	21.8	21.8	21.9	21.8	22.0	22.0	22.3	—	50	WL
25	03/06/22	21.9	21.8 <sup>9</sup>	21.9	21.9	22.1	22.2	22.5	—	50	WL
26	04/06/22	21.8	21.6	21.7	21.8	21.9	22.0	22.2 <sup>10</sup>	—	50	SO
27	05/06/22	21.9	21.9	22.0	22.0	22.0	22.0	22.3	—	50	SO
28	06/06/22	21.9	22.0	22.0	22.0	22.0	22.0	22.4	—	50	WL

\* meter recalibrated

22.1

22.0

22.1

20.8

22.4

22.7

22.3

22.9

EV 2022/08/15



28 - day *Sphaerium* Toxicity Test

Concentration: Control

Sample Name: PJ2122-004 clams

Sample # 1570-0012241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
	2022					
0	09/05	22.2	7.9	8.6	245	0.04
2	11/05	22.3	8.1	8.6	248	
4	13/05	22.4	8.0	8.1	239	
7	16/05	22.6	7.9	8.2	262	0.06
9	18/05	22.6	8.1	8.3	233	
11	20/05	22.0	8.1	8.3	236	
14	23/05	21.4	8.2	8.8	241	0.07
16	25/05	22.2	8.1	8.4	261	
18	27/05	22.5	8.1	8.3	241	
21	30/05	21.8/9	8.1	7.8/7	266	0.09
23	01/06	22.4	8.3 <sup>7.9</sup>	8.3	281	
25	03/06	22.1	8.0	8.9	250	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.4	7.9	8.4	272		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.0	8.2	281		4/4	13/88	5/6	5	5	5	5	WL
22.3	8.0	8.2	302	0.04	6/4	13/88	5/6	5	5	5	5	SO
22.7	8.1	8.2	269		6/4	13/88	5/6	5	5	5	5	SO
22.7	8.1	8.2	264		6/4	13/88	5/6	5	5	5	5	SO
21.9	8.2	8.8	288	0.10	5/5	13 <sup>10</sup> /89	6/7	5	5	5	5	WL
22.7	8.1	8.1	273		6/4	13/88	5/6	5	5	5	5	SO
22.9	8.1	8.2	288		6/4	13/88	5/6	5	5	5	5	SO
22.2	8.1	7.5	289	0.02	50/5/5	12/89	6/7	5	5	5	5	WL
22.9	8.0	8.4	314		5/5	12/89	6/7	5	5	5	5	SO
21.9	8.1	8.7	303		6/4/50	13/88	5/6	5	5	5	5	WL
22.4	8.0 <sup>8</sup>	7.9	303	0.03	5/5	13 <sup>12</sup> /88	6/7 <sup>5</sup>	5	5	5	5(1)	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 0.32

Sample Name: PJ2122-004 clams

Sample #: 1510-001 2241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
	2022					
0	09/05	21.3	7.5	9.5	243	0.01
2	11/05	21.3	7.4	10.6	239	
4	13/05	20.7	7.4	10.9	236	
7	16/05	22.1	7.4	10.2	257	0.01
9	18/05	22.4	7.5	10.4	232	
11	20/05	21.1	7.4	11.3	225	
14	23/05	23.0	7.5	11.7	242	0.01
16	25/05	<del>22.2</del> <sup>21.8</sup>	7.5	10.9	<del>261</del> <sup>239</sup>	
18	27/05	21.4	7.6	10.9	230	
21	30/05	20.5	7.5	10.2	228	0.0
23	01/06	21.9	7.6	10.4	248	
25	03/06	21.8	7.7	11.1	240	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.6	7.9	8.3	275		6/4	13/88	5/6	5	5	5	5	SO
22.5	7.9	8.4	278		6/4	13/88	5/6	5	5	5	5	WL
22.3	8.0	8.1	309	0.03	6/4	13/88	5/6	5	5	5	5	SO
22.5	8.1	8.3	268		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.1	8.2	264		6/4	13/88	5/6	5	5	5	5	SO
22.0	8.1	8.8	285	0.09	5/5	12/89	6/7	5	5	5	5	WL
22.3	8.0	8.2	269		6/4	13/88	5/6	5	5	5	5	SO
22.6	8.1	8.1	269		6/4	13/88	5/6	5	5	5	5	SO
22.2	8.0	<del>8.0</del> <sup>7.5</sup>	283	0.0	<del>5/5</del> <sup>5/5</sup>	12/89	6/7	5	5	5	5	WL
22.5	8.0	8.3	289		5/5	12/89	6/7	5	5	5	5	SO
21.9	8.1	8.7	278		6/4/50	13/88	5/6	5	5	5	5	WL
22.2	8.1	7.9	296	0.04	5/5	12/89	6/7	5	5	5	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaeriu* p. Toxicity Test

Concentration: 1.0

Sample Name: PJ2122-004 clams

Sample #: 1510-0012241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
0	09/05	21.0	7.5	9.7	260	0.01
2	11/05	21.2	7.3	10.8	257	
4	13/05	20.7	7.4	11.4	254	
7	16/05	21.6	7.4	10.7	274	0.00
9	18/05	21.5	7.5	10.9	246	
11	20/05	20.9	7.4	11.7	242	
14	23/05	22.9	7.5	12.1	261	0.02
16	25/05	20.6	7.5	11.2	<del>423</del> 227	
18	27/05	20.8	7.5	11.5	244	
21	30/05	20.6	7.5	10.4	246	0.0
23	01/06	21.1	7.5	10.9	260	
25	03/06	21.2	7.7	11.3	256	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.2	7.9	8.5	291		6/4	13/88	5/6	5	5	5	5	SO
22.6	7.9	8.3	292		6/4	13/88	5/6	5	5	5	5	WL
22.4	8.0	8.2	314	0.00 <sup>4</sup>	6/4	13/88	5/6	5	5	5	5	SO
22.6	8.1	8.2	279		6/4	13/88	5/6	5	5	5	5	SO
22.6	8.1	8.1	278		6/4	13/88	5/6	5	5	5	5	SO
22.3	8.1	8.7	298	0.08	5/5	12/89	6/7	5	5	5	5	WL
22.3	8.0	8.2	279		6/4	13/88	5/6	5	5	5	5	SO
22.7	7.8	8.1	282		6/4	13/88	5/6	5	5	5	5	SO
22.2	8.0	7.5	293	0.0	<del>5/5</del> 5/5	12/89	6/7	5	5	5	5	WL
22.7	7.9	8.0	299		5/5	12/89	6/7	5	5	5	5	SO
21.9	8.1	8.7	289		6/4/50	13/88	<del>5/6</del> 5/6	5	5	5	5	WL
22.2	8.0 <sup>1</sup>	8.0	306	0.03	5/5	12/89	6/7	5	5	5	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 3.2

Sample Name: PJ2122-004

Sample #: 1570-0012241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
0	09/05	20.9	7.5	9.8	329	0.00
2	11/05	20.8	7.4	10.8	323	
4	13/05	20.8	7.4	11.1	323	
7	16/05	21.4	7.5	10.5	344	0.01
9	18/05	21.7	7.5	10.7	308	
11	20/05	20.8	7.5	11.6	304	
14	23/05	23.0 <sup>4</sup> <del>20.8</del>	7.6	12.0	330	0.01
16	25/05	20.6	7.6	11.2	307	
18	27/05	20.6	7.6	11.3	308	
21	30/05	20.6	7.6	10.5	311	0.0
23	01/06	21.1	7.6	10.9	332	
25	03/06	21.0	7.7	11.3	322	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	13/81 12/89	6/7	5	5	5	5	SO
22.0	8.0	8.6	363		6/4	13/88 12/89	5/6	5	5	5	5	SO
22.3	8.0	8.3	364		6/4	13/88 12/89	5/6	5	5	5	5	WL
22.3	8.0	8.2	399	0.04	6/4	12/89 13/88	5/6	5	5	5	5	SO
22.5	8.1	8.0	351		6/4	12/89 13/88	5/6	5	5	5	5	SO
22.5	8.1	8.2	345		6/4	13/88 12/89	5/6	5	5	5	5	SO
21.9	8.1	8.8	370	0.09	5/5	12/89	6/7	5	5	5	5	WL
22.1	8.1	8.3	345		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.0	8.2	352		6/4	13/88	5/6	5	5	5	5	SO
22.3	8.1	7.6	367	0.0	5/5 5/5	12/81	6/7	5	5	5	5	WL
22.4	8.0	8.2	376		5/5	12/89	6/7	5	5	5	5	SO
21.9	8.1	8.7	365		5/4/50	13/88	5/6	5	5	5	5	WL
22.0	8.0 <sup>1</sup>	8.0	384	0.05	5/5	12/89	6/7	5	5	5	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 10

Sample Name: PJ2122-004 clams

Sample #: 1510-0012241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
0	09/05	20.7	7.6	9.8	515	0.01
2	11/05	21.3	7.5	10.5	518	
4	13/05	20.8	7.6	10.9	511	
7	15 <sup>th</sup> /05	21.4	7.5	10.5	546	0.01
9	18/05	21.3	7.6	10.5	487	
11	20/05	21.0	7.6	11.3	484	
14	23/05	23.2	7.6	11.6	524	0.01
16	26 <sup>th</sup> /05	20.6	7.7	11.1	479	
18	27/05	20.7	7.7	11.0	486	
21	30/05	21.1	7.7	9.9	497	0.0
23	01/06	21.1	7.6	10.7	522	
25	03/06	21.0	7.8	11.3 <sup>wt</sup>	510	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.4	8.0	8.4	529		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.1	8.2	552		6/4	13/88	5/6	5	5	5	5	WL
22.3	8.1	8.1	588	0.00 <sup>60</sup>	6/4	13/88	5/6	5	5	5	5	SO
22.6	8.1	7.9	529		6/4	13/88	5/6	5	5	5	5	SO
22.7	8.2	8.0	525		6/4	13/88	5/6	5	5	5	5	SO
22.3	8.2	8.7	548	0.13	5/5	12/89	6/7	5	5	5	5	WL
22.3	8.2	8.1	510		6/4	13/88	5/6	5	5	5	5	SO
22.7	8.0	8.2	530		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.1	7.4 <sup>wt</sup>	542	0.01	5/5	12/89	6/7	5	5	5	5	WL
22.6	8.1	8.1	569		5/5	12/89	6/7	5	5	5	5	SO
22.1	8.2	8.5	548		6/4/50	13/88	5/6	5	5	5	5	WL
22.2	8.2	7.9	570	0.07	5/5	12/89	6/7	5	5	5	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 32

Sample Name: PJ2122-004 clams

Sample #: 1510-0012241

Day	Date	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
	2022					
0	09/05	20.8	7.8	9.9	1100	0.00
2	11/05	21.1	7.9	10.5	1116	
4	13/05	20.7	7.8	11.0	1100	
7	16/05	21.1	7.8	10.4	1169	0.00
9	18/05	21.3	7.9	10.3	1055	
11	20/05	20.9	7.8	11.3	1046	
14	23/05	23.0	7.8	11.8	1119	0.01
16	25/05	20.6	7.9	11.3	1033	
18	27/05	20.7	8.0	11.3	1057	
21	30/05	20.5	7.9	10.3	1047	0.0
23	01/06	20.8	7.8	11.2	1131	
25	03/06	20.7	7.9	11.76	1091	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.4	8.3	8.5	1120		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.3	8.3	1182		6/4	13/88	5/6	5	5	5	5	WL
22.5	8.3	8.1	1256	0.09	6/4	13/88	5/6	5	5	5	5	SO
22.8	8.4	8.1	1122		6/4	13/88	5/6	5	5	5	5	SO
22.6	8.4	8.1	1114		6/4	13/88	5/6	5	5	5	5	SO
21.8	8.4	8.7	1151	0.15	5/5	12/89	6/7	5	5	5	5	WL
22.3	8.3	8.2	1061		6/4	13/88	5/6	5	5	5	5	SO
22.6	8.3	8.1	1125		6/4	13/88	5/6	5	5	5	5	SO
22.5	8.3	7.3	1147	0.06	5/5	12/89	6/7	5	5	5	5	WL
22.6	8.3	8.1	1223		5/5	12/89	6/7	5	5	5	5	SO
22.2	8.4	8.7	1169		6/4/50	13/88	5/6	5	5	5	5	WL
22.2	8.5	7.9	1212	0.06	5/5	12/89	6/7	5	5(1)	5	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 56

Sample Name: PJ2122-004 clams

Sample #: 1510-0012241

Day	Date 2022	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
0	09/05	20.9	8.6	9.8	1720	0.00
2	11/05	21.8	8.1	10.3	1769	
4	13/05	20.7	8.0	10.7	1725	
7	16/05	21.6	8.0	10.1	1844	0.00 <sup>15</sup>
9	18/05	21.5	8.1	10.3	1645	
11	20/05	21.1	8.0	11.2	1638	
14	23/05	23.1	8.0	11.6	1745	0.01
16	25/05	20.6	8.1	11.1	1622	
18	27/05	20.8	8.1	11.0	1652	
21	30/05	20.6	8.0	10.1	1628	0.0
23	01/06	21.1	8.0	10.6	1789	
25	03/06	21.2	8.1	11.3	1724	
28	06/06					

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.2	8.5	8.5	1777		6/4	12/88	5/6	5	5	5	5	SO
22.4	8.6	8.4	1885		6/4	13/88	5/6	5	5	5	5	WL
22.8	8.5	8.0	1980	0.12	6/4	13/88	5/6	5	5	5	5	SO
23.0	8.6	8.0	1736		6/4	13/88	5/6	5	5	5	5	SO
22.7	8.6	8.0	1717		6/4	13/88	5/6	5	5	5	5	SO
22.3	8.6	8.5	1759	0.13	5/5	12/89	6/7	5	5	5	5	WL
22.6	8.5	8.2	1636		4/4	13/88	5/6	5	5	5	5	SO
22.9	8.6	8.0	1738		4/4	13/88	5/6	5	5	5	5	SO
22.5	8.5	7.4	1760	0.04	5/5	12/89	6/7	5	5	5	5	WL
22.9	8.5	8.1	1886		5/5	12/89	6/7	5	5	5	5	SO
22.5	8.6	8.6	1818		6/4/50	13/88	5/6	5	5	5	5	WL
22.5	8.6	7.8	1888	0.05	5/5	12/89	6/7	5	5	5(1)	5	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

EV 2022/08/15



28 - day *Sphaerium* p. Toxicity Test

Concentration: 100

Sample Name: PJ2122-004 clams

Sample #: 1570-0012241

Day	Date 2022	New solutions				
		°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>
0	09/05	20.6	8.1	9.7	2680	0.01
2	11/05	21.9	8.2	10.1	2820	
4	13/05	21.1	8.2	10.9	2760	
7	16/05	21.6	8.2	10.3	2790	0.00
9	18/05	21.8	8.2	10.5	2800	
11	20/05	21.0	8.2	11.4	2760	
14	23/05	23.3	8.2	11.6	2850	0.02
16	25/05	21.1	8.3	10.4	2760	
18	27/05	20.8	8.3	10.9	2750	
21	30/05	<del>20.7</del>	<del>8.2</del>	<del>10.0</del>	<del>2680</del>	<del>0.02</del>
23						
25						
28						

Old solutions					Meter / Probe			# of Survival / Rep				Initials
°C	pH (units)	D.O. (mg/L)	Cond (µmhos)	NH <sub>3</sub>	D.O. / °C	pH	Cond	A	B	C	D	
					5/5	12/89	6/7	5	5	5	5	SO
22.5	8.7	8.5	2700		6/4	13/88	5/6	5	5	5	5	SO
22.7	8.8	8.3	2890		6/4	13/88	5/6	5	5	5	5	WL
22.9	8.8	7.9	2930	0.17	6/4	13/88	5/6	3	2	0	2	SO
23.2	8.8	8.0	2920		6/4	13/88	5/6	2	2	0	1	SO
22.6	8.8	8.0	2870		6/4	13/88	5/6	1	2	0	0	SO
22.6	8.8	8.5	2850	0.15	5/5	12/89	6/7	1	0	0	0	WL
22.8	8.7	8.2	2740		6/4	13/88	5/6	1	0	0	0	SO
22.9	8.8	8.1	2890		6/4	13/88	5/6	1	0	0	0	SO
22.8	8.7	7.5	<del>2740</del> 2700	0.00	<del>5/5</del> 5/5	12/89	6/7	0	0	0	0	WL

Note: Day 28 - Numbers in brackets (#) indicate the number of alive clams that were not burrowed in the sand (sitting on surface)

Ⓢ: did not use new solution because all clams in all reps died.

EV 2022/08/15



Initial length and dry weight of fingernail clams used in testing:

Control

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	4.3	0.73893	0.76845
2	4.1		
3	3.3		
4	3.5		
5	5.3		
Rep 2			
1	3.6	0.73580	0.76465
2	3.9		
3	4.3		
4	5.0		
5	3.5		
Rep 3			
1	4.5	0.74360	0.77310
2	4.6		
3	4.3		
4	4.5		
5	3.9		
Rep 4			
1	4.2	0.73618	0.76214
2	3.3		
3	4.2		
4	3.8		
5	4.4		

EV

2022/08/15



Initial length and dry weight of fingernail clams used in testing:

0.32%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	3.7	<del>0.7221</del> <sup>50</sup> 0.72200	0.74980
2	4.6		
3	5.5		
4	2.7		
5	4.5		
Rep 2			
1	4.0	0.72312	0.75030
2	3.9		
3	3.7		
4	4.0		
5	3.9		
Rep 3			
1	3.6	0.72592	0.75825
2	5.0		
3	4.8		
4	3.5		
5	5.0		
Rep 4			
1	2.9	0.7318 <sup>10</sup> <sub>24</sub>	0.76248
2	4.2		
3	3.7		
4	5.3		
5	5.4		

EV

2022/08/15



Initial length and dry weight of fingernail clams used in testing:

1.0%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	3.0	0.73214	0.75551
2	3.5		
3	5.2		
4	3.4		
5	4.1		
Rep 2			
1	3.9	0.73271	0.76234 <del>0.75175</del> 50
2	3.3		
3	3.3		
4	3.6		
5	4.1		
Rep 3			
1	4.3	0.73196	0.75956
2	4.8		
3	4.9		
4	3.8		
5	4.2		
Rep 4			
1	3.3	0.73501	0.76625
2	3.9		
3	4.9		
4	3.2		
5	4.9		

EV

2022/08/15



Initial length and dry weight of fingernail clams used in testing:

3.2%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	5.6	0.72106	0.74960
2	3.7		
3	3.7		
4	3.0		
5	3.4		
Rep 2			
1	5.0	0.73210	0.76275
2	4.1		
3	3.7		
4	3.6		
5	4.5		
Rep 3			
1	4.2	0.73165	0.75892
2	4.0		
3	3.1		
4	3.7		
5	3.8		
Rep 4			
1	4.9	0.71386	0.74493
2	3.9		
3	4.0		
4	3.8		
5	3.9		

EV

2022/08/15



Initial length and dry weight of fingernail clams used in testing:

10%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	3.7	0.72045	0.74556
2	3.8		
3	3.5		
4	3.5		
5	4.4		
Rep 2			
1	4.1	0.72753	0.75568
2	3.8		
3	3.8		
4	3.9		
5	3.6		
Rep 3			
1	3.7	0.72427	0.74747
2	3.4		
3	3.3		
4	3.6		
5	3.8		
Rep 4			
1	2.8	0.72412	0.755210
2	5.4		
3	4.0		
4	3.7		
5	3.9		

EV

2012/08/15



Initial length and dry weight of fingernail clams used in testing:

32%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	4.5	0.73089	0.76359
2	4.3		
3	3.9		
4	3.9		
5	3.5		
Rep 2			
1	3.9	0.74653	0.77218
2	3.8		
3	3.7		
4	3.8		
5	3.4		
Rep 3			
1	4.8	0.74934	0.78150
2	4.7		
3	4.2		
4	3.8		
5	3.2		
Rep 4			
1	4.0	0.74202	0.77170
2	4.2		
3	4.0		
4	4.8		
5	3.0		

EV

2022/08/15



# NAUTILUS

10823 27<sup>th</sup> Street SE Calgary, Alberta Canada T2Z 3V9  
Tel (403) 253-7121 Fax (403) 252-9363  
www.nautilusenvironmental.ca

Initial length and dry weight of fingernail clams used in testing: 56%

Clam number	Length (mm)	Initial pan weight (mg)	Final pan weight (mg)
Rep 1			
1	3.0	0.73726	0.76438
2	3.3		
3	4.7		
4	4.7		
5	4.7		
Rep 2			
1	4.5	0.72800	0.76002
2	4.2		
3	4.3		
4	3.6		
5	3.6		
Rep 3			
1	3.3	0.73176	0.7554 <sup>88%</sup>
2	4.2		
3	3.9		
4	3.1		
5	4.6		
Rep 4			
1	4.2	0.72570	0.7504 <sup>10%</sup> 22
2	3.4		
3	4.3		
4	4.1		
5	3.4		

EV 2022/08/15



## CETIS Analytical Report

Report Date: 30 Aug-22 13:41 (p 1 of 2)

Test Code/ID: PJ2122-004 clam / 14-3957-8334

## Fingernail clam 28-d Survival and Growth Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 16-8330-3669	<b>Endpoint:</b> 28-d Survival Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:41	<b>Analysis:</b> Binomial Method	<b>Status Level:</b> 1
<b>Edit Date:</b> 19 Aug-22 17:10	<b>MD5 Hash:</b> 71E52910FC9D1E8E1ABEF29277B6414D	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 05-8400-3480	<b>Test Type:</b> Survival-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 May-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 06 Jun-22	<b>Species:</b> Not Applicable	<b>Brine:</b>
<b>Test Length:</b> 28d 0h	<b>Taxon:</b>	<b>Source:</b> In-House Culture <b>Age:</b>
<b>Sample ID:</b> 16-0544-9269	<b>Code:</b> PJ2122-004 Clam	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 27 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 217d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Binomial/Graphical Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0	0.00%	1.874	0	74.83	56	100	1.336	1	1.786

Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
0.32		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
1		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
3.2		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
10		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
32		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
56		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
100		4	0.0000	0.0000	0.0000	0.0000		100.00%	0/20	0	100.00%

## Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
56		1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000

## Survival Rate Binomials

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	5/5	5/5	5/5	5/5
0.32		5/5	5/5	5/5	5/5
1		5/5	5/5	5/5	5/5
3.2		5/5	5/5	5/5	5/5
10		5/5	5/5	5/5	5/5
32		5/5	5/5	5/5	5/5
56		5/5	5/5	5/5	5/5
100		0/5	0/5	0/5	0/5

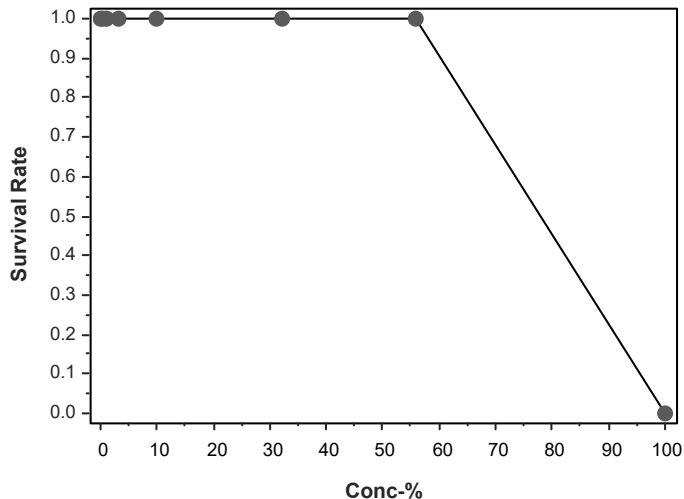


# CETIS Analytical Report

Report Date: 30 Aug-22 13:41 (p 2 of 2)  
Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	16-8330-3669	Endpoint:	28-d Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:41	Analysis:	Binomial Method	Status Level:	1
Edit Date:	19 Aug-22 17:10	MD5 Hash:	71E52910FC9D1E8E1ABEF29277B6414D	Editor ID:	003-581-756-9

## Graphics





## CETIS Analytical Report

Report Date: 30 Aug-22 13:37 (p 1 of 2)

Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
<b>Analysis ID:</b>	00-4122-5440	<b>Endpoint:</b>	28-d Survival Rate	<b>CETIS Version:</b>	CETISv2.1.0
<b>Analyzed:</b>	30 Aug-22 13:36	<b>Analysis:</b>	Linear Interpolation (ICPIN)	<b>Status Level:</b>	1
<b>Edit Date:</b>	19 Aug-22 17:10	<b>MD5 Hash:</b>	71E52910FC9D1E8E1ABEF29277B6414D	<b>Editor ID:</b>	003-581-756-9
<b>Batch ID:</b>	05-8400-3480	<b>Test Type:</b>	Survival-Growth	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	09 May-22	<b>Protocol:</b>	Not Applicable	<b>Diluent:</b>	Dechlorinated Tap Water
<b>Ending Date:</b>	06 Jun-22	<b>Species:</b>	Not Applicable	<b>Brine:</b>	
<b>Test Length:</b>	28d 0h	<b>Taxon:</b>		<b>Source:</b>	In-House Culture
<b>Sample ID:</b>	16-0544-9269	<b>Code:</b>	PJ2122-004 Clam	<b>Project:</b>	PJ2122-004
<b>Sample Date:</b>	04 Oct-21	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	30 Mar-22	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	217d 0h	<b>Client:</b>	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1164060	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	59.36	59.36	59.36	1.685	1.685	1.685
LC15	61.11	61.11	61.11	1.636	1.636	1.636
LC20	62.91	62.91	62.91	1.59	1.59	1.59
LC25	64.76	64.76	64.76	1.544	1.544	1.544
LC40	70.66	70.66	70.66	1.415	1.415	1.415
LC50	74.87	74.87	74.87	1.336	1.336	1.336

## Survival Rate Summary

Survival Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
			Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
Conc.-%	Code	Count									
0	N	4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
0.32		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
1		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
3.2		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
10		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
32		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
56		4	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
100		4	0.0000	0.0000	0.0000	0.0000		100.00%	0/20	0	100.00%

## Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	1.0000	1.0000	1.0000	1.0000
0.32		1.0000	1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000	1.0000
3.2		1.0000	1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000	1.0000
32		1.0000	1.0000	1.0000	1.0000
56		1.0000	1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000	0.0000

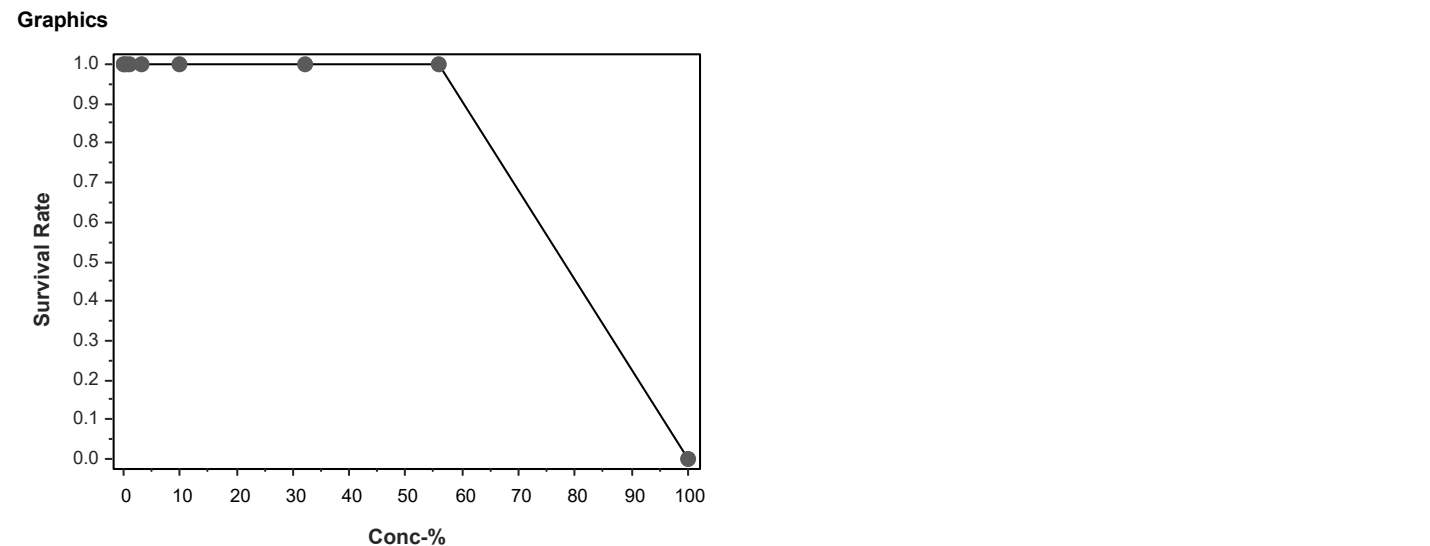


# CETIS Analytical Report

Report Date: 30 Aug-22 13:37 (p 2 of 2)  
Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	00-4122-5440	Endpoint:	Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:36	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	19 Aug-22 17:10	MD5 Hash:	71E52910FC9D1E8E1ABEF29277B6414D	Editor ID:	003-581-756-9

Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	5/5	5/5	5/5	5/5
0.32		5/5	5/5	5/5	5/5
1		5/5	5/5	5/5	5/5
3.2		5/5	5/5	5/5	5/5
10		5/5	5/5	5/5	5/5
32		5/5	5/5	5/5	5/5
56		5/5	5/5	5/5	5/5
100		0/5	0/5	0/5	0/5





# CETIS Summary Report

Report Date: 30 Aug-22 13:42 (p 1 of 1)  
 Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
Batch ID:	05-8400-3480	Test Type:	Survival-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 May-22	Protocol:	Not Applicable	Diluent:	Dechlorinated Tap Water
Ending Date:	06 Jun-22	Species:	Not Applicable	Brine:	
Test Length:	28d 0h	Taxon:		Source:	In-House Culture
Sample ID:	16-0544-9269	Code:	PJ2122-004 Clam	Project:	PJ2122-004
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	30 Mar-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	217d 0h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
16-8330-3669	Survival Rate	Binomial/Graphical		LC50	74.83	56	100	1.336	1

Survival Rate Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
0.32		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
1		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
3.2		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
10		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
32		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
56		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		0.00%
100		4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		100.00%

Survival Rate Detail						MD5: 71E52910FC9D1E8E1ABEF29277B6414D					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4						
0	N	1.0000	1.0000	1.0000	1.0000						
0.32		1.0000	1.0000	1.0000	1.0000						
1		1.0000	1.0000	1.0000	1.0000						
3.2		1.0000	1.0000	1.0000	1.0000						
10		1.0000	1.0000	1.0000	1.0000						
32		1.0000	1.0000	1.0000	1.0000						
56		1.0000	1.0000	1.0000	1.0000						
100		0.0000	0.0000	0.0000	0.0000						

Survival Rate Binomials					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	5/5	5/5	5/5	5/5
0.32		5/5	5/5	5/5	5/5
1		5/5	5/5	5/5	5/5
3.2		5/5	5/5	5/5	5/5
10		5/5	5/5	5/5	5/5
32		5/5	5/5	5/5	5/5
56		5/5	5/5	5/5	5/5
100		0/5	0/5	0/5	0/5



## CETIS Analytical Report

Report Date: 30 Aug-22 13:39 (p 1 of 2)

Test Code/ID: PJ2122-004 clam / 14-3957-8334

## Fingernail clam 28-d Survival and Growth Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 04-2540-1364	<b>Endpoint:</b> Mean Dry Weight-mg	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:38	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Edit Date:</b> 19 Aug-22 17:10	<b>MD5 Hash:</b> B82EB6CBF46D6AA5783F469C08FA98CD	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 05-8400-3480	<b>Test Type:</b> Survival-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 May-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 06 Jun-22	<b>Species:</b> Not Applicable	<b>Brine:</b>
<b>Test Length:</b> 28d 0h	<b>Taxon:</b>	<b>Source:</b> In-House Culture <b>Age:</b>
<b>Sample ID:</b> 16-0544-9269	<b>Code:</b> PJ2122-004 Clam	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 30 Mar-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 217d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	121103	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	>56	---	---	<1.786	---	---
IC15	>56	---	---	<1.786	---	---
IC20	>56	---	---	<1.786	---	---
IC25	>56	---	---	<1.786	---	---
IC40	>56	---	---	<1.786	---	---
IC50	>56	---	---	<1.786	---	---

## Mean Dry Weight-mg Summary

Mean Dry Weight-mg Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	N	4	5.692	5.835	5.192	5.904	5.95%	0.00%	5.808	0.00%
0.32		4	5.925	5.899	5.436	6.466	8.51%	-4.10%	5.808	0.00%
1		4	5.592	5.723	4.674	6.248	12.88%	1.75%	5.734	1.27%
3.2		4	5.876	5.919	5.454	6.214	6.10%	-3.25%	5.734	1.27%
10		4	5.372	5.326	4.64	6.196	12.73%	5.61%	5.691	2.02%
32		4	6.009	6.184	5.13	6.54	10.69%	-5.59%	5.691	2.02%
56		4	5.389	5.164	4.824	6.404	13.49%	5.32%	5.389	7.22%

## Mean Dry Weight-mg Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	5.904	5.77	5.9	5.192
0.32		5.56	5.436	6.466	6.238
1		4.674	5.37	6.076	6.248
3.2		5.708	6.13	5.454	6.214
10		5.022	5.63	4.64	6.196
32		6.54	5.13	6.432	5.936
56		5.424	6.404	4.824	4.904

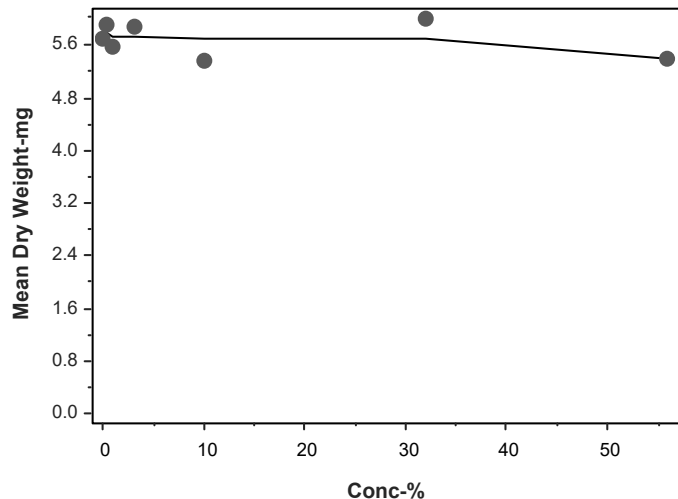


# CETIS Analytical Report

Report Date: 30 Aug-22 13:39 (p 2 of 2)  
Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test			Nautilus Environmental Calgary	
Analysis ID:	04-2540-1364	Endpoint:	Mean Dry Weight-mg	CETIS Version: CETISv2.1.0
Analyzed:	30 Aug-22 13:38	Analysis:	Linear Interpolation (ICPIN)	Status Level: 1
Edit Date:	19 Aug-22 17:10	MD5 Hash:	B82EB6CBF46D6AA5783F469C08FA98CD	Editor ID: 003-581-756-9

## Graphics





## CETIS Summary Report

Report Date: 30 Aug-22 13:43 (p 1 of 1)

Test Code/ID: PJ2122-004 clam / 14-3957-8334

## Fingernail clam 28-d Survival and Growth Test

Nautilus Environmental Calgary

Batch ID:	05-8400-3480	Test Type:	Survival-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 May-22	Protocol:	Not Applicable	Diluent:	Dechlorinated Tap Water
Ending Date:	06 Jun-22	Species:	Not Applicable	Brine:	
Test Length:	28d 0h	Taxon:		Source:	In-House Culture
				Age:	

Sample ID:	16-0544-9269	Code:	PJ2122-004 Clam	Project:	PJ2122-004
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	30 Mar-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	217d 0h	Client:	Syncrude Canada Ltd		

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
04-2540-1364	Mean Dry Weight-mg	Linear Interpolation (ICPIN)		IC10	>56	---	---	<1.786	1
			✓	IC15	>56	---	---	<1.786	
			✓	IC20	>56	---	---	<1.786	
			✓	IC25	>56	---	---	<1.786	
			✓	IC40	>56	---	---	<1.786	
			✓	IC50	>56	---	---	<1.786	

## Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	5.692	5.152	6.231	5.192	5.904	0.1694	0.3388	5.95%	0.00%
0.32		4	5.925	5.123	6.727	5.436	6.466	0.2522	0.5043	8.51%	-4.10%
1		4	5.592	4.446	6.738	4.674	6.248	0.3602	0.7203	12.88%	1.75%
3.2		4	5.876	5.306	6.447	5.454	6.214	0.1791	0.3583	6.10%	-3.25%
10		4	5.372	4.283	6.461	4.64	6.196	0.342	0.6841	12.73%	5.61%
32		4	6.009	4.987	7.032	5.13	6.54	0.3213	0.6426	10.69%	-5.59%
56		4	5.389	4.232	6.546	4.824	6.404	0.3635	0.7271	13.49%	5.32%

## Mean Dry Weight-mg Detail

MD5: B82EB6CBF46D6AA5783F469C08FA98CD

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	5.904	5.77	5.9	5.192
0.32		5.56	5.436	6.466	6.238
1		4.674	5.37	6.076	6.248
3.2		5.708	6.13	5.454	6.214
10		5.022	5.63	4.64	6.196
32		6.54	5.13	6.432	5.936
56		5.424	6.404	4.824	4.904
100		---	---	---	---



## CETIS Analytical Report

Report Date: 30 Aug-22 13:38 (p 1 of 2)

Test Code/ID: PJ2122-004 clam / 14-3957-8334

## Fingernail clam 28-d Survival and Growth Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 03-3660-5867	<b>Endpoint:</b> Mean Length-mm	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:37	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Edit Date:</b> 19 Aug-22 17:10	<b>MD5 Hash:</b> 4C722850BCD175A4B582136A66D2AFC6	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 05-8400-3480	<b>Test Type:</b> Survival-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 May-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 06 Jun-22	<b>Species:</b> Not Applicable	<b>Brine:</b>
<b>Test Length:</b> 28d 0h	<b>Taxon:</b>	<b>Source:</b> In-House Culture <b>Age:</b>
<b>Sample ID:</b> 16-0544-9269	<b>Code:</b> PJ2122-004 Clam	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 30 Mar-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 217d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1952813	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	54.93	27.17	---	1.821	---	3.681
IC15	>56	---	---	<1.786	---	---
IC20	>56	---	---	<1.786	---	---
IC25	>56	---	---	<1.786	---	---
IC40	>56	---	---	<1.786	---	---
IC50	>56	---	---	<1.786	---	---

## Mean Length-mm Summary

			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	N	4	4.15	4.1	4	4.4	4.17%	0.00%	4.15	0.00%
0.32		4	4.075	4.1	3.9	4.2	3.68%	1.81%	4.075	1.81%
1		4	3.8	3.75	3.3	4.4	13.07%	8.43%	4.012	3.31%
3.2		4	4.05	4.1	3.8	4.2	4.73%	2.41%	4.012	3.31%
10		4	3.9	3.9	3.7	4.1	4.68%	6.02%	4.012	3.31%
32		4	4.3	4.25	3.9	4.8	9.11%	-3.61%	4.012	3.31%
56		4	3.725	3.65	3.2	4.4	15.40%	10.24%	3.725	10.24%

## Mean Length-mm Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	4.1	4.1	4.4	4
0.32		4.2	3.9	4.2	4
1		3.3	3.5	4.4	4
3.2		4	4.2	3.8	4.2
10		3.8	4	3.7	4.1
32		4.4	3.9	4.8	4.1
56		3.2	4.4	3.3	4

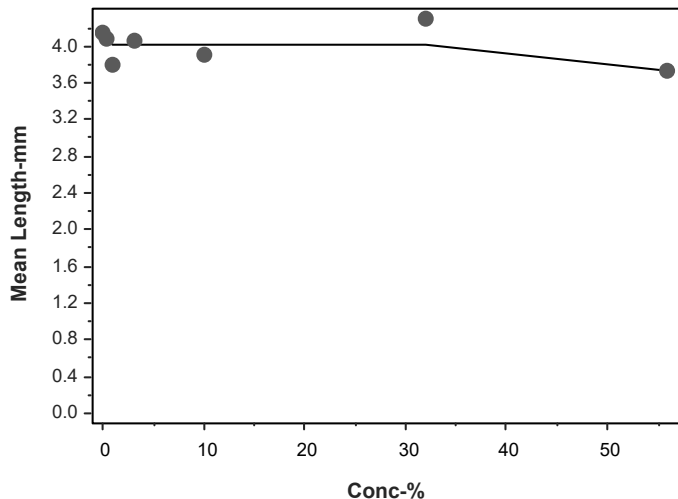


# CETIS Analytical Report

Report Date: 30 Aug-22 13:38 (p 2 of 2)  
Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
Analysis ID:	03-3660-5867	Endpoint:	Mean Length-mm	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:37	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	19 Aug-22 17:10	MD5 Hash:	4C722850BCD175A4B582136A66D2AFC6	Editor ID:	003-581-756-9

## Graphics





# CETIS Summary Report

Report Date: 30 Aug-22 13:44 (p 1 of 1)  
Test Code/ID: PJ2122-004 clam / 14-3957-8334

Fingernail clam 28-d Survival and Growth Test				Nautilus Environmental Calgary	
Batch ID:	05-8400-3480	Test Type:	Survival-Growth	Analyst:	Stephanie Schiffer
Start Date:	09 May-22	Protocol:	Not Applicable	Diluent:	Dechlorinated Tap Water
Ending Date:	06 Jun-22	Species:	Not Applicable	Brine:	
Test Length:	28d 0h	Taxon:		Source:	In-House Culture
Sample ID:	16-0544-9269	Code:	PJ2122-004 Clam	Project:	PJ2122-004
Sample Date:	04 Oct-21	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	30 Mar-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	217d 0h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
00-6579-9487	Mean Length-mm	Linear Interpolation (ICPIN)	✓	IC15	>56	---	---	<1.786	1
			✓	IC20	>56	---	---	<1.786	
			✓	IC25	>56	---	---	<1.786	
			✓	IC40	>56	---	---	<1.786	
			✓	IC50	>56	---	---	<1.786	

Mean Length-mm Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	4.15	3.874	4.426	4	4.4	0.0866	0.1732	4.17%	0.00%
0.32		4	4.075	3.836	4.314	3.9	4.2	0.075	0.15	3.68%	1.81%
1		4	3.8	3.01	4.59	3.3	4.4	0.2483	0.4967	13.07%	8.43%
3.2		4	4.05	3.745	4.355	3.8	4.2	0.09574	0.1915	4.73%	2.41%
10		4	3.9	3.609	4.191	3.7	4.1	0.09129	0.1826	4.68%	6.02%
32		4	4.3	3.677	4.923	3.9	4.8	0.1958	0.3916	9.11%	-3.61%
56		4	3.725	2.812	4.638	3.2	4.4	0.2869	0.5737	15.40%	10.24%

Mean Length-mm Detail						MD5: 52F8503327235F067EB550602EA5A2BF					
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4						
0	N	4.1	4.1	4.4	4						
0.32		4.2	3.9	4.2	4						
1		3.3	3.5	4.4	4						
3.2		4	4.2	3.8	4.2						
10		3.8	4	3.7	4.1						
32		4.4	3.9	4.8	4.1						
56		3.2	4.4	3.3	4						
100		---	---	---	---						



## **APPENDIX I – Mussel (*Lampsilis siliquoidea*) Toxicity Test Data**



Extraction location  
picked at 1000, finished at 1024

Individual viability

Mussel No.	Glochidia closed before NaCl	Glochidia closed after NaCl
1	3	207
2	2	238
3	1	118

Pooled viability (Initial - CCIW)

Viability count	Glochidia closed before NaCl	Glochidia closed after NaCl
1	2	104
2	1	144
3	1	199

EV 2022/08/31



Glochidia open after NaCl	% viability	Average Viability
4	97	98
0	99	
1	98	

Glochidia open after NaCl	% viability	Average Viability
1	97	98
2	98	
2	99	

EV

2022/08/31



## Initial Parameters

Concentration	Temperature	pH	D.O	conductivity	Chloride
Control	21.5	7.6	9.3	407	1134
0.32	21	7.6	9.4	306	1140
1	21.3	7.6	9.1	326	1139
3.2	21.1	7.7	9.1	391	1138
10	21	7.9	9.2	590	1138
32	20.3	8.2	9.7	1204	1143
56	19.8	8.4	10.1	1868	1149
100	19.5	8.5	11.3	3049	1148

## Final Parameters

Concentration	Temperature	pH	D.O	conductivity	Chloride (mg/L)
Control	20.1	8.2	9.6	463	11.64
0.32	19.6	8.2	9.8	473	11.56
1	19.7	8.3	9.8	493	12.73
3.2	19.8	8.2	9.8	576	21.83
10	19.9	8.3	9.8	847	49.56
32	20.3	8.7	9.8	1811	142.1
56	20.2	8.8	9.7	2725	236.6
100	20.4	9	9.7	4392	405.5

EV

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Ammonia	Date
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22
<0.25	16.08.22

Ammonia	Date
<0.25	19.08.22
<0.25	18.08.22
<0.25	18.08.22
<0.25	18.08.22
<0.25	18.08.22
<0.25	18.08.22
<0.25	18.08.22
<0.25	18.08.22

EV 2022/08/31



24 hr

Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
Control A	1	132	3	135	97.0	97.0
Control B	4	169	1	170	97.1	
Control C	1	173	4	177	97.2	
Control D	1	158	4	162	96.9	
Control E	0	147	5	152	96.7	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
0.32 A	2	221	6	227	96.5	94.9
0.32 B	4	162	3	165	95.8	
0.32 C	2	150	10	160	92.5	
0.32 D	2	149	6	155	94.8	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
1 A	2	225	8	233	95.7	95.9
1 B	0	144	3	147	98.0	
1 C	4	142	5	147	93.9	
1 D	3	206	5	211	96.2	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
3.2 A	7	209	3	212	95.3	96.7
3.2 B	3	182	3	185	96.8	
3.2 C	3	165	4	169	95.9	
3.2 D	1	248	2	250	98.8	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
10 A	3	186	9	195	93.8	93.4
10 B	5	240	8	248	94.8	
10 C	5	182	4	186	95.2	
10 D	13	154	3	157	89.8	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
32 A	18	186	8	194	86.6	87.9
32 B	19	153	2	155	86.5	
32 C	24	220	5	225	87.1	
32 D	10	138	2	140	91.4	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
56 A	48	177	6	183	70.5	65.0
56 B	41	135	4	139	67.6	
56 C	50	154	3	157	66.2	
56 D	74	169	2	171	55.6	
Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
100 A	173	222	2	224	21.9	27.8
100 B	127	207	11	218	36.7	
100 C	140	208	9	217	31.3	
100 D	87	111	2	113	21.2	

EV

2022/08/31



48 hr

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
Control A	3	151	1	152	97.4	95.0
Control B	1	173	5	178	96.6	
Control C	3	162	10	172	92.4	
Control D	4	126	6	132	92.4	
Control E	4	204	4	208	96.2	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
0.32 A	2	192	3	195	97.4	95.4
0.32 B	8	200	6	206	93.2	
0.32 C	8	217	4	221	94.6	
0.32 D	1	168	5	173	96.5	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
1 A	8	249	11	260	92.7	93.6
1 B	3	156	4	160	95.6	
1 C	4	141	8	149	91.9	
1 D	3	129	5	134	94.0	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
3.2 A	4	235	10	245	94.3	95.3
3.2 B	4	172	2	174	96.6	
3.2 C	3	132	4	136	94.9	
3.2 D	2	186	7	193	95.3	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
10 A	8	158	2	160	93.8	93.1
10 B	4	210	7	217	94.9	
10 C	9	135	2	137	92.0	
10 D	8	203	10	213	91.5	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
32 A	23	262	14	276	86.6	77.8
32 B	49	236	21	257	72.8	
32 C	74	241	8	249	67.1	
32 D	24	255	17	272	84.9	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
56 A	70	209	13	222	62.6	51.7
56 B	85	161	10	171	44.4	
56 C	121	199	17	216	36.1	
56 D	60	179	8	187	63.6	

Concentration /	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
100 A	234	257	5	262	8.8	13.4
100 B	156	188	5	193	16.6	
100 C	186	228	16	244	17.2	
100 D	129	146	6	152	11.2	

EV

2022/08/31



Concentration / Rep	Glochidia closed before NaCl	Glochidia closed after NaCl	Glochidia open after NaCl	Total glochidia	% viability	Average Viability
Control A	5	146	10	156	90.4	90.9
Control B	9	147	7	154	89.6	
Control C	9	102	5	107	86.9	
Control D	3	149	5	154	94.8	
Control E	9	166	3	169	92.9	

EV 2022/08/31



# CETIS Analytical Report

Report Date: 01 Sep-22 09:31 (p 1 of 2)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 10-9769-5158	<b>Endpoint:</b> 24h Viability Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 01 Sep-22 9:30	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Edit Date:</b>	<b>MD5 Hash:</b> 9DBEA5AEF11B358E56129B9FE1910D72	<b>Editor ID:</b>
<b>Batch ID:</b> 01-4192-9921	<b>Test Type:</b> Viability (48h)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 16 Aug-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 18 Aug-22	<b>Species:</b> L. siliquioidea	<b>Brine:</b>
<b>Test Length:</b> 48h	<b>Taxon:</b>	<b>Source:</b> Field Collected <b>Age:</b>
<b>Sample ID:</b> 18-2876-2434	<b>Code:</b> PJ2122-004 Mussel	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21 10:26	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 27 Apr-22 10:26	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 315d 14h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0.03015	29.52%	1.862	0.01591	72.71	67.58	78.24	1.375	1.278	1.48

## 24h Viability Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.9698	0.9704	0.9671	0.9718	0.18%	0.00%	772/796	0.9698	0.00%
0.32		4	0.9489	0.9530	0.9250	0.9648	1.82%	2.15%	672/707	0.9584	1.18%
1		4	0.9594	0.9596	0.9388	0.9796	1.75%	1.07%	708/738	0.9584	1.18%
3.2		4	0.9667	0.9631	0.9528	0.9880	1.59%	0.31%	790/816	0.9584	1.18%
10		4	0.9339	0.9430	0.8981	0.9516	2.63%	3.70%	736/786	0.9339	3.70%
32		4	0.8790	0.8685	0.8645	0.9143	2.70%	9.36%	626/714	0.8790	9.36%
56		4	0.6498	0.6693	0.5556	0.7049	10.04%	33.00%	422/650	0.6498	33.00%
100		4	0.2779	0.2661	0.2124	0.3670	27.08%	71.35%	221/772	0.2779	71.35%

## 24h Viability Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9704	0.9706	0.9718	0.9691	0.9671
0.32		0.9648	0.9576	0.9250	0.9484	
1		0.9571	0.9796	0.9388	0.9621	
3.2		0.9528	0.9676	0.9586	0.9880	
10		0.9385	0.9476	0.9516	0.8981	
32		0.8660	0.8645	0.8711	0.9143	
56		0.7049	0.6763	0.6624	0.5556	
100		0.2188	0.3670	0.3134	0.2124	

## 24h Viability Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	131/135	165/170	172/177	157/162	147/152
0.32		219/227	158/165	148/160	147/155	
1		223/233	144/147	138/147	203/211	
3.2		202/212	179/185	162/169	247/250	
10		183/195	235/248	177/186	141/157	
32		168/194	134/155	196/225	128/140	
56		129/183	94/139	104/157	95/171	
100		49/224	80/218	68/217	24/113	



# CETIS Analytical Report

Report Date: 01 Sep-22 09:31 (p 2 of 2)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

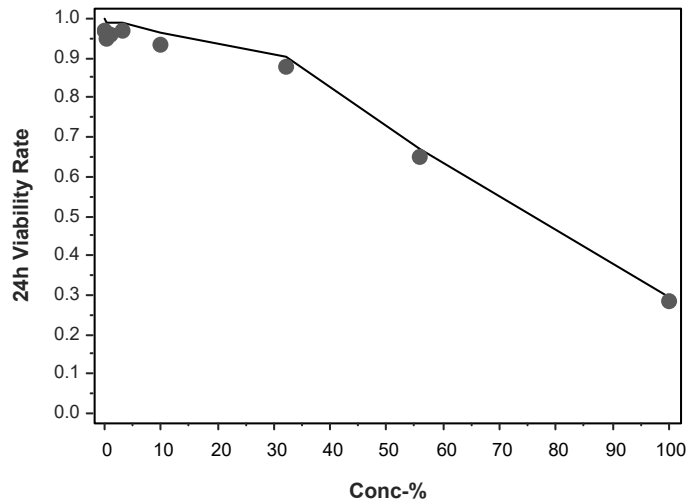
## Glochidia 48-h Acute Viability Test

Nautilus Environmental Calgary

Analysis ID: 10-9769-5158  
Analyzed: 01 Sep-22 9:30  
Edit Date:  
Endpoint: 24h Viability Rate  
Analysis: Trimmed Spearman-Kärber  
MD5 Hash: 9DBEA5AEF11B358E56129B9FE1910D72

CETIS Version: CETISv2.1.0  
Status Level: 1  
Editor ID:

### Graphics





## CETIS Analytical Report

Report Date: 01 Sep-22 09:32 (p 1 of 2)  
 Test Code/ID: PJ2122-004 MU / 00-4190-5137

Glochidia 48-h Acute Viability Test				Nautilus Environmental Calgary			
Analysis ID:	20-3895-8855	Endpoint:	24h Viability Rate	CETIS Version:	CETISv2.1.0		
Analyzed:	01 Sep-22 9:31	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1		
Edit Date:		MD5 Hash:	9DBEA5AEF11B358E56129B9FE1910D72	Editor ID:			
Batch ID:	01-4192-9921	Test Type:	Viability (48h)	Analyst:	Stephanie Schiffer		
Start Date:	16 Aug-22	Protocol:	Not Applicable	Diluent:	Dechlorinated Tap Water		
Ending Date:	18 Aug-22	Species:	L. siliquioidea	Brine:			
Test Length:	48h	Taxon:		Source:	Field Collected	Age:	
Sample ID:	18-2876-2434	Code:	PJ2122-004 Mussel	Project:	PJ2122-004		
Sample Date:	04 Oct-21 10:26	Material:	Ambient Sample	Source:	Syncrude Canada Ltd		
Receipt Date:	27 Apr-22 10:26	CAS (PC):		Station:	Treated OSPW		
Sample Age:	315d 14h	Client:	Syncrude Canada Ltd				

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1824157	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	32.31	25.53	35.23	3.095	2.839	3.917
LC15	36.42	34.48	39.61	2.745	2.525	2.9
LC20	41.05	37.45	45.56	2.436	2.195	2.671
LC25	46.24	40.48	52.89	2.162	1.891	2.471
LC40	62.38	52.06	68.27	1.603	1.465	1.921
LC50	72.85	65.16	80.75	1.373	1.238	1.535

## 24h Viability Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.9698	0.9704	0.9671	0.9718	0.18%	0.00%	772/796	0.9698	0.00%
0.32		4	0.9489	0.9530	0.9250	0.9648	1.82%	2.15%	672/707	0.9584	1.18%
1		4	0.9594	0.9596	0.9388	0.9796	1.75%	1.07%	708/738	0.9584	1.18%
3.2		4	0.9667	0.9631	0.9528	0.9880	1.59%	0.31%	790/816	0.9584	1.18%
10		4	0.9339	0.9430	0.8981	0.9516	2.63%	3.70%	736/786	0.9339	3.70%
32		4	0.8790	0.8685	0.8645	0.9143	2.70%	9.36%	626/714	0.8790	9.36%
56		4	0.6498	0.6693	0.5556	0.7049	10.04%	33.00%	422/650	0.6498	33.00%
100		4	0.2779	0.2661	0.2124	0.3670	27.08%	71.35%	221/772	0.2779	71.35%

## 24h Viability Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9704	0.9706	0.9718	0.9691	0.9671
0.32		0.9648	0.9576	0.9250	0.9484	
1		0.9571	0.9796	0.9388	0.9621	
3.2		0.9528	0.9676	0.9586	0.9880	
10		0.9385	0.9476	0.9516	0.8981	
32		0.8660	0.8645	0.8711	0.9143	
56		0.7049	0.6763	0.6624	0.5556	
100		0.2188	0.3670	0.3134	0.2124	



# CETIS Analytical Report

Report Date: 01 Sep-22 09:32 (p 2 of 2)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

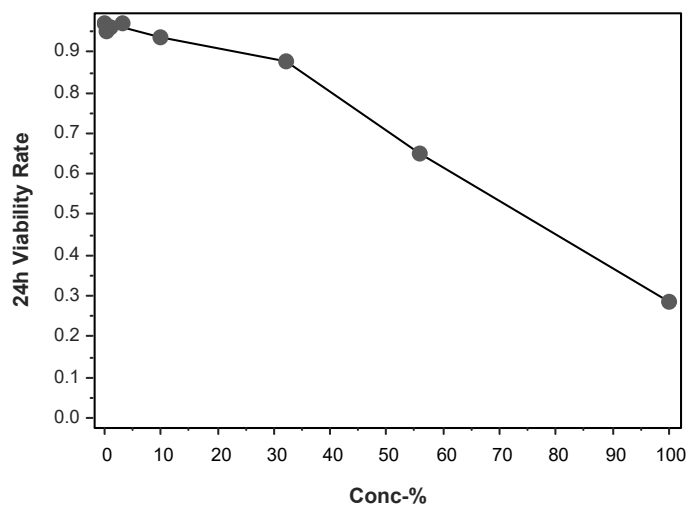
Nautilus Environmental Calgary

Analysis ID: 20-3895-8855 Endpoint: 24h Viability Rate CETIS Version: CETISv2.1.0  
Analyzed: 01 Sep-22 9:31 Analysis: Linear Interpolation (ICPIN) Status Level: 1  
Edit Date: MD5 Hash: 9DBEA5AEF11B358E56129B9FE1910D72 Editor ID:

### 24h Viability Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	131/135	165/170	172/177	157/162	147/152
0.32		219/227	158/165	148/160	147/155	
1		223/233	144/147	138/147	203/211	
3.2		202/212	179/185	162/169	247/250	
10		183/195	235/248	177/186	141/157	
32		168/194	134/155	196/225	128/140	
56		129/183	94/139	104/157	95/171	
100		49/224	80/218	68/217	24/113	

### Graphics





## CETIS Summary Report

Report Date: 01 Sep-22 17:40 (p 1 of 1)

Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

## Nautilus Environmental Calgary

<b>Batch ID:</b> 01-4192-9921	<b>Test Type:</b> Viability (48h)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 16 Aug-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 18 Aug-22	<b>Species:</b> L. siliquioidea	<b>Brine:</b>
<b>Test Length:</b> 48h	<b>Taxon:</b>	<b>Source:</b> Field Collected <b>Age:</b>
<b>Sample ID:</b> 18-2876-2434	<b>Code:</b> PJ2122-004 Mussel	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21 10:26	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 27 Apr-22 10:26	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 315d 14h	<b>Client:</b> Syncrude Canada Ltd	

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
20-3895-8855	24h Viability Rate	Linear Interpolation (ICPIN)		LC10	32.31	25.53	35.23	3.095	1
				LC15	36.42	34.48	39.61	2.745	
				LC20	41.05	37.45	45.56	2.436	
				LC25	46.24	40.48	52.89	2.162	
				LC40	62.38	52.06	68.27	1.603	
				LC50	72.85	65.16	80.75	1.373	

## 24h Viability Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9698	0.9676	0.9720	0.9671	0.9718	0.0008	0.0018	0.18%	0.00%
0.32		4	0.9489	0.9214	0.9765	0.9250	0.9648	0.0087	0.0173	1.82%	2.15%
1		4	0.9594	0.9327	0.9861	0.9388	0.9796	0.0084	0.0168	1.75%	1.07%
3.2		4	0.9667	0.9422	0.9913	0.9528	0.9880	0.0077	0.0154	1.59%	0.31%
10		4	0.9339	0.8949	0.9730	0.8981	0.9516	0.0123	0.0245	2.63%	3.70%
32		4	0.8790	0.8412	0.9167	0.8645	0.9143	0.0119	0.0237	2.70%	9.36%
56		4	0.6498	0.5459	0.7536	0.5556	0.7049	0.0326	0.0653	10.04%	33.00%
100		4	0.2779	0.1581	0.3976	0.2124	0.3670	0.0376	0.0752	27.08%	71.35%

## 24h Viability Rate Detail

MD5: 9DBEA5AEF11B358E56129B9FE1910D72

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9704	0.9706	0.9718	0.9691	0.9671
0.32		0.9648	0.9576	0.9250	0.9484	
1		0.9571	0.9796	0.9388	0.9621	
3.2		0.9528	0.9676	0.9586	0.9880	
10		0.9385	0.9476	0.9516	0.8981	
32		0.8660	0.8645	0.8711	0.9143	
56		0.7049	0.6763	0.6624	0.5556	
100		0.2188	0.3670	0.3134	0.2124	

## 24h Viability Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	131/135	165/170	172/177	157/162	147/152
0.32		219/227	158/165	148/160	147/155	
1		223/233	144/147	138/147	203/211	
3.2		202/212	179/185	162/169	247/250	
10		183/195	235/248	177/186	141/157	
32		168/194	134/155	196/225	128/140	
56		129/183	94/139	104/157	95/171	
100		49/224	80/218	68/217	24/113	



## CETIS Analytical Report

Report Date: 30 Aug-22 13:49 (p 1 of 2)

Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 00-7838-0391	<b>Endpoint:</b> 48h Viability Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:48	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Edit Date:</b>	<b>MD5 Hash:</b> AB92C38D7F377A2C68F181FDDCE28849	<b>Editor ID:</b>
<b>Batch ID:</b> 01-4192-9921	<b>Test Type:</b> Viability (48h)	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 09 Aug-22	<b>Protocol:</b> Not Applicable	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 11 Aug-22	<b>Species:</b> L. siliquioidea	<b>Brine:</b>
<b>Test Length:</b> 48h	<b>Taxon:</b>	<b>Source:</b> Field Collected <b>Age:</b>
<b>Sample ID:</b> 18-2876-2434	<b>Code:</b> PJ2122-004 Mussel	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 04 Oct-21 10:26	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 27 Apr-22 10:26	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 308d 14h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0.04869	14.07%	1.756	0.007458	56.95	55.03	58.94	1.756	1.697	1.817

## 48h Viability Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.9500	0.9615	0.9242	0.9737	2.51%	0.00%	801/842	0.9522	0.00%
0.32		4	0.9544	0.9555	0.9320	0.9744	2.00%	-0.45%	758/795	0.9522	0.00%
1		4	0.9357	0.9336	0.9195	0.9563	1.73%	1.51%	657/703	0.9442	0.84%
3.2		4	0.9526	0.9509	0.9429	0.9655	1.01%	-0.27%	712/748	0.9442	0.84%
10		4	0.9305	0.9286	0.9155	0.9493	1.69%	2.06%	677/727	0.9305	2.28%
32		4	0.7784	0.7884	0.6707	0.8659	12.16%	18.07%	824/1054	0.7784	18.25%
56		4	0.5170	0.5353	0.3611	0.6364	26.36%	45.58%	412/796	0.5170	45.70%
100		4	0.1344	0.1388	0.0878	0.1721	30.65%	85.85%	114/851	0.1344	85.89%

## 48h Viability Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9737	0.9663	0.9244	0.9242	0.9615
0.32		0.9744	0.9320	0.9457	0.9653	
1		0.9269	0.9563	0.9195	0.9403	
3.2		0.9429	0.9655	0.9485	0.9534	
10		0.9375	0.9493	0.9197	0.9155	
32		0.8659	0.7276	0.6707	0.8493	
56		0.6261	0.4444	0.3611	0.6364	
100		0.0878	0.1658	0.1721	0.1118	

## 48h Viability Rate Binomials

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	148/152	172/178	159/172	122/132	200/208
0.32		190/195	192/206	209/221	167/173	
1		241/260	153/160	137/149	126/134	
3.2		231/245	168/174	129/136	184/193	
10		150/160	206/217	126/137	195/213	
32		239/276	187/257	167/249	231/272	
56		139/222	76/171	78/216	119/187	
100		23/262	32/193	42/244	17/152	



# CETIS Analytical Report

Report Date: 30 Aug-22 13:49 (p 2 of 2)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

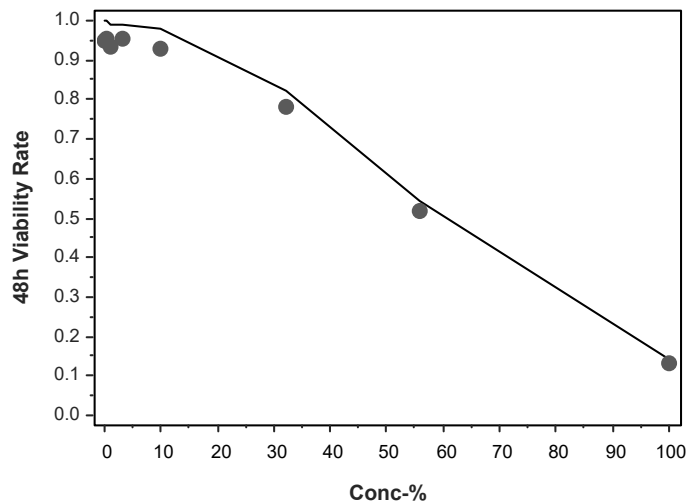
Nautilus Environmental Calgary

Analysis ID: 00-7838-0391  
Analyzed: 30 Aug-22 13:48  
Edit Date:

Endpoint: 48h Viability Rate  
Analysis: Trimmed Spearman-Kärber  
MD5 Hash: AB92C38D7F377A2C68F181FDDCE28849

CETIS Version: CETISv2.1.0  
Status Level: 1  
Editor ID:

### Graphics





## CETIS Analytical Report

Report Date: 30 Aug-22 13:48 (p 1 of 2)  
 Test Code/ID: PJ2122-004 MU / 00-4190-5137

Glochidia 48-h Acute Viability Test				Nautilus Environmental Calgary			
Analysis ID: 04-2692-3097		Endpoint: 48h Viability Rate		CETIS Version: CETISv2.1.0			
Analyzed: 30 Aug-22 13:47		Analysis: Linear Interpolation (ICPIN)		Status Level: 1			
Edit Date:		MD5 Hash: AB92C38D7F377A2C68F181FDDCE28849		Editor ID:			
Batch ID: 01-4192-9921		Test Type: Viability (48h)		Analyst: Stephanie Schiffer			
Start Date: 09 Aug-22		Protocol: Not Applicable		Diluent: Dechlorinated Tap Water			
Ending Date: 11 Aug-22		Species: Not Applicable		Brine:			
Test Length: 48h		Taxon:		Source: Field Collected		Age:	
Sample ID: 18-2876-2434		Code: PJ2122-004 Muss		Project: PJ2122-004			
Sample Date: 04 Oct-21 10:26		Material: Ambient Sample		Source: Syncrude Canada Ltd			
Receipt Date: 27 Apr-22 10:26		CAS (PC):		Station: Treated OSPW			
Sample Age: 308d 14h		Client: Syncrude Canada Ltd					

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1830861	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	17.96	11.87	38.69	5.567	2.585	8.421
LC15	25.91	13.87	39.69	3.859	2.52	7.207
LC20	33.39	17.16	40.33	2.995	2.48	5.826
LC25	36.95	24.75	45.55	2.707	2.195	4.04
LC40	49.99	37.75	66.27	2	1.509	2.649
LC50	59.63	43.06	71.9	1.677	1.391	2.323

## 48h Viability Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.9500	0.9615	0.9242	0.9737	2.51%	0.00%	801/842	0.9522	0.00%
0.32		4	0.9544	0.9555	0.9320	0.9744	2.00%	-0.45%	758/795	0.9522	0.00%
1		4	0.9357	0.9336	0.9195	0.9563	1.73%	1.51%	657/703	0.9442	0.84%
3.2		4	0.9526	0.9509	0.9429	0.9655	1.01%	-0.27%	712/748	0.9442	0.84%
10		4	0.9305	0.9286	0.9155	0.9493	1.69%	2.06%	677/727	0.9305	2.28%
32		4	0.7784	0.7884	0.6707	0.8659	12.16%	18.07%	824/1054	0.7784	18.25%
56		4	0.5170	0.5353	0.3611	0.6364	26.36%	45.58%	412/796	0.5170	45.70%
100		4	0.1344	0.1388	0.0878	0.1721	30.65%	85.85%	114/851	0.1344	85.89%

## 48h Viability Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.9737	0.9663	0.9244	0.9242	0.9615
0.32		0.9744	0.9320	0.9457	0.9653	
1		0.9269	0.9563	0.9195	0.9403	
3.2		0.9429	0.9655	0.9485	0.9534	
10		0.9375	0.9493	0.9197	0.9155	
32		0.8659	0.7276	0.6707	0.8493	
56		0.6261	0.4444	0.3611	0.6364	
100		0.0878	0.1658	0.1721	0.1118	



# CETIS Analytical Report

Report Date: 30 Aug-22 13:48 (p 2 of 2)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

## Glochidia 48-h Acute Viability Test

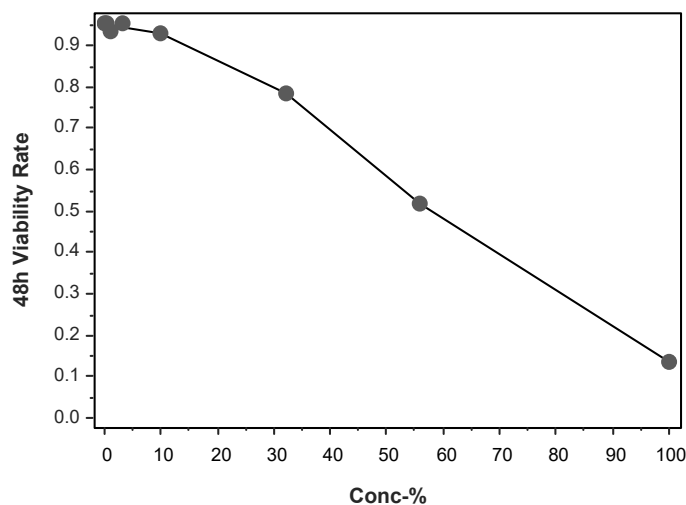
Nautilus Environmental Calgary

Analysis ID: 04-2692-3097 Endpoint: 48h Viability Rate CETIS Version: CETISv2.1.0  
Analyzed: 30 Aug-22 13:47 Analysis: Linear Interpolation Status Level: 1  
Edit Date: MD5 Hash: AB92C38D7F377A2C68F181FDDCE28849 Editor ID:

### 48h Viability Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	148/152	172/178	159/172	122/132	200/208
0.32		190/195	192/206	209/221	167/173	
1		241/260	153/160	137/149	126/134	
3.2		231/245	168/174	129/136	184/193	
10		150/160	206/217	126/137	195/213	
32		239/276	187/257	167/249	231/272	
56		139/222	76/171	78/216	119/187	
100		23/262	32/193	42/244	17/152	

### Graphics





# CETIS Summary Report

Report Date: 30 Aug-22 13:50 (p 1 of 1)  
Test Code/ID: PJ2122-004 MU / 00-4190-5137

Glochidia 48-h Acute Viability Test				Nautilus Environmental Calgary		
Batch ID:	01-4192-9921	Test Type:	Viability (48h)	Analyst:	Stephanie Schiffer	
Start Date:	16 Aug-22	Protocol:	Not Applicable	Diluent:	Dechlorinated Tap Water	
Ending Date:	18 Aug-22	Species:	L. siliquiodae	Brine:		
Test Length:	48h	Taxon:		Source:	Field Collected	Age:
Sample ID:	18-2876-2434	Code:	PJ2122-004 Mussel	Project:	PJ2122-004	
Sample Date:	04 Oct-21 10:26	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	27 Apr-22 10:26	CAS (PC):		Station:	Treated OSPW	
Sample Age:	308d 14h	Client:	Syncrude Canada Ltd			

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
00-7838-0391	48h Viability Rate	Trimmed Spearman-Kärber		LC50	56.95	55.03	58.94	1.756	1

48h Viability Rate Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9500	0.9204	0.9797	0.9242	0.9737	0.0107	0.0239	2.51%	0.00%
0.32		4	0.9544	0.9240	0.9847	0.9320	0.9744	0.0095	0.0191	2.00%	-0.45%
1		4	0.9357	0.9100	0.9615	0.9195	0.9563	0.0081	0.0162	1.73%	1.51%
3.2		4	0.9526	0.9372	0.9679	0.9429	0.9655	0.0048	0.0096	1.01%	-0.27%
10		4	0.9305	0.9054	0.9556	0.9155	0.9493	0.0079	0.0158	1.69%	2.06%
32		4	0.7784	0.6278	0.9290	0.6707	0.8659	0.0473	0.0946	12.16%	18.07%
56		4	0.5170	0.3001	0.7339	0.3611	0.6364	0.0681	0.1363	26.36%	45.58%
100		4	0.1344	0.0688	0.1999	0.0878	0.1721	0.0206	0.0412	30.65%	85.85%

48h Viability Rate Detail							MD5: AB92C38D7F377A2C68F181FDDCE28849				
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.9737	0.9663	0.9244	0.9242	0.9615					
0.32		0.9744	0.9320	0.9457	0.9653						
1		0.9269	0.9563	0.9195	0.9403						
3.2		0.9429	0.9655	0.9485	0.9534						
10		0.9375	0.9493	0.9197	0.9155						
32		0.8659	0.7276	0.6707	0.8493						
56		0.6261	0.4444	0.3611	0.6364						
100		0.0878	0.1658	0.1721	0.1118						

48h Viability Rate Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	148/152	172/178	159/172	122/132	200/208
0.32		190/195	192/206	209/221	167/173	
1		241/260	153/160	137/149	126/134	
3.2		231/245	168/174	129/136	184/193	
10		150/160	206/217	126/137	195/213	
32		239/276	187/257	167/249	231/272	
56		139/222	76/171	78/216	119/187	
100		23/262	32/193	42/244	17/152	



## **APPENDIX J – Walleye (*Sander vitreus*) Toxicity Test Data**



# Walleye ELS 30-d Bench Sheet

Method: 30-d WA ELS Client: SYN100 Sample: PJ2122-004  
Test Log

Date	Day	Time	Technicians	Comments	Bench Sheet Review
2022/05/06	0	15:00	SS/KLM/EV	3 8°C, 80% rep	KLM
2022/05/07	1	11:25	KLM/EV	CC #2, used 3 pH	MAP
2022/05/08	2	1430	SS/KCRM	3	EV
2022/05/09	3	11:00	SS/KCRM	3	EV
2022/05/10	4	1300	KLM/EV	3, 50% rep.	EV
2022/05/11	5	1030	KLM/SS/SH	3, used DO cc 2	EV
2022/05/12	6	1230	KLM	3 12:10 PM 46 CC3 KLM	EV
2022/05/13	7	1030	KLM/SS	CC3	EV
2022/05/14	8	1230	KLM	CC3	MAP
2022/05/15	9	1430	KLM/	CC3	EV
2022/05/16	10	12:00	KCRM/SS	CC3 7 KMP 12°C	-
2022/05/17	11	1300	KCRM/KLM	CC2	-
2022/05/18	12	1330	KLM/KCRM	CC2	-
2022/05/19	13	1030	KLM/KCRM	CC2	SS
2022/05/20	14	1130	KLM	CC3	EV
2022/05/21	15	1230	KLM	CC2	EV
2022/05/22	16	1330	KCRM	CC3	-
2022/05/23	17	1530	KCRM	CC3	SS
2022/05/24	18	1530	EV/KCRM	CC3	SS
2022/05/25	19	0930	KLM	CC3	EV
2022/05/26	20	1230	KLM	CC3	EV
2022/05/27	21	1000	SS/KLM	CC3	EV
2022/05/28	22	0930	KLM/EV	CC3	-
2022/05/29	23	1330	SS/KCRM	CC3	-
2022/05/30	24	1100	SS/KCRM	CC2	-
2022/05/31	25	1400	EV/KLM	CC3	SS
2022/06/01	26	1400	KLM/KCRM	CC2	SS
2022/06/02	27	1140	KLM/EV	CC3	SS
2022/06/03	28	1130	KLM/EV	CC3	SS
2022/06/04	29	1230	KLM	CC2	SS
2022/06/05	30	1500	SS/KCRM	CC3	-

→ 2022/05/12 1030  
KLM/EV - temp ↑ to 10°C

→ Hatch jar pH 7.8 EC 439 DO 19.6

→ Hatch jar ammonia 0.15

Batch #: 20220505WA

Weekly Ammonia Readings:

Day	Lab Ctl	0.32%	1.0%	3.2%	10%	32%	56%	100%

Reviewed by:

EV

Date: 2022/08/31



## Walleye ELS 30-d Bench Sheet

Method: 30-d WA ELS

Client: SYN100

Sample: PJ2122-004

## Chemistry

## New Solutions

Conc (%) day	Lab ctl	0.32	1.0	3.2	10	32	56	100
pH (units)								
0	8.3	8.3	8.3	8.3	8.3	8.3	8.4	8.4
1	8.0	8.1	8.1	8.2	8.2	8.3	8.3	8.4
2	8.2	8.1	8.1	8.1	8.1	8.2	8.2	8.3
3	8.0	8.1	8.0	8.0	8.1	8.2	8.2	8.3
4	8.0	8.0	8.0	8.0	8.1	8.2	8.2	8.3
5	7.8	8.0	8.0	8.0	8.1	8.1	8.2	8.3
6	8.0	8.0	8.0	8.0	8.1	8.1	8.2	8.3
7	8.0	8.0	8.0	8.0	8.1	8.2	8.3	8.3
8	8.1	8.1	8.1	8.1	8.2	8.3	8.3	8.3
9	8.2	8.2	8.2	8.2	8.3	8.3	8.3	8.3
10	8.0	7.9	7.9	7.9	8.0	8.1	8.2	8.3

## Conductivity (µS/cm)

0	475	483	517	559	729	1317	1955	3160
1	448	453	473	528	709	1243	1889	3040
2	539	477	507	577	719	1264	1934	3140
3	389	401	420	470	600	1084	1627	2660
4	418	408	420	470	595	1055	1611	2640
5	398	407	421	462	626	1076	1613	2640
6	409	409	421	472	607	1105	1632	2600
7	402	400	425	474	618	1076	1614	2630
8	461	410	424	469	616	1090	1621	2610
9	408	412	426	469	630	1115	1632	2640
10	416	422	430	482	626	1110	1644	2640

## Dissolved oxygen (mg/L)

0	10.1	10.2	10.2	10.2	10.2	10.1	9.9	9.5
1	9.9	10.0	10.1	10.1	10.1	10.0	9.8	9.6
2	9.9	9.9	9.9	10.0	10.0	10.0	9.8	9.5
3	9.9	10.0	10.1	10.1	10.0	10.0	9.8	9.5
4	9.6	10.0	9.9	10.0	10.0	9.9	9.9	9.7
5	9.8	10.2	10.3	10.3	10.3	10.3	10.1	10.0
6	9.9	10.0	10.1	10.1	10.1	10.1	10.0	9.9
7	9.6	9.5	9.6	9.6	9.5	9.5	9.5	9.5
8	9.3	9.5	9.7	9.7	9.7	9.7	9.7	9.7
9	9.3	9.6	9.6	9.7	9.7	9.7	9.7	9.7
10	9.5	9.5	9.4	9.4	9.5	9.5	9.5	9.5

## Temperature (°C)

0	9	9	9	9	9	9	9	9
1	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10
3	10	9	9	9	9	9	9	9
4	10	10	10	10	10	10	10	10
5	9	9	9	9	9	9	9	9
6	10	10	10	10	10	10	10	10
7	10	10	10	10	10	10	10	10
8	11	11	11	11	11	11	11	11
9	11	11	11	11	11	11	11	11
10	12	12	12	12	12	12	12	12

## Old Solutions

Lab ctl	0.32	1.0	3.2	10	32	56	100
pH (units)							
8.2							
8.2	8.2	8.2	8.1	8.2	8.3	8.4	8.6
8.0	8.1	8.1	8.1	8.1	8.2	8.3	8.5
8.0	8.0	8.0	8.0	8.0	8.1	8.3	8.4
8.0	8.0	8.0	7.9	8.0	8.1	8.2	8.4
8.0	8.0	8.0	8.0	8.0	8.1	8.3	8.4
8.0	8.0	8.0	8.0	8.0	8.2	8.3	8.4
8.0	8.0	8.0	8.0	8.1	8.2	8.3	8.5
8.1	8.1	8.1	8.1	8.1	8.3	8.4	8.6
8.1	8.1	8.1	8.1	8.2	8.4	8.5	8.6
8.0	8.0	8.0	8.0	8.1	8.2	8.3	8.5

## Conductivity (µS/cm)

453	460	494	531	693	1262	1854	3000
509	488	520	560	747	1318	1960	3160
415	404	435	468	606	1094	1636	2680
441	418	437	468	618	1082	1610	2610
462	414	431	474	617	1062	1629	2660
423	412	433	469	610	1067	1603	2550
442	414	432	479	619	1090	1653	2640
434	422	432	477	621	1098	1625	2640
436	422	434	479	623	1100	1625	2650
409	430	442	486	648	1135	1696	2690

## Dissolved oxygen (mg/L)

10.1	10.1	10.1	10.1	10.1	10.1	10.0	10.0
10.1	10.3	10.1	9.9	10.2	10.1	10.1	10.1
10.1	10.0	10.1	10.2	10.0	10.1	10.0	10.2
10.0	10.0	10.1	10.6	10.7	10.0	10.1	10.0
9.9	10.3	10.4	10.4	10.4	10.3	10.3	10.3
9.8	10.0	10.0	10.1	10.0	10.0	10.0	10.0
9.9	9.9	9.5	9.6	9.5	9.4	9.4	9.5
9.6	9.7	9.8	9.8	9.8	9.7	9.7	9.7
9.5	9.5	9.6	9.6	9.6	9.7	9.6	9.7
9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4

## Temperature (°C)

10	10	10	10	10	10	10	10
9	9	9	9	9	9	9	9
9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10
9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11
11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12

Reviewed by:

EV

Date:

2022/08/31



Method: 30-d WA ELS

Client: SYN100

Sample: PJ2122-004

## Chemistry

## New Solutions

Conc (%)	Lab ctl	0.32	1.0	3.2	10	32	56	100
day								

pH (units)

11	8.0	7.9	7.9	7.9	7.9	8.0	8.0	8.1
12	7.5	7.6	7.8	7.7	7.8	7.9	8.1	8.2
13	7.8	7.8	7.8	7.8	8.0	8.1	8.1	8.2
14	7.8	7.8	7.8	7.8	7.9	8.0	8.1	8.2
15	7.8	7.8	7.9	8.0	8.0	8.1	8.2	8.3
16	7.8	7.8	7.9	7.9	8.0	8.1	8.2	8.3
17	8.0	7.9	8.0	8.0	8.1	8.1	8.2	8.3
18	7.9	8.0	7.9	8.0	8.1	8.2	8.2	8.3
19	7.8	7.9	7.9	7.9	8.0	8.1	8.2	8.3
20	7.7	7.7	7.8	7.7	7.8	8.0	8.1	8.2
21	8.1	8.0	8.0	8.0	8.1	8.2	8.3	8.6

Conductivity (µS/cm)

11	549	425	454	507	666	1176	1714	2780
12	402	406	437	488	640	1133	1710	2760
13	399	410	421	471	620	1181	1716	2800
14	396	407	421	473	592	1065	1607	2630
15	409	424	445	536	660	1167	1706	2790
16	392	405	417	467	598	1107	1675	2700
17	412	*	437	485	629	1177	1718	2830
18	407	421	432	480	631	1148	1657	2740
19	427	446	462	516	672	1178	1770	2820
20	438	449	486	505	708	1203	1733	2790
21	429	448	464	502	680	1216	1715	2830

Dissolved oxygen (mg/L)

11	9.7	9.5	9.7	9.8	9.8	9.8	9.8	9.8
12	9.3	9.5	9.6	9.7	9.8	9.8	9.8	9.8
13	9.8	9.8	9.7	9.7	9.8	9.8	9.8	9.9
14	9.7	9.6	9.7	9.5	9.8	9.8	9.8	9.8
15	9.5	9.8	9.9	9.9	9.9	10.0	10.0	10.0
16	9.3	9.1	9.6	9.6	9.6	9.6	9.6	9.7
17	9.2	*	9.5	9.5	9.5	9.5	9.5	9.6
18	9.4	9.4	9.5	9.4	9.5	9.4	9.5	9.5
19	10.0	10.1	10.1	10.1	10.0	10.1	10.3	10.2
20	9.6	9.4	9.5	9.5	9.5	9.5	9.4	9.4
21	8.8	8.8	8.8	8.8	8.8	8.6	8.7	8.6

Temperature (°C)

11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12
13	12	12	12	12	12	12	12	12
14	12	12	12	12	12	12	12	12
15	11	11	11	11	11	11	11	11
16	12	12	12	12	12	12	12	12
17	12	*	12	12	12	12	12	12
18	12	12	12	12	12	12	12	12
19	12	12	12	12	12	12	12	12
20	12	12	12	12	12	12	12	12
21	14	14	14	14	14	14	14	14

\* Spilled K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

Reviewed by:

EV

## Old Solutions

Lab ctl	0.32	1.0	3.2	10	32	56	100
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pH (units)

7.7	7.7	7.8	7.8	7.8	8.0	8.1	8.3
7.8	7.8	7.8	7.8	7.9	8.0	8.1	8.3
7.9	7.8	7.8	7.8	7.9	8.0	8.1	8.3
7.8	7.8	7.8	7.8	7.9	8.0	8.1	8.3
7.9	7.9	8.0	8.0	8.0	8.1	8.2	8.5
7.4	7.9	7.9	7.9	8.0	8.1	8.2	8.4
7.9	8.0	8.0	8.0	8.1	8.2	8.3	8.5
8.0	8.0	7.9	7.9	8.0	8.1	8.3	8.5
7.9	7.8	7.8	7.8	7.9	8.0	8.1	8.3
7.9	7.8	7.8	7.8	7.9	8.0	8.1	8.4
8.0	8.0	8.0	8.0	8.1	8.2	8.4	8.4

Conductivity (µS/cm)

461	485	461	506	671	1192	1763	2850
449	437	459	511	668	1191	1744	2840
470	440	452	500	659	1183	1752	2820
493	424	428	473	624	1093	1611	2630
424	435	447	499	638	1163	1728	2810
463	476	435	481	619	1119	1655	2700
433	436	469	445	642	1165	1731	2820
424	437	446	490	635	1132	1663	2740
466	435	445	490	648	1167	1697	2770
510	457	461	513	661	1170	1714	2820
509	476	468	505	657	1163	1767	2820

Dissolved oxygen (mg/L)

9.6	9.7	9.5	9.8	9.8	9.8	9.8	9.7
9.6	9.5	9.7	9.7	9.7	9.7	9.6	9.6
9.7	9.5	9.8	9.8	9.7	9.7	9.7	9.6
9.6	9.7	9.8	9.8	9.8	9.7	9.7	9.6
9.8	9.9	9.9	9.9	9.9	9.9	9.9	9.8
9.4	9.6	9.6	9.6	9.6	9.5	9.5	9.5
9.8	9.5	9.5	9.5	9.5	9.5	9.5	9.5
9.7	9.3	9.3	9.4	9.4	9.5	9.4	9.4
10.0	10.0	10.0	10.0	9.9	9.9	9.9	9.9
9.3	9.5	9.5	9.5	9.4	9.4	9.4	9.4
8.6	8.6	8.6	8.7	8.6	8.7	8.6	8.7

Temperature (°C)

12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
11	11	11	11	11	11	11	11
13	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
14	14	14	14	14	14	14	14



## Chemistry

## New Solutions

Conc (%)	Lab ctl	0.32	1.0	3.2	10	32	56	100
day								
		$8.0 \mu\text{M}$ pH (units)						
22	7.9	7.9	8.0	8.0	8.1	8.2	8.3	8.3
23	7.9	8.0	7.9	7.9	8.0	8.1	8.1	8.2
24	7.7	7.7	7.7	7.8	7.8	8.0	8.1	8.2
25	8.1	8.0	8.0	8.1	8.1	8.2	8.3	8.4
26	8.1	8.1	8.0	8.1	8.2	8.2	8.2	8.3
27	7.6	7.7	7.7	7.8	7.9	8.0	8.0	8.1
28	7.9	8.0	8.0	7.9	8.0	8.1	8.2	8.2
29	8.6	7.9	7.9	8.0	8.0	8.1	8.2	8.5
30								

## Old Solutions

Lab ctl	0.32	1.0	3.2	10	32	56	100
pH (units)							
8.1	8.1	8.0	8.0	8.0	8.2	8.3	8.8
7.9	7.9	7.8	7.8	7.9	8.1	8.2	8.4
7.8	7.9	7.8	7.9	7.8	7.9	8.1	8.3
8.1	8.1	8.0	8.1	8.1	8.3	8.4	8.6
8.0	8.1	8.0	8.0	8.1	8.3	8.3	8.5
7.8	7.8	7.8	7.8	7.9	8.0	8.2	8.3
8.0	8.0	8.0	8.0	8.0	8.2	8.3	8.5
8.1	8.1	8.0	-	8.1	8.2	8.4	8.3
7.9	8.0	8.0	8.0	8.1	8.2	8.4	8.5

Conductivity ( $\mu\text{S}/\text{cm}$ )

22	418	437	449	495	640	1153	1681	1800
23	435	434	456	505	655	1174	1710	2780
24	465	485	505	560	735	1346	1902	3120
25	486	484	500	581	720	1256	1853	3060
26	456	476	497	551	808	1308	1954	3110
27	472	480	495	553	708	1252	1812	2990
28	464	480	497	579	690	1319	1865	3100
29	465	481	504	575	805	1386	1816	3160
30								

Conductivity ( $\mu\text{S}/\text{cm}$ )

487	471	465	515	635	1186	1721	2810
453	463	511	515	614	1190	1723	2811
517	518	516	566	739	1332	1958	3130
561	514	516	569	743	1309	1871	3080
549	535	518	587	752	1331	1932	3178
606	516	520	574	777	1331	1932	3120
529	516	523	540	752	1336	1927	3090
690	522	523	-	738	1229	1932	3110
491	497	511	570	781	1325	1867	3090

## Dissolved oxygen (mg/L)

22	8.8	9.0	9.0	9.0	9.0	9.1	9.1	9.1
23	8.8	8.8	8.8	8.8	8.9	8.8	8.9	8.9
24	8.5	8.6	8.6	8.7	8.7	8.7	8.8	8.8
25	9.1	9.1	9.1	9.1	9.1	9.1	9.2	9.3
26	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
27	8.8	8.8	8.9	9.0	9.0	9.1	9.1	9.2
28	8.6	8.8	8.8	8.8	8.9	8.9	9.0	9.0
29	8.6	8.7	8.8	8.8	8.8	8.8	8.9	8.7
30								

## Dissolved oxygen (mg/L)

8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
8.6	8.6	8.6	8.7	8.7	8.7	8.7	8.7
8.7	8.6	8.6	8.6	8.6	8.6	8.6	8.6
9.0	9.0	9.0	9.0	9.1	9.0	9.0	9.0
9.0	8.9	8.9	8.9	8.8	8.8	8.8	8.8
9.0	8.9	9.0	8.9	8.9	8.9	8.9	8.9
8.8	8.8	8.8	8.9	8.8	8.8	8.8	8.8
8.6	8.6	8.6	—	8.7	8.7	8.7	8.6
8.2	8.4	8.4	8.6	8.7	8.5	8.6	8.6

## Temperature (°C)

	Temperature (°C)							
22	15	15	15	15	15	15	15	15
23	15	15	15	15	15	15	15	15
24	16	16	16	16	16	16	16	16
25	16	16	16	16	16	16	16	16
26	15	15	15	15	15	15	15	15
27	15	15	15	15	15	15	15	15
28	15	15	15	15	15	15	15	15
29	15	15	15	15	15	15	15	15
30								

## Temperature (°C)

[illegible]

Reviewed by:

Date:



**Early-life stage test  
Survival and Growth**

Species: Walleye (P52122-004)

Date started: May 6, 2022

Number of alive embryos								
Treatment ID	Days							
	Rep.	1	2	3	4	5	6	7
Control	A	29	29	25	23	23	23	23
	B	30	30	29	29	29	28	28
	C	29	29	28	25	24	24	23
	D	29	29	25	24	24	24	23
	E	28	26(3)	21	19	18	18	17
0.32%	A	29	27	25	25	25	25	24
	B	29	27	25	23	23	23	23
	C	30	30	28	25	25	25	25
	D	30	30	29	26	26	26(1)	26(1)
	E	30	30	29	28	28	28	28
1.0%	A	30	30	27	23	22	22	22
	B	29	27	21	19	18	18	18
	C	29	28	26	24	24	22	22
	D	30	30	24	22	21	21	21
	E	30	29	25	20	19	19	19
3.2%	A	29	29	27	25	25	25	25
	B	29	28	26	22	22	22	22
	C	30	28	28	26	25	25	25
	D	30	30	28	25	24	24	24
	E	30	28	25	25	25	25(1)	25(1)
10%	A	29	29	26	24	24	24	24
	B	29	27	26(1)	23	23	23	23
	C	30	30	29	25	25	24	24
	D	28	28	25	23	23	23	23
	E	30	30	27	26	24	24	24
32%	A	30	30	27	23	23	22	22
	B	30	29(1)	26	24	23	23	23
	C	30	27(2)	25	24	24	24	24
	D	30	29	27	23	23	23	23
	E	30	30	28	27	26	26	26(1)
56%	A	30	28(1)	25	24	23	23	23
	B	29	28	23(1)	20	20	20	20
	C	30	30	30	25	25	25	25
	D	30	29	25	23	23	ev 29 23	23
	E	29	28	28	28	28	28	27
Technician initials:		EV/KLM	SS/KCRM	SS/KCRM	EV/KLM	SS/KLMISH	EV/KLM	SS/KLM

Comments:

SS 2022/08/31



Species: Walleye (P12122-004)

Date started: May 6, 2022

		Days						
Treatment ID	Rep.	1	2	3	4	5	6	7
100%	A	30	30	30	25	23	23	22
	B	30	30	30	27	25	25	25
	C	29 30	29	29	29	29	29 (2)	26 (1)
	D	30 30	30	30	29	28	27	27
	E	30 (1)	30 (1)	30 (1)	<del>EV/KLM</del> EV	23	<del>EV/KLM</del> 23 EV	23
Technician initials:		SS/KRM	SS/KRM	SS/KRM	EV/KLM	SS/KLM/SH	EV/KLM	SS/KLM

**Comments:**

SS 2022108131



# Early-life stage test Survival and Growth

Species: Walleye (P2122-604)

Date Initiated: Nov 6, 2022

Number of embryos and hatched

		Days																								
Treatment ID	Rep.	8					9					10					11					12				
		AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS
Control	A	23	0	0	0		23	0	0	0		23	0	0	0		23	0	0	0		23	0	0	0	
	B	28	1			/	28	1			/	28	1			/	28	1			/	28	1			/
	C	23				/	23				/	23				/	23				/	23				/
	D	23				/	23				/	23				/	23				/	23				/
	E	17	↓			/	17				/	17				/	17				/	17				/
0.32%	A	24	0				24					24					24					24				
	B	22	1			/	22				/	22				/	22				/	22				/
	C	24	1			/	24				/	24				/	24				/	24				/
	D	26	0			/	26				/	26				/	26				/	26				/
	E	28	↓			/	28				/	28				/	28				/	28				/
1.0%	A	22	0				22					22					22					22				
	B	17	1			/	17				/	17				/	17				/	17				/
	C	22	0			/	22				/	22				/	22				/	22				/
	D	21	↓			/	21				/	21				/	21				/	21				/
	E	19	↓			/	19				/	19				/	19				/	19				/
3.2%	A	25	0				25					25					25					25				
	B	22	↓			/	22				/	22				/	22	↓			/	22				/
	C	25				/	25				/	25				/	24	1			/	24				/
	D	24	↓			/	24				/	24				/	24	0			/	24				/
	E	23	1			/	23				/	23				/	23				/	23				/
10%	A	24	0				24					24					24					24				
	B	23	↓			/	23				/	23				/	23				/	23				/
	C	24				/	24				/	24				/	24				/	24				/
	D	23				/	23				/	23				/	23				/	23				/
	E	24	↓			/	24				/	24				/	24				/	24				/
32%	A	22	0				22					22					22					22				
	B	23				/	23				/	23				/	23				/	23				/
	C	24	↓			/	24				/	24				/	24	↓			/	24				/
	D	22	1			/	22				/	22				/	21	1			/	21				/
	E	26	0			/	26				/	26				/	26	0			/	26				/
56%	A	23	0				23					23					22	1				21	21			
	B	20	↓			/	20				/	20				/	20	0			/	19	20			/
	C	25				/	25				/	25				/	25				/	25				/
	D	23				/	23				/	23				/	23				/	23				/
	E	27	↓	↓	↓	/	27	↓	↓	↓	/	27	↓	↓	↓	/	27	↓	↓	↓	/	27	↓	↓	↓	/
Technician initials:		SS/KLM					KLM					SS/KCRM					KCRM/KLM					KLM/KCRM				

Comments: AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 2022/08/31



## Early-life stage test

### Survival and Growth

Species: Walleye (P52122-W04)

Date Initiated: May 6, 2022

### Number of embryos and hatched

[illegible]

**Comments:** AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 2022108131



# Early-life stage test Survival and Growth

Species: Walleye (P12122-024)

Date Initiated: May 6, 2022

Number of embryos and hatched

		Days																								
Treatment ID	Rep.	13					14					15					16					17				
		AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS
Control	A	23	0	0	0	23	23	0	0	0	23	23	0	0	0	23	22	0	1	0	23	22	0	12	0	23
	B	28				28	28				28	28				28	27		1		28	21		7		28
	C	23				23	23				23	23				23	23		0		23	12		11		23
	D	23				23	23				23	23				23	23				23	14		9		23
	E	17				27	17				17	17				17	12				27	17		0		17
0.32%	A	24				24	24				24	24				24	17	0	7	0	24	9	0	15	0	24
	B	22				22	22				22	22(1)				22(1)	22		0		22	21		1		22
	C	24				24	24				24	24				24	24				24	22		2		24
	D	26				26	26				26	26				26	26				26	22		4		26
	E	28				28	28				28	28				28	27		1		28	18		10		28
1.0%	A	22				22	22				22	22				22	22	0	0	0	22	11	0	11	0	22
	B	17				17	17				17	17				17	17				17	13		4		17
	C	22				22	22				22	22				22	22				22	12		10		22
	D	21				21	21				21	21				21	21				21	15		6		21
	E	19				19	19				19	19				19	19				19	11		8		19
3.2%	A	25				25	25				25	25				25	23	0	2	0	25	13	0	12	0	25
	B	22				22	22				22	22				22	22		0		22	16		6		22
	C	24				24	24				24	24				24	23		1		24	11		13		24
	D	24				24	24				24	24				24	23		1(1)		24	15		9		24
	E	23				23	23				23	23				23	23		0		23	7		21		23
10%	A	24				24	24				24	23				24	23	0	1	0	24	16	0	8	0	24
	B	23				23	23				23	23				23	23		0		23	12		11		23
	C	24				24	24				24	24				24	23		1		24	13		11		24
	D	23				23	23				23	23				23	23		1		23	15		8		23
	E	24				24	24				24	24				24	22		2		24	8		16		24
32%	A	22				22	22				22	21				22	17	0	5	0	22	12	0	10	0	22
	B	23				23	23				23	23				23	23		0		23	4		19		23
	C	24				24	24				24	24				24	23		1		24	10		14		24
	D	21				21	21				21	21				21	21		0		21	10		11		21
	E	26				26	26				26	26				26	26				26	3		23		26
56%	A	21	0			21	21				21	21				21	17	0	4	0	21	6	0	15	0	21
	B	19	1			19	19				19	17			2	19	13	0	6	1	19	8		11		19
	C	24	0	1		25	24			1	25	24			1	25	23		2		25	10		15		25
	D	23		0		23	23			0	23	21			2	23	20		5		23	8		15		23
	E	27				27	27				27	26			1	27	24		3		27	9		18		27
Technician initials:		KLM/KCRM					KLM					KLM					KCRM					KCRM				

Comments: AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 202205131



## Survival and Growth

Species: Walleye (P52122-004)

Date Initiated: May 6, 2022

### Number of embryos and hatched

[illegible]

**Comments:** AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 2022/08/21



# Early-life stage test Survival and Growth

Species: Walleye (P1212-004)

Date Initiated: May 6, 2022

Number of embryos and hatched

		Days																								
Treatment ID	Rep.	18					19					20					21					22				
		AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS
Control	A	3	0	20	0	23	1	0	22	0	23	0	1	19	3	19	0	0	17	2	17	0	0	16	1	16
	B	0	0	28	0	28	0	0	28	0	28	↓	0	28	0	28	↓	↓	26	2	26	0	0	25	1	25
	C	4	0	19	↓	28 <sup>3</sup>	2	↓	21	↓	23	2	↓	23 <sup>1</sup>	↓	23	↓	↓	21	1	21	↓	↓	19	2	19
	D	4	0	19	↓	23	0	↓	23	↓	23	0	↓	23	↓	23	↓	0	22	1	22	↓	↓	22	0	22
	E	8	0	9	↓	17	1	↓	16	↓	17	↓	↓	17	↓	17	↓	↓	17	0	17	↓	↓	13	4	13
0.32%	A	2	0	22	0	24	0	1	22	1	22	0	0	22	0	22	0	0	22	0	22	0	0	18	4	18
	B	0	1	21	↓	21	↓	0	21	0	21	↓	↓	21	↓	21	↓	↓	19	2	19	↓	↓	18	1	18
	C	13	0	11	↓	24	1	0	23	0	24	↓	↓	24	↓	24	↓	↓	24	0	24	↓	↓	21	3	21
	D	6	0	20	↓	26	0	↓	26	↓	26	↓	↓	25	1	26 <sup>5</sup>	↓	↓	25	0	25	↓	↓	24	1	24
	E	1	0	27	↓	28	↓	↓	28	↓	28	↓	↓	27	1	28 <sup>1</sup>	↓	↓	27	0	27	↓	↓	27	0	27
1.0%	A	1	0	21	0	22	0	0	22	0	22	0	0	21	1	21	0	0	19	2	19	0	0	15	4 <sup>0</sup>	15
	B	5	0	12	↓	21 <sup>17</sup>	1	↓	16	↓	17	↓	↓	17	0	17	↓	↓	17	0	17	↓	↓	14	3	14
	C	1	0	21	↓	22	0	↓	22	↓	22	↓	↓	22	↓	22	↓	↓	19	3	19	↓	↓	18	1	18
	D	1	0	20	↓	21	↓	↓	21	↓	21	↓	↓	21	↓	21 (1AS)	↓	↓	21	0	21	↓	↓	19	2	19
	E	3	0	16	↓	19	1	↓	18	↓	19	1	↓	16	2	17	1	↓	16	↓	17	1	↓	13	3	14
3.2%	A	0	1	24	0	24	0	0	24	0	24	0	0	22	2	22 (2AS)	0	0	17	5	17	0	0	16	1	16
	B	5	0	17	0 <sup>1A</sup>	22	↓	↓	22	↓	22	↓	↓	22	0	22	↓	↓	21	1	21	↓	↓	21	0	21
	C	0	0	24	0 <sup>1A</sup>	24	0 <sup>1A</sup>	↓	23 <sup>1</sup>	↓	24	↓	↓	24	↓	24	↓	↓	23	1	22 <sup>3</sup>	↓	↓	23	0	23
	D	7	0	17	0 <sup>1A</sup>	24	1	↓	23	↓	24	↓	↓	23	↓	23	↓	↓	21	2	21	↓	↓	20	1	20
	E	2	0	21	0	23	1	↓	22	↓	23	1	0	17	5	18	1	↓	16	1	17	↓	↓	15	1	15
10%	A	1	0	23	0	24	0	0	23	1	23	0	0	21	2	21 (1AS)	0	0	21	0	21	0	0	21	0	21
	B	0	0	23	↓	23	↓	↓	22	1	23 <sup>2</sup>	↓	↓	22 <sup>1</sup>	2 <sup>1</sup>	20 (2AS)	↓	↓	21	1	21	↓	↓	21	0	21
	C	0	0	24	↓	24	↓	↓	23	1	23	↓	↓	23	0	23 (1AS)	↓	↓	23	↓	23	↓	↓	23	0	23
	D	7	0	16	↓	23	2	↓	21	0	23	1	↓	21	1	22	↓	↓	21	↓	21	↓	↓	20	1	20
	E	2	0	27	↓	24	1	↓	22	1	23	1	↓	19	3	20	↓	0	20	↓	20	↓	↓	19	1	19
32%	A	2	0	20	0	22	1	1	16	4	17	0	0	16	1	16 (1AS)	0	0	15	1	15 (2AS)	0	0	14	1	14
	B	0	0	23	0	23	0	0	22	1	22	0	0	20	2	20	↓	↓	18	2	18	↓	↓	16	2	16
	C	2	0	21	1	23	↓	↓	23	0	23	↓	↓	22	1	22 (1AS)	↓	↓	21	1	21	↓	↓	18	3	18
	D	3	0	18	0	21	1	↓	19	1	20	1	↓	17	2	18	↓	↓	18	0	18	↓	↓	16	2	16
	E	1	0	25	0	26	0	↓	24	2	24	0	↓	23	1	23 (1AS)	↓	↓	22	1	22	↓	↓	22	0	22
56%	A	0	0	21	0	21	0	0	19	2	19	0	0	18	1	18 (2AS)	0	0	13	5	13 (2AS)	0	0	12	1	12
	B	0	0	19	↓	19	↓	↓	19	0	19	↓	↓	19	0	19 (3AS)	↓	↓	18	1	18	↓	↓	17	1	17
	C	0	0	25	↓	25	↓	↓	25	0	25	↓	↓	24	1	24	↓	↓	22	2	22	↓	↓	20	2	20
	D	1	0	22	↓	23	↓	↓	22	↓	22	↓	↓	20	2	20 (2AS)	↓	↓	20	0	20 (2AS)	↓	↓	19	1	19
	E	0	0	27	↓	27	↓	↓	25	2	25 (2)	↓	↓	24	1	24 (1AS)	↓	↓	22	2	22 (3AS)	↓	↓	17	5	17
Technician initials:		EV/KCRM					KLM/SS					KLM					SS/KLM					EV/KLM				

Comments: AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

① killed by tech

\* Starting day 21 - many of the

SS 2022/08/13

hatched larvae appear stressed (not very active) in all TJS.



## Survival and Growth

Wallace (PJ2122-404)

May 6, 2022

### Number of embryos and hatched

[illegible]

**Comments:** AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

\* Starting day 21, <sup>many</sup> hatched larvae appear stressed (not very active)

SS 2022/08/31



**Early-life stage test  
Survival and Growth**

Species: Walleye (PS2122-004)

Date Initiated: May 6, 2022

Number of embryos and hatched

Treatment ID	Rep.	Days																								
		23					24					25					26					27				
		AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS	AE	DE	AH	DH	TS
Control	A	0	0	15	1	15	0	0	12	3	12	0	0	9	3	9	0	0	3	6	3	0	0	3	0	3
	B			24	1	24			24	0	24			20	4	20			18	2	18			13	5	13
	C			15	4	15(1E)			12	3	12(1E)			9	3	9(1E)			6	3	6			2	4	6 <sup>2</sup>
	D			19	3	19			18	1	18			15	3	15			6	4	6			6	0	6
	E			13	0	13			12	1	12			2	10	2			21	10 <sup>2</sup>	21			1	0	1
0.32%	A			16	2	16			15	1	15			7	8	7			7	8	7			2	4	2
	B			16	2	16			15	1	15			12	3	12			7	5	7			6	1	6
	C			21	0	21			18	3	18			17	1	17			14	3	14			7	7	7
	D			23	1	23			23	0	23			21	2	21			14	7	14			10	4	10
	E			27	0	27			27	0	27			24	3	24			19	4 <sup>5</sup>	19			11	8	11
1.0%	A			15	0	15			14	1	14			13	1	13			13	0	13			9	4	9
	B			13	1	13			13	0	13			9	4	9			9	0	9			3	6	3
	C			16	2	16			15	1	15			15	0	15			12	2 <sup>3</sup>	12			6	6	6
	D			19	0	19			18	1	18			15	3	15			10	5	10			9	1	9
	E			14	0	14			13	1	13			11	2	11			6	5	6			5	1	5
3.2%	A			15	1	15			15	0	15			15	0	15			13	2	13			4	9	4
	B			21	0	21			21	0	21			18	3	18			17	1	17			14	3	14
	C			23	0	23			23	0	23			22	1	22			18	4	18			9	9	9
	D			20	0	20			19	1	19			16	3	16			8	8	8			5	3	5
	E			14	1	14			14	0	14			13	1	13			11	2	11			7	4	7
10%	A			21	0	21(1E)			20	1	20			18	2	18			17	1	17			14	3	14
	B			21	0	21			20	1	20			19	1	19			17	2	17			14	3	14
	C			23	0	23			23	0	23			23	0	23			20	3	20			13	7	13
	D			18	2	18			18	0	18			18	0	18			18	0	18			12	6	12
	E			19	0	19			19	0	19			10	9	10			9	1	9			8	1	8
32%	A			10	4	10			10	0	10			10	0	10			9	1	9			7	2	7
	B			12	4	12(1AS)			8	4	8			7	1	7			6	1	6			2	4	2
	C			15	3	15			13	2	13			12	1	12			10	2	10			3	7	3
	D			11	5	16			10	1	10			8	2	8			6	2	6			4	2	4
	E			15	7	15			13	2	13			10	3	10			9	1	9			2	7	2
56%	A			10	2	10(2E)			7	3	7			6	1	6			5	1	5			2	3	2
	B			11	6	11(2AS, 2E)			7	4	7(2E)			2	5	2			1	1	1			1	0	1
	C			10	10	10(1AS, 1E)			8	2	8(1AS)			2	6	2			1	1	1			0	1	0
	D			11	8	11(2AS)			6	5	6(1AS, 1E)			5	1	5			2	3	2			0	2	0
	E	✓	✓	10	7	10(2AS)	✓	✓	3	7	3(2AS)	✓	✓	1	2	1	✓	✓	0	1	0	✓	✓	0	0	0
Technician initials:		SS/KRM					SS/KRM					EU/KRM					KRM/KCRM					KRM/ev				

Comments: AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival



### Early-life stage test

#### Survival and Growth

Species: Walleye (P52122-W04)

Date Initiated: May 6/2022

### Number of embryos and hatched

[illegible]

**Comments:** AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS

2022/08/31



# Early-life stage test Survival and Growth

Species: Wallace (P52122-004)

Date Initiated: May 6, 2022

Number of embryos and hatched

Treatment ID	Rep.	Days																								
		28					29					30					AE	DE	AH	DH	TS	AE	DE	AH	DH	TS
Control	A	0	0	3	0	3	0	0	2	1	2	0	0	1	1	1										
	B			12	1	12			12	0	12			11	1	11										
	C			2	0	2			2	0	2			1	1	1										
	D			6	0	6			6	0	6			6	0	6										
	E			1	0	1			1	0	1			1	0	1										
0.32%	A			1	1	1			1	0	1			0	1	0										
	B			4	2	4			3	1	3			3	0	3										
	C			5	2	5			5	0	5			4	1	4										
	D			8	2	8			7	1	7			6	1	6										
	E			10	1	10			9	1	9			9	0	9										
1.0%	A			5	4	5			4	1	4			2	2	2										
	B			3	0	3			3	0	3			3	0	3										
	C			4	2	4			3 <sup>2</sup>	1	3			3	0	3										
	D			8	1	8			8	0	8			8	0	8										
	E			3	2	3			1	2	1			1	0	1										
3.2%	A			1	3	1			0	1	0			0	0	0										
	B			11	3	11			10	1	10			8	2	8										
	C			4	5	4			3	1	3			1	2	1										
	D			5	0	5			5	0	5			4	1	4										
	E			5	2	5			5	0	5			4	1	4										
10%	A			6	8	6			4	2	4			3	1	3										
	B			2	12	2			0	2	0			0	0	0										
	C			12	1	12			11	1	11			9	2	9										
	D			9	3	9			9	0	9			8	1	8										
	E			7	1	7			6	1	6			3	3	3										
32%	A			1	6	1			1	0	1			1	0	1										
	B			1	1	1			1	0	1			1	0	1										
	C			0	3	0			0	0	0			0	0	0										
	D			2	2	2			2	0	2			2	0	2										
	E			1	1	1			1	0	1			1	0	1										
56%	A			0	2	0			0	0	0			0	0	0										
	B			1	0	1			1	0	1			1	0	1										
	C			0	0	0			0	0	0			0	0	0										
	D			0	0	0			0	0	0			0	0	0										
	E			0	0	0			0	0	0			0	0	0										
Technician initials:		EV/KLM					KLM					SS/KCRM														

Comments: AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 2022/08/31



### Early-life stage test

#### Survival and Growth

Species: Walleye (P52122-004)

Date Initiated: May 6, 2022

### Number of embryos and hatched

[illegible]

**Comments:** AE = alive embryo, DE = dead embryo, AH = alive hatched, DH = dead hatched, TS = total survival

SS 2022/08β1



30-d WA

Client

SYN100

Sample: OSPW

## Test Termination

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

Concentration: LAB CONTROL

For sampling method column, use the following notation:

F = formalin or D = dry weight

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
H	1	9	D	AN
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
B	1	9	D	N
	2	9	+	AS
	3	10	-	2
	4	10	-	2
	5	10	-	2
	6	10	-	2
	7	9	-	2
	8	9	-	2
	9	10	-	2
	10	10	-	2
	11	10	↓	2
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			
	21			
	22			
	23			
	24			
	25			
	26			
	27			
	28			
	29			
	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
C	1	10	D	N
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
D	1	9	D	2
	2	9	-	2
	3	9	-	2
	4	10	-	2
	5	10	-	2
	6	9	↓	2
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			
	21			
	22			
	23			
	24			
	25			
	26			
	27			
	28			
	29			
	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
G	1	10	F	N
	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			

Comments: mouth + guts developed. no food / feeding in gut despite b-shrimp in jar. guts v. empty & not fed on TP.  
 No swim bladder inflation

EV 2022/08/31



Method 30-d WA

Client SYN100

Sample: OSPW

## Test Termination

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

Concentration: 0.32 %

For sampling method column, use the following notation:

F = formalin or D = dry weight

Replicate # **A**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1		F	
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			

Replicate # **B**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	↓	222
2	100	↓	222
3	100	↓	222
4	100	↓	222
5	100	↓	222
6	100	↓	222
7	100	↓	222
8	100	↓	222
9	100	↓	222
10	100	↓	222
11	100	↓	222
12	100	↓	222
13	100	↓	222
14	100	↓	222
15	100	↓	222
16	100	↓	222
17	100	↓	222
18	100	↓	222
19	100	↓	222
20	100	↓	222
21	100	↓	222
22	100	↓	222
23	100	↓	222
24	100	↓	222
25	100	↓	222
26	100	↓	222
27	100	↓	222
28	100	↓	222
29	100	↓	222
30	100	↓	222

Replicate # **C**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	↓	222
2	100	↓	222
3	100	↓	222
4	100	↓	222
5	100	↓	222
6	100	↓	222
7	100	↓	222
8	100	↓	222
9	100	↓	222
10	100	↓	222
11	100	↓	222
12	100	↓	222
13	100	↓	222
14	100	↓	222
15	100	↓	222
16	100	↓	222
17	100	↓	222
18	100	↓	222
19	100	↓	222
20	100	↓	222
21	100	↓	222
22	100	↓	222
23	100	↓	222
24	100	↓	222
25	100	↓	222
26	100	↓	222
27	100	↓	222
28	100	↓	222
29	100	↓	222
30	100	↓	222

Replicate # **D**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	↓	222
2	100	↓	222
3	100	↓	222
4	100	↓	222
5	100	↓	222
6	100	↓	222
7	100	↓	222
8	100	↓	222
9	100	↓	222
10	100	↓	222
11	100	↓	222
12	100	↓	222
13	100	↓	222
14	100	↓	222
15	100	↓	222
16	100	↓	222
17	100	↓	222
18	100	↓	222
19	100	↓	222
20	100	↓	222
21	100	↓	222
22	100	↓	222
23	100	↓	222
24	100	↓	222
25	100	↓	222
26	100	↓	222
27	100	↓	222
28	100	↓	222
29	100	↓	222
30	100	↓	222

Replicate # **E**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	↓	222
2	100	↓	222
3	100	↓	222
4	100	↓	222
5	100	↓	222
6	100	↓	222
7	100	↓	222
8	100	↓	222
9	100	↓	222
10	100	↓	222
11	100	↓	222
12	100	↓	222
13	100	↓	222
14	100	↓	222
15	100	↓	222
16	100	↓	222
17	100	↓	222
18	100	↓	222
19	100	↓	222
20	100	↓	222
21	100	↓	222
22	100	↓	222
23	100	↓	222
24	100	↓	222
25	100	↓	222
26	100	↓	222
27	100	↓	222
28	100	↓	222
29	100	↓	222
30	100	↓	222

Comments:

Mouth + guts developed. No food in gut despite being fed brine shrimp. Guts v. empty.  
Swim bladders not inflated.

EV 2022/08/31



Method 30-d WAClient SYN100Sample: OSPW**Test Termination**

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

For sampling method column, use the following notation:

F = formalin or D = dry weight

Concentration: 1.0 %

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
A				
1	1	10	F	N
2	2	10	↓	N
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
B				
1	1	10	D	N
2	2	10	↓	N
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
C				
1	1	10	D	N
2	2	10	↓	N
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
D				
1	1	10	D	N
2	2	10	↓	N
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
E				
1	1	10	D	N
2	2	10	↓	N
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			

Comments: Mouths + guts developed. Only B(3) had 1 fish that was eating. Most guts look empty.  
Swim bladders not inflated

EV 2022/08/31



Method 30-d WA

Client SYN100

Sample: OSPW

## Test Termination

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

For sampling method column, use the following notation:

F = formalin or D = dry weight

Replicate # **A**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1		F	
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			

Replicate # **B**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	D	N
2	100		
3	100		
4	100		
5	100		
6	100		
7	100		
8	100		
9	100		
10	100		
11	100		
12	100		
13	100		
14	100		
15	100		
16	100		
17	100		
18	100		
19	100		
20	100		
21	100		
22	100		
23	100		
24	100		
25	100		
26	100		
27	100		
28	100		
29	100		
30	100		

Concentration: 3.2%

Replicate # **C**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	10	F	N
2	10		
3	10		
4	10		
5	10		
6	10		
7	10		
8	10		
9	10		
10	10		
11	10		
12	10		
13	10		
14	10		
15	10		
16	10		
17	10		
18	10		
19	10		
20	10		
21	10		
22	10		
23	10		
24	10		
25	10		
26	10		
27	10		
28	10		
29	10		
30	10		

Replicate # **D**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	D	N
2	100		
3	100		
4	100		
5	100		
6	100		
7	100		
8	100		
9	100		
10	100		
11	100		
12	100		
13	100		
14	100		
15	100		
16	100		
17	100		
18	100		
19	100		
20	100		
21	100		
22	100		
23	100		
24	100		
25	100		
26	100		
27	100		
28	100		
29	100		
30	100		

Replicate # **E**

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	100	D	N
2	100		
3	100		
4	100		
5	100		
6	100		
7	100		
8	100		
9	100		
10	100		
11	100		
12	100		
13	100		
14	100		
15	100		
16	100		
17	100		
18	100		
19	100		
20	100		
21	100		
22	100		
23	100		
24	100		
25	100		
26	100		
27	100		
28	100		
29	100		
30	100		

Swim bladder present

Comments: Same as past comments

EV 2022/08/31



Method 30-d WA

Client SYN100

Sample: OSPW

## Test Termination

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

For sampling method column, use the following notation:

F = formalin or D = dry weight

Replicate # <sup>H</sup>

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	9.75	F	E-G
2	9		AS
3	9	↓	E-H+G
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			

Replicate # <sup>BC</sup>

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	9	D	N
2	9.5		
3	9.5		
4	9.5		
5	9.5		
6	9.5		
7	9.5		
8	9.5		
9	9.5		
10	9.5		
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Concentration: 10%  
Replicate # <sup>EO</sup>

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	9	D	N
2	9.5		
3	9.5		
4	9.5		
5	9.5		
6	9.5		
7	9.5		
8	9.5		
9	9.5		
10	9.5		
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Replicate # <sup>DE</sup>

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	9	D	N
2	9.5		
3	9.5	↓	↓
4	9		
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			

Replicate # <sup>EB</sup>

Fish	Length (mm)	Sampling Method	Normal/Abnormal
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			

Comments:

swim bladder partially inflated  
 ↳ same comments as previous.

\* check weigh pans

CB → B

DE → BC

EB → D

E → B (no fish)

EV 2012/08/31



Method 30-d WAClient SYN100Sample: OSPW**Test Termination**For **normal/abnormal** column, use the following notation:**N=Normal** or **A= Abnormal** + location: **H=head**, **A= abdomen**, **E=eyes**, **S=spine**For **sampling method** column, use the following notation:**F = formalin** or **D = dry weight**

Replicate # B

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	<u>9.5</u>	<u>D</u>	<u>N</u>
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			

Replicate # B

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	<u>9</u>	<u>D</u>	<u>N</u>
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			

Concentration: 32%

Replicate # C

Fish	Length (mm)	Sampling Method	Normal/Abnormal
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			

Replicate # D

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	<u>9</u>	<u>D</u>	<u>N</u>
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			

Replicate # E

Fish	Length (mm)	Sampling Method	Normal/Abnormal
1	<u>9</u>	<u>D</u>	<u>N</u>
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			

Comments:

\* oddly inflated SB  
 \* SB inflated

EV 2022/08/31



Method 30-d WA

Client SYN100

Sample: OSPW

## Test Termination

For normal/abnormal column, use the following notation:

N=Normal or A= Abnormal + location: H=head, A= abdomen, E=eyes, S=spine

For sampling method column, use the following notation:

F = formalin or D = dry weight

Concentration: 56%

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	1		F	
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	1	8	D	N
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	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			

Comments:

\* fully inflated SB.

EV 2022/08/31



Method 30-d WAClient SYN100Sample: OSPW**Test Termination**For **normal/abnormal** column, use the following notation:**N=Normal** or **A= Abnormal** + location: **H=head**, **A= abdomen**, **E=eyes**, **S=spine**For **sampling method** column, use the following notation:**F = formalin** or **D = dry weight**

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	1		F	
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	1	9	D	N
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	1	9.5	D	N
	2	10		
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	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			

Replicate #	Fish	Length (mm)	Sampling Method	Normal/Abnormal
	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			

Comments:

C-1 - weird SB inflation  
(see photo)

C-2 - fully inflated SB

EV 2012/08/31



# Organism Weights Bench Sheet

 Client SYN100 Sample PJ2122-004 Organism WA Batch 20220505WA

	Item Weighed	Date	Initials	Balance*
Initial Weight (mg):	dried pan	2022/06/01	KLM	2
Final Weight (mg):	dried pan + organisms	2022/06/01	KLM	1

\* same balance must be used for initial and final weights  
 \* for FM/HA/CT, must use scale with 0.01 mg accuracy

		Concentration									
		CTL		0.32		1		3.2		10	
Replicate		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a		404.85	405.12	393.57	-	403.51	*	396.17	-	399.08	*
b		402.59	406.64	400.22	*	405.16	406.03	397.84	400.32	393.99	396.83
c		405.88	406.21	403.30	404.73	400.28	401.34	397.06	*	392.35	395.16
d		406.22	408.28	397.72	399.73	400.02	402.64	403.15	404.52	404.43	405.70
e		398.54	*	400.99	404.57	398.10	398.42	405.49	406.85	410.16	-
		* no weights taken		* no weights taken		KLM		* no weights taken		* fish not subsampled during ID	
		56		160							
Replicate		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
a		400.97	-	404.36	-						
b		394.21	394.44	400.34	400.64						
c		392.48	-	403.57	404.38						
d		404.10	-	392.41	-						
e		398.02	-	394.88	-						

## Balance Calibration Check:

	Initial	Final
first pan weighed:	CTLA	CTLA
weight of first pan:	404.85	405.12
first pan after all		
other pans weighed:	404.86	405.12

% difference <5%: Yes/No Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

 Reviewed By: EV

 Date Reviewed: 2022/08/31

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action



## CETIS Analytical Report

Report Date: 01 Sep-22 17:45 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 01-1702-6097	<b>Endpoint:</b> Hatch Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 01 Sep-22 17:44	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Edit Date:</b> 01 Sep-22 17:43	<b>MD5 Hash:</b> F128F814C0F6B221F6630FA7079DF446	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 19-3129-9634	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 05 May-22	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 05 Jun-22	<b>Species:</b> Sander vitreus	<b>Brine:</b>
<b>Test Length:</b> 31d 0h	<b>Taxon:</b>	<b>Source:</b> <b>Age:</b>
<b>Sample ID:</b> 05-1550-6252	<b>Code:</b> PJ2122-004 WA	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 27 Apr-22	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 28 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 8d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1850882	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	86.81	---	---	1.152	---	---
LC15	>100	---	---	<1	---	---
LC20	>100	---	---	<1	---	---
LC25	>100	---	---	<1	---	---
LC40	>100	---	---	<1	---	---
LC50	>100	---	---	<1	---	---

Hatch Rate Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.7467	0.7333	0.5667	0.9333	17.46%	0.00%	112/150	0.7800	0.00%
0.32		5	0.8133	0.8000	0.7000	0.9333	11.07%	-8.93%	122/150	0.7800	0.00%
1		5	0.6733	0.7000	0.5667	0.7333	10.73%	9.82%	101/150	0.7493	3.93%
3.2		5	0.7667	0.7667	0.7333	0.8000	4.35%	-2.68%	115/150	0.7493	3.93%
10		5	0.7800	0.8000	0.7333	0.8000	3.82%	-4.46%	117/150	0.7493	3.93%
32		5	0.7667	0.7667	0.7000	0.8667	9.22%	-2.68%	115/150	0.7493	3.93%
56		5	0.7600	0.7333	0.6333	0.9000	14.01%	-1.79%	114/150	0.7493	3.93%
100		5	0.6867	0.7000	0.6000	0.7333	7.36%	8.04%	103/150	0.6867	11.97%

## Hatch Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.7333	0.9333	0.7333	0.7667	0.5667
0.32		0.7667	0.7000	0.8000	0.8667	0.9333
1		0.7333	0.5667	0.7333	0.7000	0.6333
3.2		0.8000	0.7333	0.8000	0.7667	0.7333
10		0.8000	0.7667	0.8000	0.7333	0.8000
32		0.7000	0.7667	0.8000	0.7000	0.8667
56		0.7000	0.6333	0.8333	0.7333	0.9000
100		0.6000	0.7000	0.7000	0.7333	0.7000



# CETIS Analytical Report

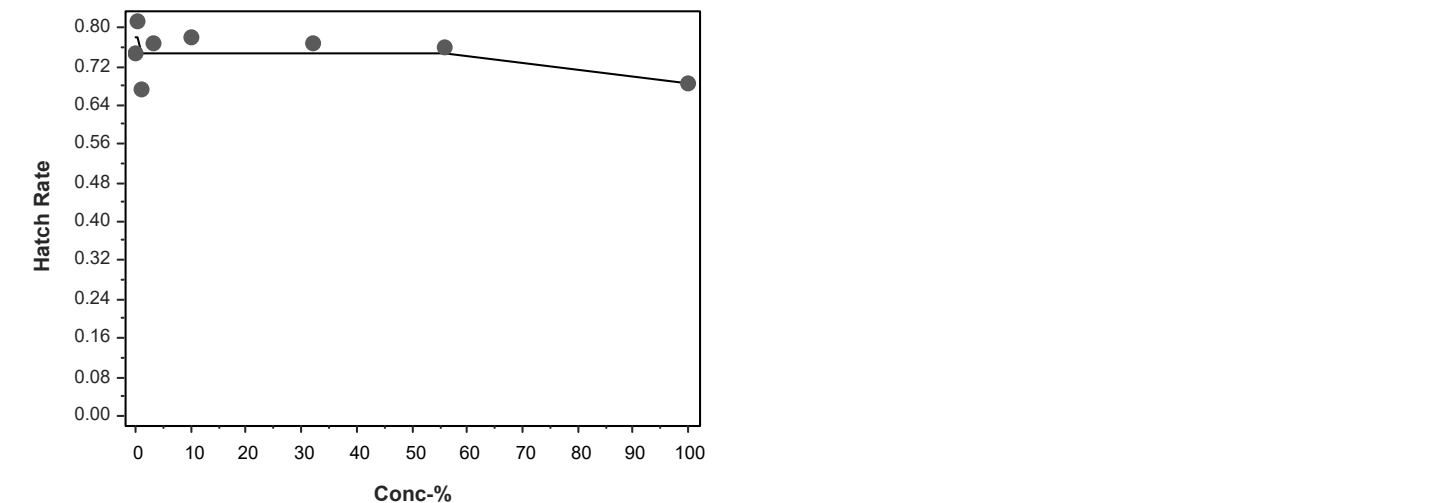
Report Date: 01 Sep-22 17:45 (p 2 of 2)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test Nautilus Environmental Calgary

Analysis ID: 01-1702-6097	Endpoint: Hatch Rate	CETIS Version: CETISv2.1.0
Analyzed: 01 Sep-22 17:44	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 01 Sep-22 17:43	MD5 Hash: F128F814C0F6B221F6630FA7079DF446	Editor ID: 003-581-756-9

Hatch Rate Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	22/30	28/30	22/30	23/30	17/30
0.32		23/30	21/30	24/30	26/30	28/30
1		22/30	17/30	22/30	21/30	19/30
3.2		24/30	22/30	24/30	23/30	22/30
10		24/30	23/30	24/30	22/30	24/30
32		21/30	23/30	24/30	21/30	26/30
56		21/30	19/30	25/30	22/30	27/30
100		18/30	21/30	21/30	22/30	21/30

### Graphics





# CETIS Summary Report

Report Date: 01 Sep-22 17:46 (p 1 of 1)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
04-2210-7568	Hatch Rate	Linear Interpolation (ICPIN)		LC10	86.81	---	---	1.152	1
				LC15	>100	---	---	<1	
				LC20	>100	---	---	<1	
				LC25	>100	---	---	<1	
				LC40	>100	---	---	<1	
				LC50	>100	---	---	<1	

Hatch Rate Summary											
Conc.-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.7467	0.5848	0.9086	0.5667	0.9333	0.0583	0.1304	17.46%	0.00%
0.32		5	0.8133	0.7015	0.9252	0.7000	0.9333	0.0403	0.0901	11.07%	-8.93%
1		5	0.6733	0.5836	0.7631	0.5667	0.7333	0.0323	0.0723	10.73%	9.82%
3.2		5	0.7667	0.7253	0.8081	0.7333	0.8000	0.0149	0.0333	4.35%	-2.68%
10		5	0.7800	0.7430	0.8170	0.7333	0.8000	0.0133	0.0298	3.82%	-4.46%
32		5	0.7667	0.6789	0.8545	0.7000	0.8667	0.0316	0.0707	9.22%	-2.68%
56		5	0.7600	0.6278	0.8922	0.6333	0.9000	0.0476	0.1065	14.01%	-1.79%
100		5	0.6867	0.6239	0.7494	0.6000	0.7333	0.0226	0.0506	7.36%	8.04%

Hatch Rate Detail							MD5: F128F814C0F6B221F6630FA7079DF446				
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.7333	0.9333	0.7333	0.7667	0.5667					
0.32		0.7667	0.7000	0.8000	0.8667	0.9333					
1		0.7333	0.5667	0.7333	0.7000	0.6333					
3.2		0.8000	0.7333	0.8000	0.7667	0.7333					
10		0.8000	0.7667	0.8000	0.7333	0.8000					
32		0.7000	0.7667	0.8000	0.7000	0.8667					
56		0.7000	0.6333	0.8333	0.7333	0.9000					
100		0.6000	0.7000	0.7000	0.7333	0.7000					

Hatch Rate Binomials						
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	22/30	28/30	22/30	23/30	17/30
0.32		23/30	21/30	24/30	26/30	28/30
1		22/30	17/30	22/30	21/30	19/30
3.2		24/30	22/30	24/30	23/30	22/30
10		24/30	23/30	24/30	22/30	24/30
32		21/30	23/30	24/30	21/30	26/30
56		21/30	19/30	25/30	22/30	27/30
100		18/30	21/30	21/30	22/30	21/30



## CETIS Analytical Report

Report Date: 30 Aug-22 13:24 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 12-7426-2061	<b>Endpoint:</b> 23-d Survival Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:23	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Edit Date:</b> 30 Aug-22 13:19	<b>MD5 Hash:</b> 2D78DA619EBDC4867C72FA3CB2B83BAC	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 19-3129-9634	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 05 May-22	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 05 Jun-22	<b>Species:</b> Sander vitreus	<b>Brine:</b>
<b>Test Length:</b> 31d 0h	<b>Taxon:</b>	<b>Source:</b> <b>Age:</b>
<b>Sample ID:</b> 05-1550-6252	<b>Code:</b> PJ2122-004 WA	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 27 Apr-22	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 28 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 8d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0.4267	44.44%	1.868	0.1388	73.76	38.93	139.8	1.356	0.7155	2.569

## 23-d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.5733	0.5000	0.4333	0.8000	25.48%	0.00%	86/150	0.6300	0.00%
0.32		5	0.6867	0.7000	0.5333	0.9000	22.92%	-19.77%	103/150	0.6300	0.00%
1		5	0.5163	0.5000	0.4483	0.6333	14.15%	9.94%	77/149	0.6054	3.90%
3.2		5	0.6200	0.6667	0.4667	0.7667	21.03%	-8.14%	93/150	0.6054	3.90%
10		5	0.6800	0.7000	0.6000	0.7667	9.56%	-18.60%	102/150	0.6054	3.90%
32		5	0.4200	0.4000	0.3333	0.5000	18.27%	26.74%	63/150	0.4200	33.33%
56		5	0.3467	0.3333	0.3333	0.3667	5.27%	39.53%	52/150	0.3467	44.97%
100		5	0.2800	0.2333	0.2000	0.4000	29.88%	51.16%	42/150	0.2800	55.56%

## 23-d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.5000	0.8000	0.5000	0.6333	0.4333
0.32		0.5333	0.5333	0.7000	0.7667	0.9000
1		0.5000	0.4483	0.5333	0.6333	0.4667
3.2		0.5000	0.7000	0.7667	0.6667	0.4667
10		0.7000	0.7000	0.7667	0.6000	0.6333
32		0.3333	0.4000	0.5000	0.3667	0.5000
56		0.3333	0.3667	0.3333	0.3667	0.3333
100		0.2000	0.3333	0.2333	0.2333	0.4000

## 23-d Survival Rate Binomials

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	15/30	24/30	15/30	19/30	13/30
0.32		16/30	16/30	21/30	23/30	27/30
1		15/30	13/29	16/30	19/30	14/30
3.2		15/30	21/30	23/30	20/30	14/30
10		21/30	21/30	23/30	18/30	19/30
32		10/30	12/30	15/30	11/30	15/30
56		10/30	11/30	10/30	11/30	10/30
100		6/30	10/30	7/30	7/30	12/30

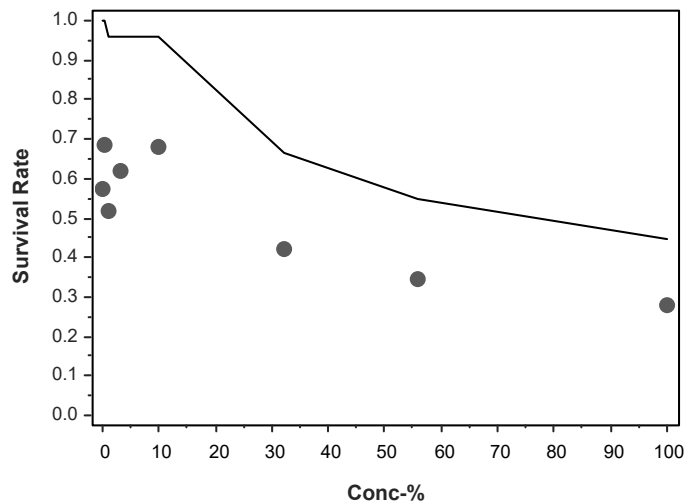


# CETIS Analytical Report

Report Date: 30 Aug-22 13:24 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test			Nautilus Environmental Calgary	
Analysis ID:	12-7426-2061	Endpoint:	23-d Survival Rate	CETIS Version: CETISv2.1.0
Analyzed:	30 Aug-22 13:23	Analysis:	Trimmed Spearman-Kärber	Status Level: 1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	2D78DA619EBDC4867C72FA3CB2B83BAC	Editor ID: 003-581-756-9

## Graphics





## CETIS Analytical Report

Report Date: 30 Aug-22 13:23 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b>	05-7179-5891	<b>Endpoint:</b>	23-d Survival Rate	<b>CETIS Version:</b>	CETISv2.1.0
<b>Analyzed:</b>	30 Aug-22 13:22	<b>Analysis:</b>	Linear Interpolation (ICPIN)	<b>Status Level:</b>	1
<b>Edit Date:</b>	30 Aug-22 13:19	<b>MD5 Hash:</b>	2D78DA619EBDC4867C72FA3CB2B83BAC	<b>Editor ID:</b>	003-581-756-9
<b>Batch ID:</b>	19-3129-9634	<b>Test Type:</b>	Survival-Development-Growth	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	05 May-22	<b>Protocol:</b>	ASTM E1241-05 (2013)	<b>Diluent:</b>	Dechlorinated Tap Water
<b>Ending Date:</b>	05 Jun-22	<b>Species:</b>	Sander vitreus	<b>Brine:</b>	
<b>Test Length:</b>	31d 0h	<b>Taxon:</b>		<b>Source:</b>	Age:
<b>Sample ID:</b>	05-1550-6252	<b>Code:</b>	PJ2122-004 WA	<b>Project:</b>	PJ2122-004
<b>Sample Date:</b>	27 Apr-22	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	28 Apr-22	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	8d 0h	<b>Client:</b>	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1160819	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	12.82	---	19.89	7.798	5.027	---
LC15	15.66	---	26.77	6.387	3.736	---
LC20	19.07	8.358	35.82	5.244	2.792	11.96
LC25	23.19	10.43	42.3	4.313	2.364	9.587
LC40	44.13	17.93	63.66	2.266	1.571	5.576
LC50	73.8	40.68	---	1.355	---	2.458

## 23-d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.5733	0.5000	0.4333	0.8000	25.48%	0.00%	86/150	0.6300	0.00%
0.32		5	0.6867	0.7000	0.5333	0.9000	22.92%	-19.77%	103/150	0.6300	0.00%
1		5	0.5163	0.5000	0.4483	0.6333	14.15%	9.94%	77/149	0.6054	3.90%
3.2		5	0.6200	0.6667	0.4667	0.7667	21.03%	-8.14%	93/150	0.6054	3.90%
10		5	0.6800	0.7000	0.6000	0.7667	9.56%	-18.60%	102/150	0.6054	3.90%
32		5	0.4200	0.4000	0.3333	0.5000	18.27%	26.74%	63/150	0.4200	33.33%
56		5	0.3467	0.3333	0.3333	0.3667	5.27%	39.53%	52/150	0.3467	44.97%
100		5	0.2800	0.2333	0.2000	0.4000	29.88%	51.16%	42/150	0.2800	55.56%

## 23-d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.5000	0.8000	0.5000	0.6333	0.4333
0.32		0.5333	0.5333	0.7000	0.7667	0.9000
1		0.5000	0.4483	0.5333	0.6333	0.4667
3.2		0.5000	0.7000	0.7667	0.6667	0.4667
10		0.7000	0.7000	0.7667	0.6000	0.6333
32		0.3333	0.4000	0.5000	0.3667	0.5000
56		0.3333	0.3667	0.3333	0.3667	0.3333
100		0.2000	0.3333	0.2333	0.2333	0.4000



# CETIS Analytical Report

Report Date: 30 Aug-22 13:23 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

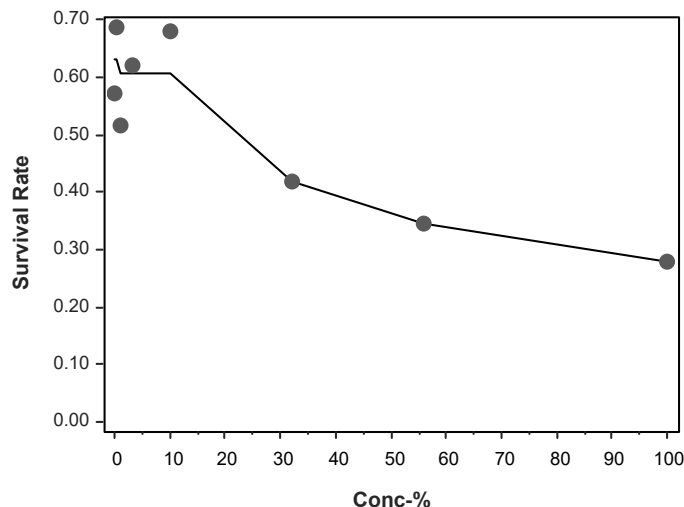
Nautilus Environmental Calgary

Analysis ID: 05-7179-5891      Endpoint: 23-d Survival Rate      CETIS Version: CETISv2.1.0  
Analyzed: 30 Aug-22 13:22      Analysis: Linear Interpolation (ICPIN)      Status Level: 1  
Edit Date: 30 Aug-22 13:19      MD5 Hash: 2D78DA619EBDC4867C72FA3CB2B83BAC      Editor ID: 003-581-756-9

### 23-d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	15/30	24/30	15/30	19/30	13/30
0.32		16/30	16/30	21/30	23/30	27/30
1		15/30	13/29	16/30	19/30	14/30
3.2		15/30	21/30	23/30	20/30	14/30
10		21/30	21/30	23/30	18/30	19/30
32		10/30	12/30	15/30	11/30	15/30
56		10/30	11/30	10/30	11/30	10/30
100		6/30	10/30	7/30	7/30	12/30

### Graphics





# CETIS Summary Report

Report Date: 30 Aug-22 13:54 (p 1 of 1)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test					Nautilus Environmental Calgary	
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water	
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:		
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004	
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW	
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd			

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
12-7426-2061	Survival Rate	Trimmed Spearman-Kärber		LC50	73.76	38.93	139.8	1.356	1

23-d Survival Rate Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.5733	0.3920	0.7547	0.4333	0.8000	0.0653	0.1461	25.48%	0.00%
0.32		5	0.6867	0.4912	0.8821	0.5333	0.9000	0.0704	0.1574	22.92%	-19.77%
1		5	0.5163	0.4256	0.6070	0.4483	0.6333	0.0327	0.0731	14.15%	9.94%
3.2		5	0.6200	0.4581	0.7819	0.4667	0.7667	0.0583	0.1304	21.03%	-8.14%
10		5	0.6800	0.5993	0.7607	0.6000	0.7667	0.0291	0.0650	9.56%	-18.60%
32		5	0.4200	0.3247	0.5153	0.3333	0.5000	0.0343	0.0767	18.27%	26.74%
56		5	0.3467	0.3240	0.3693	0.3333	0.3667	0.0082	0.0183	5.27%	39.53%
100		5	0.2800	0.1761	0.3839	0.2000	0.4000	0.0374	0.0837	29.88%	51.16%

23-d Survival Rate							MD5: 2D78DA619EBDC4867C72FA3CB2B83BAC				
Detail Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.5000	0.8000	0.5000	0.6333	0.4333					
0.32		0.5333	0.5333	0.7000	0.7667	0.9000					
1		0.5000	0.4483	0.5333	0.6333	0.4667					
3.2		0.5000	0.7000	0.7667	0.6667	0.4667					
10		0.7000	0.7000	0.7667	0.6000	0.6333					
32		0.3333	0.4000	0.5000	0.3667	0.5000					
56		0.3333	0.3667	0.3333	0.3667	0.3333					
100		0.2000	0.3333	0.2333	0.2333	0.4000					

23-d Survival Rate Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	15/30	24/30	15/30	19/30	13/30
0.32		16/30	16/30	21/30	23/30	27/30
1		15/30	13/29	16/30	19/30	14/30
3.2		15/30	21/30	23/30	20/30	14/30
10		21/30	21/30	23/30	18/30	19/30
32		10/30	12/30	15/30	11/30	15/30
56		10/30	11/30	10/30	11/30	10/30
100		6/30	10/30	7/30	7/30	12/30



## CETIS Analytical Report

Report Date: 30 Aug-22 13:30 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 04-7445-0664	<b>Endpoint:</b> 30-d Survival Rate	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:30	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Edit Date:</b> 30 Aug-22 13:19	<b>MD5 Hash:</b> 107AB50D92DF730CFF97EDF934B16D9D	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 19-3129-9634	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 05 May-22	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 05 Jun-22	<b>Species:</b> Sander vitreus	<b>Brine:</b>
<b>Test Length:</b> 31d 0h	<b>Taxon:</b>	<b>Source:</b> <b>Age:</b>
<b>Sample ID:</b> 05-1550-6252	<b>Code:</b> PJ2122-004 WA	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 27 Apr-22	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 28 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 8d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0.8667	9.52%	1.319	0.01804	20.85	19.19	22.66	4.796	4.413	5.211

## 30-d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.1333	0.0333	0.0333	0.3667	111.80%	0.00%	20/150	0.1400	0.00%
0.32		5	0.1467	0.1333	0.0000	0.3000	76.40%	-10.00%	22/150	0.1400	0.00%
1		5	0.1140	0.1000	0.0333	0.2667	78.89%	14.48%	17/149	0.1269	9.36%
3.2		5	0.1133	0.1333	0.0000	0.2667	92.07%	15.00%	17/150	0.1269	9.36%
10		5	0.1533	0.1000	0.0000	0.3000	82.21%	-15.00%	23/150	0.1269	9.36%
32		5	0.0333	0.0333	0.0000	0.0667	70.71%	75.00%	5/150	0.0333	76.19%
56		5	0.0067	0.0000	0.0000	0.0333	223.61%	95.00%	1/150	0.0133	90.48%
100		5	0.0200	0.0000	0.0000	0.0667	149.07%	85.00%	3/150	0.0133	90.48%

## 30-d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.0333	0.3667	0.0333	0.2000	0.0333
0.32		0.0000	0.1000	0.1333	0.2000	0.3000
1		0.0667	0.1034	0.1000	0.2667	0.0333
3.2		0.0000	0.2667	0.0333	0.1333	0.1333
10		0.1000	0.0000	0.3000	0.2667	0.1000
32		0.0333	0.0333	0.0000	0.0667	0.0333
56		0.0000	0.0333	0.0000	0.0000	0.0000
100		0.0000	0.0333	0.0667	0.0000	0.0000

## 30-d Survival Rate Binomials

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/30	11/30	1/30	6/30	1/30
0.32		0/30	3/30	4/30	6/30	9/30
1		2/30	3/29	3/30	8/30	1/30
3.2		0/30	8/30	1/30	4/30	4/30
10		3/30	0/30	9/30	8/30	3/30
32		1/30	1/30	0/30	2/30	1/30
56		0/30	1/30	0/30	0/30	0/30
100		0/30	1/30	2/30	0/30	0/30

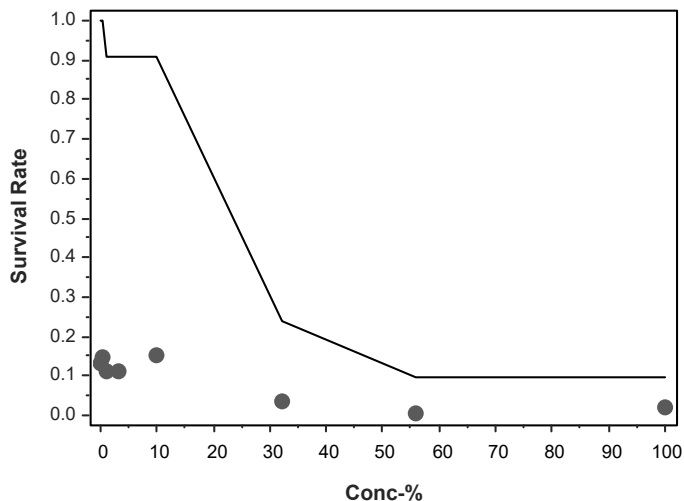


# CETIS Analytical Report

Report Date: 30 Aug-22 13:30 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	04-7445-0664	Endpoint:	30-d Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:30	Analysis:	Trimmed Spearman-Kärber	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	107AB50D92DF730CFF97EDF934B16D9D	Editor ID:	003-581-756-9

## Graphics





## CETIS Analytical Report

Report Date: 30 Aug-22 13:29 (p 1 of 2)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	08-0469-4513	Endpoint:	30-d Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:29	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	107AB50D92DF730CFF97EDF934B16D9D	Editor ID:	003-581-756-9
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	28301	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	10.12	---	12.91	9.882	7.748	---
LC15	11.07	---	14.11	9.032	7.088	---
LC20	12.11	---	15.41	8.261	6.488	---
LC25	13.23	---	16.83	7.56	5.942	---
LC40	17.21	---	21.86	5.812	4.574	---
LC50	20.46	---	27.24	4.888	3.671	---

## 30-d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.1333	0.0333	0.0333	0.3667	111.80%	0.00%	20/150	0.1400	0.00%
0.32		5	0.1467	0.1333	0.0000	0.3000	76.40%	-10.00%	22/150	0.1400	0.00%
1		5	0.1140	0.1000	0.0333	0.2667	78.89%	14.48%	17/149	0.1269	9.36%
3.2		5	0.1133	0.1333	0.0000	0.2667	92.07%	15.00%	17/150	0.1269	9.36%
10		5	0.1533	0.1000	0.0000	0.3000	82.21%	-15.00%	23/150	0.1269	9.36%
32		5	0.0333	0.0333	0.0000	0.0667	70.71%	75.00%	5/150	0.0333	76.19%
56		5	0.0067	0.0000	0.0000	0.0333	223.61%	95.00%	1/150	0.0133	90.48%
100		5	0.0200	0.0000	0.0000	0.0667	149.07%	85.00%	3/150	0.0133	90.48%

## 30-d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.0333	0.3667	0.0333	0.2000	0.0333
0.32		0.0000	0.1000	0.1333	0.2000	0.3000
1		0.0667	0.1034	0.1000	0.2667	0.0333
3.2		0.0000	0.2667	0.0333	0.1333	0.1333
10		0.1000	0.0000	0.3000	0.2667	0.1000
32		0.0333	0.0333	0.0000	0.0667	0.0333
56		0.0000	0.0333	0.0000	0.0000	0.0000
100		0.0000	0.0333	0.0667	0.0000	0.0000



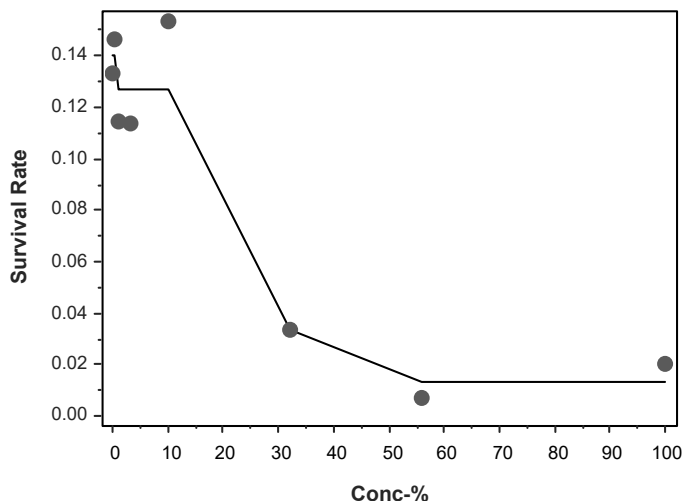
# CETIS Analytical Report

Report Date: 30 Aug-22 13:29 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	08-0469-4513	Endpoint:	30-d Survival Rate	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:29	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	107AB50D92DF730CFF97EDF934B16D9D	Editor ID:	003-581-756-9

30-d Survival Rate Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/30	11/30	1/30	6/30	1/30
0.32		0/30	3/30	4/30	6/30	9/30
1		2/30	3/29	3/30	8/30	1/30
3.2		0/30	8/30	1/30	4/30	4/30
10		3/30	0/30	9/30	8/30	3/30
32		1/30	1/30	0/30	2/30	1/30
56		0/30	1/30	0/30	0/30	0/30
100		0/30	1/30	2/30	0/30	0/30

## Graphics





# CETIS Summary Report

Report Date: 30 Aug-22 13:53 (p 1 of 1)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test					Nautilus Environmental Calgary	
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water	
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:		
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004	
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW	
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd			

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
04-7445-0664	Survival Rate	Trimmed Spearman-Kärber		LC50	20.85	19.19	22.66	4.796	1

30-d Survival Rate Summary											
Conc.-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1333	-0.0518	0.3184	0.0333	0.3667	0.0667	0.1491	111.80%	0.00%
0.32		5	0.1467	0.0075	0.2858	0.0000	0.3000	0.0501	0.1121	76.40%	-10.00%
1		5	0.1140	0.0023	0.2257	0.0333	0.2667	0.0402	0.0900	78.89%	14.48%
3.2		5	0.1133	-0.0162	0.2429	0.0000	0.2667	0.0467	0.1043	92.07%	15.00%
10		5	0.1533	-0.0032	0.3098	0.0000	0.3000	0.0564	0.1261	82.21%	-15.00%
32		5	0.0333	0.0041	0.0626	0.0000	0.0667	0.0105	0.0236	70.71%	75.00%
56		5	0.0067	-0.0118	0.0252	0.0000	0.0333	0.0067	0.0149	223.61%	95.00%
100		5	0.0200	-0.0170	0.0570	0.0000	0.0667	0.0133	0.0298	149.07%	85.00%

30-d Survival Rate Detail							MD5: 107AB50D92DF730CFF97EDF934B16D9D				
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.0333	0.3667	0.0333	0.2000	0.0333					
0.32		0.0000	0.1000	0.1333	0.2000	0.3000					
1		0.0667	0.1034	0.1000	0.2667	0.0333					
3.2		0.0000	0.2667	0.0333	0.1333	0.1333					
10		0.1000	0.0000	0.3000	0.2667	0.1000					
32		0.0333	0.0333	0.0000	0.0667	0.0333					
56		0.0000	0.0333	0.0000	0.0000	0.0000					
100		0.0000	0.0333	0.0667	0.0000	0.0000					

30-d Survival Rate Binomials											
Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	1/30	11/30	1/30	6/30	1/30					
0.32		0/30	3/30	4/30	6/30	9/30					
1		2/30	3/29	3/30	8/30	1/30					
3.2		0/30	8/30	1/30	4/30	4/30					
10		3/30	0/30	9/30	8/30	3/30					
32		1/30	1/30	0/30	2/30	1/30					
56		0/30	1/30	0/30	0/30	0/30					
100		0/30	1/30	2/30	0/30	0/30					



## CETIS Analytical Report

Report Date: 30 Aug-22 13:23 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b>	05-7179-5891	<b>Endpoint:</b>	23-d Survival Rate	<b>CETIS Version:</b>	CETISv2.1.0
<b>Analyzed:</b>	30 Aug-22 13:22	<b>Analysis:</b>	Linear Interpolation (ICPIN)	<b>Status Level:</b>	1
<b>Edit Date:</b>	30 Aug-22 13:19	<b>MD5 Hash:</b>	2D78DA619EBDC4867C72FA3CB2B83BAC	<b>Editor ID:</b>	003-581-756-9
<b>Batch ID:</b>	19-3129-9634	<b>Test Type:</b>	Survival-Development-Growth	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	05 May-22	<b>Protocol:</b>	ASTM E1241-05 (2013)	<b>Diluent:</b>	Dechlorinated Tap Water
<b>Ending Date:</b>	05 Jun-22	<b>Species:</b>	Sander vitreus	<b>Brine:</b>	
<b>Test Length:</b>	31d 0h	<b>Taxon:</b>		<b>Source:</b>	Age:
<b>Sample ID:</b>	05-1550-6252	<b>Code:</b>	PJ2122-004 WA	<b>Project:</b>	PJ2122-004
<b>Sample Date:</b>	27 Apr-22	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	28 Apr-22	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	8d 0h	<b>Client:</b>	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1160819	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	12.82	---	19.89	7.798	5.027	---
LC15	15.66	---	26.77	6.387	3.736	---
LC20	19.07	8.358	35.82	5.244	2.792	11.96
LC25	23.19	10.43	42.3	4.313	2.364	9.587
LC40	44.13	17.93	63.66	2.266	1.571	5.576
LC50	73.8	40.68	---	1.355	---	2.458

## 23-d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.5733	0.5000	0.4333	0.8000	25.48%	0.00%	86/150	0.6300	0.00%
0.32		5	0.6867	0.7000	0.5333	0.9000	22.92%	-19.77%	103/150	0.6300	0.00%
1		5	0.5163	0.5000	0.4483	0.6333	14.15%	9.94%	77/149	0.6054	3.90%
3.2		5	0.6200	0.6667	0.4667	0.7667	21.03%	-8.14%	93/150	0.6054	3.90%
10		5	0.6800	0.7000	0.6000	0.7667	9.56%	-18.60%	102/150	0.6054	3.90%
32		5	0.4200	0.4000	0.3333	0.5000	18.27%	26.74%	63/150	0.4200	33.33%
56		5	0.3467	0.3333	0.3333	0.3667	5.27%	39.53%	52/150	0.3467	44.97%
100		5	0.2800	0.2333	0.2000	0.4000	29.88%	51.16%	42/150	0.2800	55.56%

## 23-d Survival Rate Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.5000	0.8000	0.5000	0.6333	0.4333
0.32		0.5333	0.5333	0.7000	0.7667	0.9000
1		0.5000	0.4483	0.5333	0.6333	0.4667
3.2		0.5000	0.7000	0.7667	0.6667	0.4667
10		0.7000	0.7000	0.7667	0.6000	0.6333
32		0.3333	0.4000	0.5000	0.3667	0.5000
56		0.3333	0.3667	0.3333	0.3667	0.3333
100		0.2000	0.3333	0.2333	0.2333	0.4000



# CETIS Analytical Report

Report Date: 30 Aug-22 13:23 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

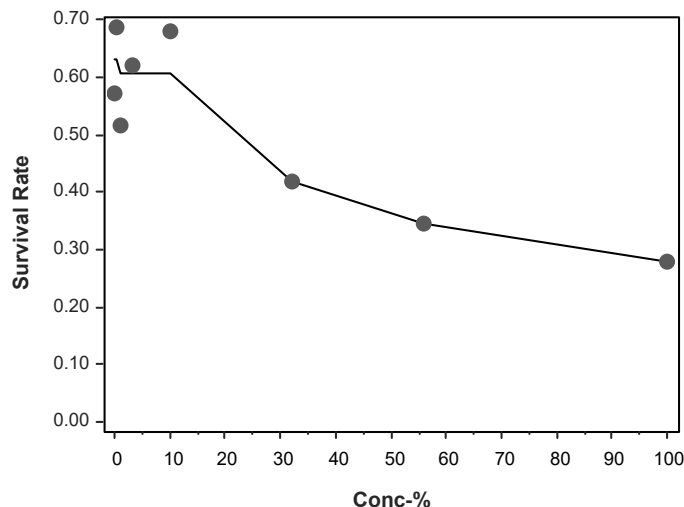
Nautilus Environmental Calgary

Analysis ID: 05-7179-5891      Endpoint: 23-d Survival Rate      CETIS Version: CETISv2.1.0  
Analyzed: 30 Aug-22 13:22      Analysis: Linear Interpolation (ICPIN)      Status Level: 1  
Edit Date: 30 Aug-22 13:19      MD5 Hash: 2D78DA619EBDC4867C72FA3CB2B83BAC      Editor ID: 003-581-756-9

### 23-d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	15/30	24/30	15/30	19/30	13/30
0.32		16/30	16/30	21/30	23/30	27/30
1		15/30	13/29	16/30	19/30	14/30
3.2		15/30	21/30	23/30	20/30	14/30
10		21/30	21/30	23/30	18/30	19/30
32		10/30	12/30	15/30	11/30	15/30
56		10/30	11/30	10/30	11/30	10/30
100		6/30	10/30	7/30	7/30	12/30

### Graphics





## CETIS Summary Report

Report Date: 30 Aug-22 13:27 (p 1 of 1)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR
				Age:	
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
21-3124-3353	Post Hatch Survival	Linear Interpolation (ICPIN)		LC10	14.43	9.509	15.71	6.929	1
				LC15	17.28	12.43	19.58	5.788	
				LC20	20.65	15.66	24.34	4.843	
				LC25	24.64	18.77	30.18	4.058	
				LC40	46.54	31.21	114.8	2.149	
				LC50	>100	---	---	<1	

## 23-d Post Hatch Survival Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.7623	0.6622	0.8625	0.6818	0.8571	0.0361	0.0807	10.58%	0.00%
0.32		5	0.8363	0.7038	0.9688	0.6957	0.9643	0.0477	0.1067	12.76%	-9.70%
1		5	0.7631	0.6580	0.8682	0.6818	0.9048	0.0379	0.0846	11.09%	-0.10%
3.2		5	0.8088	0.6021	1.0150	0.6250	0.9583	0.0744	0.1664	20.58%	-6.09%
10		5	0.8712	0.7868	0.9557	0.7917	0.9583	0.0304	0.0680	7.80%	-14.29%
32		5	0.5447	0.4736	0.6159	0.4762	0.6250	0.0256	0.0573	10.52%	28.54%
56		5	0.4651	0.3621	0.5681	0.3704	0.5789	0.0371	0.0829	17.83%	38.99%
100		5	0.4065	0.2669	0.5461	0.3182	0.5714	0.0503	0.1124	27.66%	46.68%

## 23-d Post Hatch Survival Detail

MD5: 555D1C2ABAFD72ED0D24F360B8D98C93

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.6818	0.8571	0.6818	0.8261	0.7647
0.32		0.6957	0.7619	0.8750	0.8846	0.9643
1		0.6818	0.7647	0.7273	0.9048	0.7368
3.2		0.6250	0.9545	0.9583	0.8696	0.6364
10		0.8750	0.9130	0.9583	0.8182	0.7917
32		0.4762	0.5217	0.6250	0.5238	0.5769
56		0.4762	0.5789	0.4000	0.5000	0.3704
100		0.3333	0.4762	0.3333	0.3182	0.5714

## 23-d Post Hatch Survival Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	15/22	24/28	15/22	19/23	13/17
0.32		16/23	16/21	21/24	23/26	27/28
1		15/22	13/17	16/22	19/21	14/19
3.2		15/24	21/22	23/24	20/23	14/22
10		21/24	21/23	23/24	18/22	19/24
32		10/21	12/23	15/24	11/21	15/26
56		10/21	11/19	10/25	11/22	10/27
100		6/18	10/21	7/21	7/22	12/21



## CETIS Analytical Report

Report Date: 30 Aug-22 13:32 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 17-5700-7248	<b>Endpoint:</b> 30-d Post Hatch Survival	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 30 Aug-22 13:31	<b>Analysis:</b> Trimmed Spearman-Kärber	<b>Status Level:</b> 1
<b>Edit Date:</b> 30 Aug-22 13:19	<b>MD5 Hash:</b> 536D4723FAE5A2B2F48F85B84657071C	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 19-3129-9634	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 05 May-22	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 05 Jun-22	<b>Species:</b> Sander vitreus	<b>Brine:</b>
<b>Test Length:</b> 31d 0h	<b>Taxon:</b>	<b>Source:</b> <b>Age:</b>
<b>Sample ID:</b> 05-1550-6252	<b>Code:</b> PJ2122-004 WA	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 27 Apr-22	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 28 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 8d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Trimmed Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	LC50	95% LCL	95% UCL	TU	95% LCL	95% UCL
Control Threshold	0.8214	10.56%	1.334	0.02025	21.6	19.68	23.71	4.63	4.217	5.082

30-d Post Hatch Survival Summary			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.1607	0.0588	0.0455	0.3929	98.82%	0.00%	20/112	0.1701	0.00%
0.32		5	0.1723	0.1667	0.0000	0.3214	68.80%	-7.25%	22/122	0.1701	0.00%
1		5	0.1675	0.1364	0.0526	0.3810	76.51%	-4.22%	17/101	0.1701	0.00%
3.2		5	0.1522	0.1739	0.0000	0.3636	93.74%	5.28%	17/115	0.1701	0.00%
10		5	0.1977	0.1250	0.0000	0.3750	83.34%	-23.05%	23/117	0.1701	0.00%
32		5	0.0450	0.0435	0.0000	0.0952	75.43%	72.02%	5/115	0.0450	73.57%
56		5	0.0105	0.0000	0.0000	0.0526	223.61%	93.45%	1/114	0.0196	88.51%
100		5	0.0286	0.0000	0.0000	0.0952	149.07%	82.22%	3/103	0.0196	88.51%

## 30-d Post Hatch Survival Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.0455	0.3929	0.0455	0.2609	0.0588
0.32		0.0000	0.1429	0.1667	0.2308	0.3214
1		0.0909	0.1765	0.1364	0.3810	0.0526
3.2		0.0000	0.3636	0.0417	0.1739	0.1818
10		0.1250	0.0000	0.3750	0.3636	0.1250
32		0.0476	0.0435	0.0000	0.0952	0.0385
56		0.0000	0.0526	0.0000	0.0000	0.0000
100		0.0000	0.0476	0.0952	0.0000	0.0000

## 30-d Post Hatch Survival Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/22	11/28	1/22	6/23	1/17
0.32		0/23	3/21	4/24	6/26	9/28
1		2/22	3/17	3/22	8/21	1/19
3.2		0/24	8/22	1/24	4/23	4/22
10		3/24	0/23	9/24	8/22	3/24
32		1/21	1/23	0/24	2/21	1/26
56		0/21	1/19	0/25	0/22	0/27
100		0/18	1/21	2/21	0/22	0/21

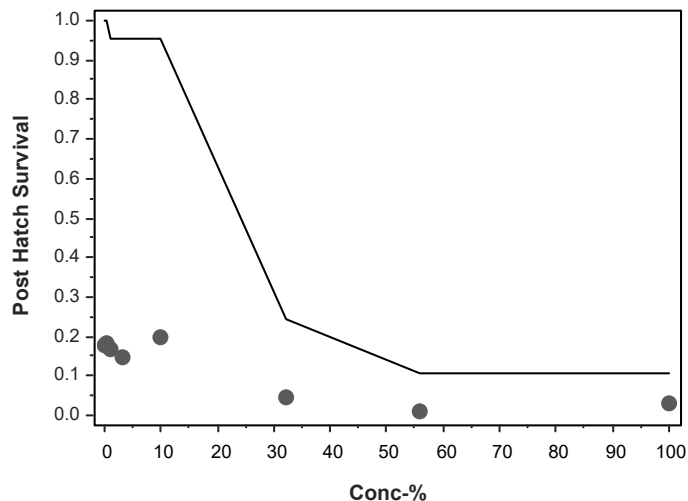


# CETIS Analytical Report

Report Date: 30 Aug-22 13:32 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	17-5700-7248	Endpoint:	30-d Post Hatch Survival	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:31	Analysis:	Trimmed Spearman-Kärber	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	536D4723FAE5A2B2F48F85B84657071C	Editor ID:	003-581-756-9

## Graphics





## CETIS Analytical Report

Report Date: 30 Aug-22 13:31 (p 1 of 2)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	14-0051-3305	Endpoint:	30-d Post Hatch Survival	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:31	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	536D4723FAE5A2B2F48F85B84657071C	Editor ID:	003-581-756-9
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	509644	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC10	10.93	---	12.62	9.15	7.921	---
LC15	11.89	---	13.9	8.412	7.195	---
LC20	12.92	---	15.29	7.737	6.539	---
LC25	14.04	---	16.82	7.12	5.947	---
LC40	17.97	---	22.29	5.563	4.487	---
LC50	21.15	---	27.26	4.728	3.669	---

## 30-d Post Hatch Survival Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	N	5	0.1607	0.0588	0.0455	0.3929	98.82%	0.00%	20/112	0.1701	0.00%
0.32		5	0.1723	0.1667	0.0000	0.3214	68.80%	-7.25%	22/122	0.1701	0.00%
1		5	0.1675	0.1364	0.0526	0.3810	76.51%	-4.22%	17/101	0.1701	0.00%
3.2		5	0.1522	0.1739	0.0000	0.3636	93.74%	5.28%	17/115	0.1701	0.00%
10		5	0.1977	0.1250	0.0000	0.3750	83.34%	-23.05%	23/117	0.1701	0.00%
32		5	0.0450	0.0435	0.0000	0.0952	75.43%	72.02%	5/115	0.0450	73.57%
56		5	0.0105	0.0000	0.0000	0.0526	223.61%	93.45%	1/114	0.0196	88.51%
100		5	0.0286	0.0000	0.0000	0.0952	149.07%	82.22%	3/103	0.0196	88.51%

## 30-d Post Hatch Survival Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.0455	0.3929	0.0455	0.2609	0.0588
0.32		0.0000	0.1429	0.1667	0.2308	0.3214
1		0.0909	0.1765	0.1364	0.3810	0.0526
3.2		0.0000	0.3636	0.0417	0.1739	0.1818
10		0.1250	0.0000	0.3750	0.3636	0.1250
32		0.0476	0.0435	0.0000	0.0952	0.0385
56		0.0000	0.0526	0.0000	0.0000	0.0000
100		0.0000	0.0476	0.0952	0.0000	0.0000

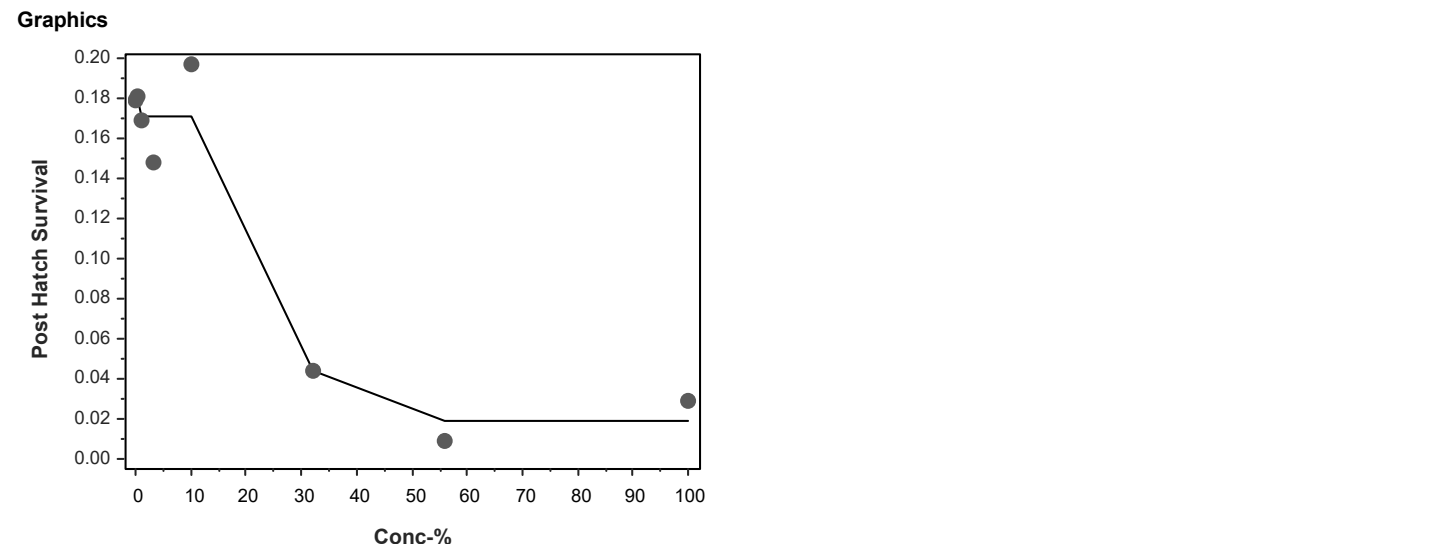


# CETIS Analytical Report

Report Date: 30 Aug-22 13:31 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	14-0051-3305	Endpoint:	30-d Post Hatch Survival	CETIS Version:	CETISv2.1.0
Analyzed:	30 Aug-22 13:31	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	536D4723FAE5A2B2F48F85B84657071C	Editor ID:	003-581-756-9

30-d Post Hatch Survival Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/22	11/28	1/22	6/23	1/17
0.32		0/23	3/21	4/24	6/26	9/28
1		2/22	3/17	3/22	8/21	1/19
3.2		0/24	8/22	1/24	4/23	4/22
10		3/24	0/23	9/24	8/22	3/24
32		1/21	1/23	0/24	2/21	1/26
56		0/21	1/19	0/25	0/22	0/27
100		0/18	1/21	2/21	0/22	0/21





# CETIS Summary Report

Report Date: 30 Aug-22 13:52 (p 1 of 1)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test					Nautilus Environmental Calgary	
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer	
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water	
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:		
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004	
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd	
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW	
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd			

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
17-5700-7248	Post Hatch Survival	Trimmed Spearman-Kärber		LC50	21.6	19.68	23.71	4.63	1

30-d Post Hatch Survival Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.1607	-0.0365	0.3579	0.0455	0.3929	0.0710	0.1588	98.82%	0.00%
0.32		5	0.1723	0.0251	0.3196	0.0000	0.3214	0.0530	0.1186	68.80%	-7.25%
1		5	0.1675	0.0084	0.3266	0.0526	0.3810	0.0573	0.1281	76.51%	-4.22%
3.2		5	0.1522	-0.0250	0.3294	0.0000	0.3636	0.0638	0.1427	93.74%	5.28%
10		5	0.1977	-0.0069	0.4023	0.0000	0.3750	0.0737	0.1648	83.34%	-23.05%
32		5	0.0450	0.0028	0.0871	0.0000	0.0952	0.0152	0.0339	75.43%	72.02%
56		5	0.0105	-0.0187	0.0398	0.0000	0.0526	0.0105	0.0235	223.61%	93.45%
100		5	0.0286	-0.0243	0.0815	0.0000	0.0952	0.0191	0.0426	149.07%	82.22%

30-d Post Hatch Survival Detail							MD5: 536D4723FAE5A2B2F48F85B84657071C				
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.0455	0.3929	0.0455	0.2609	0.0588					
0.32		0.0000	0.1429	0.1667	0.2308	0.3214					
1		0.0909	0.1765	0.1364	0.3810	0.0526					
3.2		0.0000	0.3636	0.0417	0.1739	0.1818					
10		0.1250	0.0000	0.3750	0.3636	0.1250					
32		0.0476	0.0435	0.0000	0.0952	0.0385					
56		0.0000	0.0526	0.0000	0.0000	0.0000					
100		0.0000	0.0476	0.0952	0.0000	0.0000					

30-d Post Hatch Survival Binomials						
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/22	11/28	1/22	6/23	1/17
0.32		0/23	3/21	4/24	6/26	9/28
1		2/22	3/17	3/22	8/21	1/19
3.2		0/24	8/22	1/24	4/23	4/22
10		3/24	0/23	9/24	8/22	3/24
32		1/21	1/23	0/24	2/21	1/26
56		0/21	1/19	0/25	0/22	0/27
100		0/18	1/21	2/21	0/22	0/21



## CETIS Analytical Report

Report Date: 31 Aug-22 17:17 (p 1 of 2)  
 Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	13-1259-7045	Endpoint:	Length	CETIS Version:	CETISv2.1.0
Analyzed:	31 Aug-22 17:17	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	CFB5B2ED3CF3C8D0F3A3C92E4D252D93	Editor ID:	003-581-756-9
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Age:
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	117783	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	>100	---	---	<1	---	---
IC15	>100	---	---	<1	---	---
IC20	>100	---	---	<1	---	---
IC25	>100	---	---	<1	---	---
IC40	>100	---	---	<1	---	---
IC50	>100	---	---	<1	---	---

Length Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	N	5	9.576	9.545	9	10	4.53%	0.00%	9.614	0.00%
0.32		4	9.5	9.5	9.333	9.667	1.43%	0.79%	9.614	0.00%
1		5	9.767	10	9.333	10	3.33%	-1.99%	9.614	0.00%
3.2		4	9.594	9.563	9.25	10	3.26%	-0.19%	9.594	0.21%
10		4	9.201	9.194	8.917	9.5	2.60%	3.91%	9.201	4.29%
32		4	9.125	9	9	9.5	2.74%	4.71%	9.125	5.09%
56		1	8	8	8	8	---	16.46%	8.688	9.64%
100		2	9.375	9.375	9	9.75	5.66%	2.10%	8.688	9.64%

## Length Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	9	9.545	10	9.333	10
0.32		9.667	9.5	9.5	9.333	
1		10	10	9.333	9.5	10
3.2		9.5	10	9.25	9.625	
10		8.917	9.222	9.5	9.167	
32		9.5	9	9	9	
56		8				
100		9	9.75			

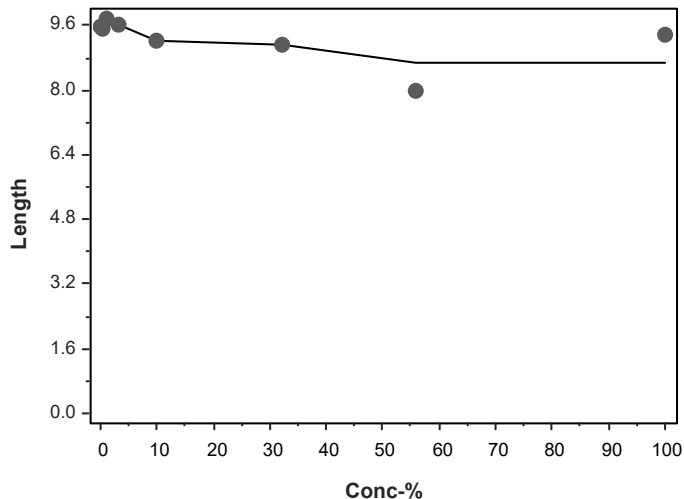


# CETIS Analytical Report

Report Date: 31 Aug-22 17:17 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Analysis ID:	13-1259-7045	Endpoint:	Length	CETIS Version:	CETISv2.1.0
Analyzed:	31 Aug-22 17:17	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	30 Aug-22 13:19	MD5 Hash:	CFB5B2ED3CF3C8D0F3A3C92E4D252D93	Editor ID:	003-581-756-9

## Graphics





## CETIS Summary Report

Report Date: 31 Aug-22 17:19 (p 1 of 1)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Batch ID:</b>	19-3129-9634	<b>Test Type:</b>	Survival-Development-Growth	<b>Analyst:</b>	Stephanie Schiffer
<b>Start Date:</b>	05 May-22	<b>Protocol:</b>	ASTM E1241-05 (2013)	<b>Diluent:</b>	Dechlorinated Tap Water
<b>Ending Date:</b>	05 Jun-22	<b>Species:</b>	Sander vitreus	<b>Brine:</b>	
<b>Test Length:</b>	31d 0h	<b>Taxon:</b>		<b>Source:</b>	Aquatox, AR
				<b>Age:</b>	
<b>Sample ID:</b>	05-1550-6252	<b>Code:</b>	PJ2122-004 WA	<b>Project:</b>	PJ2122-004
<b>Sample Date:</b>	27 Apr-22	<b>Material:</b>	Ambient Sample	<b>Source:</b>	Syncrude Canada Ltd
<b>Receipt Date:</b>	28 Apr-22	<b>CAS (PC):</b>		<b>Station:</b>	Treated OSPW
<b>Sample Age:</b>	8d 0h	<b>Client:</b>	Syncrude Canada Ltd		

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
13-1259-7045	Length	Linear Interpolation (ICPIN)		IC10	>100	---	---	<1	1
				IC15	>100	---	---	<1	
				IC20	>100	---	---	<1	
				IC25	>100	---	---	<1	
				IC40	>100	---	---	<1	
				IC50	>100	---	---	<1	

## Length Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	9.576	9.038	10.11	9	10	0.1938	0.4333	4.53%	0.00%
0.32		4	9.5	9.283	9.717	9.333	9.667	0.06804	0.1361	1.43%	0.79%
1		5	9.767	9.363	10.17	9.333	10	0.1453	0.3249	3.33%	-1.99%
3.2		4	9.594	9.096	10.09	9.25	10	0.1563	0.3125	3.26%	-0.19%
10		4	9.201	8.821	9.582	8.917	9.5	0.1197	0.2394	2.60%	3.91%
32		4	9.125	8.727	9.523	9	9.5	0.125	0.25	2.74%	4.71%
56		1	8	---	---	8	8	---	---	---	16.46%
100		2	9.375	4.61	14.14	9	9.75	0.375	0.5303	5.66%	2.10%

## Length Detail

MD5: DA3907C9E02A38822589BCBB2C8BD0F4

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	9	9.545	10	9.333	10
0.32		---	9.667	9.5	9.5	9.333
1		10	10	9.333	9.5	10
3.2		---	9.5	10	9.25	9.625
10		8.917	---	9.222	9.5	9.167
32		9.5	9	---	9	9
56		---	8	---	---	---
100		---	9	9.75	---	---



## CETIS Analytical Report

Report Date: 29 Aug-22 17:04 (p 1 of 2)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

<b>Analysis ID:</b> 09-5740-3999	<b>Endpoint:</b> Mean Dry Weight-mg	<b>CETIS Version:</b> CETISv2.1.0
<b>Analyzed:</b> 29 Aug-22 17:03	<b>Analysis:</b> Linear Interpolation (ICPIN)	<b>Status Level:</b> 1
<b>Edit Date:</b> 29 Aug-22 16:33	<b>MD5 Hash:</b> 2E10DD9A2EA9B710507D9F27148288A0	<b>Editor ID:</b> 003-581-756-9
<b>Batch ID:</b> 19-3129-9634	<b>Test Type:</b> Survival-Development-Growth	<b>Analyst:</b> Stephanie Schiffer
<b>Start Date:</b> 05 May-22	<b>Protocol:</b> ASTM E1241-05 (2013)	<b>Diluent:</b> Dechlorinated Tap Water
<b>Ending Date:</b> 05 Jun-22	<b>Species:</b> Sander vitreus	<b>Brine:</b>
<b>Test Length:</b> 31d 0h	<b>Taxon:</b>	<b>Source:</b> Aquatox, AR <b>Age:</b>
<b>Sample ID:</b> 05-1550-6252	<b>Code:</b> PJ2122-004 WA	<b>Project:</b> PJ2122-004
<b>Sample Date:</b> 27 Apr-22	<b>Material:</b> Ambient Sample	<b>Source:</b> Syncrude Canada Ltd
<b>Receipt Date:</b> 28 Apr-22	<b>CAS (PC):</b>	<b>Station:</b> Treated OSPW
<b>Sample Age:</b> 8d 0h	<b>Client:</b> Syncrude Canada Ltd	

## Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	654153	200	Yes	Two-Point Interpolation

## Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC10	44.77	25.68	---	2.234	---	3.894
IC15	52.89	32.21	---	1.891	---	3.104
IC20	>100	---	---	<1	---	---
IC25	>100	---	---	<1	---	---
IC40	>100	---	---	<1	---	---
IC50	>100	---	---	<1	---	---

## Mean Dry Weight-mg Summary

Mean Dry Weight-mg Summary			Calculated Variate						Isotonic Variate	
Conc.-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	N	4	0.3279	0.3367	0.27	0.3682	12.72%	0.00%	0.3497	0.00%
0.32		3	0.3634	0.3575	0.335	0.3978	8.75%	-10.84%	0.3497	0.00%
1		4	0.3227	0.3238	0.29	0.3533	8.08%	1.57%	0.3497	0.00%
3.2		3	0.3308	0.34	0.31	0.3425	5.47%	-0.90%	0.3497	0.00%
10		3	0.3634	0.3512	0.3156	0.4233	15.11%	-10.83%	0.3497	0.00%
32		4	0.39	0.385	0.36	0.43	7.55%	-18.95%	0.3497	0.00%
56		1	0.23	0.23	0.23	0.23	---	29.85%	0.2913	16.71%
100		2	0.3525	0.3525	0.3	0.405	21.06%	-7.51%	0.2913	16.71%

## Mean Dry Weight-mg Detail

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	0.27	0.3682	0.33	0.3433	
0.32		0.3575	0.335	0.3978		
1		0.29	0.3533	0.3275	0.32	
3.2		0.31	0.3425	0.34		
10		0.3156	0.3512	0.4233		
32		0.43	0.36	0.38	0.39	
56		0.23				
100		0.3	0.405			

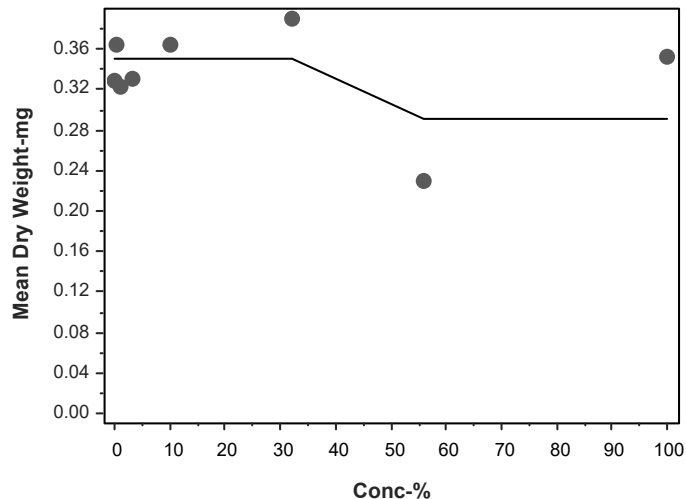


# CETIS Analytical Report

Report Date: 29 Aug-22 17:04 (p 2 of 2)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test			Nautilus Environmental Calgary	
Analysis ID:	09-5740-3999	Endpoint:	Mean Dry Weight-mg	CETIS Version: CETISv2.1.0
Analyzed:	29 Aug-22 17:03	Analysis:	Linear Interpolation (ICPIN)	Status Level: 1
Edit Date:	29 Aug-22 16:33	MD5 Hash:	2E10DD9A2EA9B710507D9F27148288A0	Editor ID: 003-581-756-9

## Graphics





# CETIS Summary Report

Report Date: 30 Aug-22 13:11 (p 1 of 1)  
Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

Walleye (Sander vitreus) 30-d survival and growth test				Nautilus Environmental Calgary	
Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR
Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

Point Estimate Summary									
Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
09-5740-3999	Mean Dry Weight-mg	Linear Interpolation (ICPIN)		IC10	44.77	25.68	---	2.234	1
				IC15	52.89	32.21	---	1.891	
				IC20	>100	---	---	<1	
				IC25	>100	---	---	<1	
				IC40	>100	---	---	<1	
				IC50	>100	---	---	<1	

Mean Dry Weight-mg Summary											
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	0.3279	0.2615	0.3942	0.27	0.3682	0.02085	0.04171	12.72%	0.00%
0.32		3	0.3634	0.2844	0.4424	0.335	0.3978	0.01836	0.03181	8.75%	-10.84%
1		4	0.3227	0.2812	0.3642	0.29	0.3533	0.01303	0.02606	8.08%	1.57%
3.2		3	0.3308	0.2859	0.3758	0.31	0.3425	0.01044	0.01809	5.47%	-0.90%
10		3	0.3634	0.227	0.4998	0.3156	0.4233	0.0317	0.05491	15.11%	-10.83%
32		4	0.39	0.3432	0.4369	0.36	0.43	0.01472	0.02944	7.55%	-18.95%
56		1	0.23	---	---	0.23	0.23	---	---	---	29.85%
100		2	0.3525	-0.3144	1.019	0.3	0.405	0.05249	0.07423	21.06%	-7.51%

Mean Dry Weight-mg Detail							MD5: 2E10DD9A2EA9B710507D9F27148288A0				
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5					
0	N	0.27	0.3682	0.33	0.3433	---					
0.32		---	---	0.3575	0.335	0.3978					
1		---	0.29	0.3533	0.3275	0.32					
3.2		---	0.31	---	0.3425	0.34					
10		---	0.3156	0.3512	0.4233	---					
32		0.43	0.36	---	0.38	0.39					
56		---	0.23	---	---	---					
100		---	0.3	0.405	---	---					



## CETIS Summary Report

Report Date: 31 Aug-22 17:24 (p 1 of 1)

Test Code/ID: PJ2122-004 WA-E / 15-7695-4515

## Walleye (Sander vitreus) 30-d survival and growth test

Nautilus Environmental Calgary

Batch ID:	19-3129-9634	Test Type:	Survival-Development-Growth	Analyst:	Stephanie Schiffer
Start Date:	05 May-22	Protocol:	ASTM E1241-05 (2013)	Diluent:	Dechlorinated Tap Water
Ending Date:	05 Jun-22	Species:	Sander vitreus	Brine:	
Test Length:	31d 0h	Taxon:		Source:	Aquatox, AR
				Age:	

Sample ID:	05-1550-6252	Code:	PJ2122-004 WA	Project:	PJ2122-004
Sample Date:	27 Apr-22	Material:	Ambient Sample	Source:	Syncrude Canada Ltd
Receipt Date:	28 Apr-22	CAS (PC):		Station:	Treated OSPW
Sample Age:	8d 0h	Client:	Syncrude Canada Ltd		

## Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
02-3369-4738	Proportion Normal	Linear Interpolation (ICPIN)		LC10	>100	---	---	<1	1
				LC15	>100	---	---	<1	
				LC20	>100	---	---	<1	
				LC25	>100	---	---	<1	
				LC40	>100	---	---	<1	
				LC50	>100	---	---	<1	

## Proportion Normal Summary

Conc.-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	5	0.9818	0.9313	1.0320	0.9091	1.0000	0.0182	0.0407	4.14%	0.00%
0.32		4	0.8125	0.5860	1.0390	0.6667	1.0000	0.0712	0.1423	17.52%	17.25%
1		5	0.8750	0.6062	1.1440	0.5000	1.0000	0.0968	0.2165	24.74%	10.88%
3.2		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.85%
10		4	0.7500	-0.0456	1.5460	0.0000	1.0000	0.2500	0.5000	66.67%	23.61%
32		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.85%
56		1	1.0000	---	---	1.0000	1.0000	---	---	---	-1.85%
100		2	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000		-1.85%

## Proportion Normal Detail

MD5: 2BD20E8C234616DA15DCCA89315930C8

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1.0000	0.9091	1.0000	1.0000	1.0000
0.32		---	1.0000	0.7500	0.8333	0.6667
1		0.5000	1.0000	1.0000	0.8750	1.0000
3.2		---	1.0000	1.0000	1.0000	1.0000
10		0.0000	---	1.0000	1.0000	1.0000
32		1.0000	1.0000	---	1.0000	1.0000
56		---	1.0000	---	---	---
100		---	1.0000	1.0000	---	---

## Proportion Normal Binomials

Conc.-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	N	1/1	10/11	1/1	6/6	1/1
0.32		---	3/3	3/4	5/6	6/9
1		1/2	3/3	3/3	7/8	1/1
3.2		---	8/8	1/1	4/4	4/4
10		0/3	---	9/9	8/8	3/3
32		1/1	1/1	---	2/2	1/1
56		---	1/1	---	---	---
100		---	1/1	2/2	---	---



**End of Report**



**End of Report**



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## **Appendix A3**

### **Biological Effects Assessment (Mesocosm Study): Supporting Data**

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## **Appendix A3.1**

### **Mesocosm Stir-Motor and Water Velocity Calibration Records**

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**Table A3.1      Mesocsom Stir motor control amperage and voltage setting and corresponding measured stream water velocities.**

Date	Table 1			Table 2			Table 3			Table 4			Table 5			Table 6			Table 7			Table 8		
	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)
2021-09-04	0.24	10	-	0.25	10.6	-	0.24	10	-	0.26	10.5	-	0.29	10	-	0.24	10	-	0.24	10	-	0.4	16	-
	0.24	10	-	0.25	10.6	-	0.24	10	-	0.26	10.5	-	0.29	10	-	0.24	10	-	0.24	10	-	0.4	16	-
	0.24	10	-	0.25	10.6	-	0.24	10	-	0.26	10.5	-	0.29	10	-	0.24	10	-	0.24	10	-	0.4	16	-
	0.24	10	-	0.25	10.6	-	0.24	10	-	0.26	10.5	-	0.29	10	-	0.24	10	-	0.24	10	-	0.4	16	-
2021-09-05	0.22	10	7	0.24	10.5	9	0.22	10	9	0.24	10.5	12	0.218	10	9	0.23	10	10	0.22	10.5	10	0.24	9.5	8
	0.22	10	8	0.24	10.5	7	0.22	10	8	0.24	10.5	8	0.218	10	10	0.23	10	9	0.22	10.5	6	0.24	9.5	10
	0.22	10	7	0.24	10.5	11	0.22	10	7	0.24	10.5	6	0.218	10	8	0.23	10	11	0.22	10.5	12	0.24	9.5	9
	0.22	10	8	0.24	10.5	8	0.22	10	12	0.24	10.5	14	0.218	10	11	0.23	10	7	0.22	10.5	9	0.24	9.5	7
2021-09-06	0.24	11	-	0.23	10.5	-	0.22	11	-	0.24	10.5	-	0.22	10.5	-	0.22	10	-	0.24	11	-	0.24	10.6	-
	0.24	11	-	0.23	10.5	-	0.22	11	-	0.24	10.5	-	0.22	10.5	-	0.22	10	-	0.24	11	-	0.24	10.6	-
	0.24	11	-	0.23	10.5	-	0.22	11	-	0.24	10.5	-	0.22	10.5	-	0.22	10	-	0.24	11	-	0.24	10.6	-
	0.24	11	-	0.23	10.5	-	0.22	11	-	0.24	10.5	-	0.22	10.5	-	0.22	10	-	0.24	11	-	0.24	10.6	-
2021-09-07	0.23	11	10	0.24	10.5	6	0.22	10	7	0.25	10.5	10	0.22	10	9	0.23	10	9	0.24	11	10	0.3	15	11
	0.23	11	9	0.24	10.5	8	0.22	10	10	0.25	10.5	9	0.22	10	11	0.23	10	7	0.24	11	10	0.3	15	10
	0.23	11	8	0.24	10.5	11	0.22	10	8	0.25	10.5	9	0.22	10	7	0.23	10	6	0.24	11	10	0.3	15	7
	0.23	11	9	0.24	10.5	10	0.22	10	8	0.25	10.5	12	0.22	10	7	0.23	10	7	0.24	11	6	0.3	15	6
2021-09-08	0.225	11	-	0.24	10.5	-	0.22	10	-	0.24	10.5	-	0.22	10	-	0.21	10	-	0.22	10.5	-	0.24	10	-
	0.225	11	-	0.24	10.5	-	0.22	10	-	0.24	10.5	-	0.22	10	-	0.21	10	-	0.22	10.5	-	0.24	10	-
	0.225	11	-	0.24	10.5	-	0.22	10	-	0.24	10.5	-	0.22	10	-	0.21	10	-	0.22	10.5	-	0.24	10	-
	0.225	11	-	0.24	10.5	-	0.22	10	-	0.24	10.5	-	0.22	10	-	0.21	10	-	0.22	10.5	-	0.24	10	-
2021-09-09	0.225	11	8	0.24	10.5	7	0.22	10.5	8	0.24	10.5	10	0.22	10.5	9	0.22	10	8	0.22	10	11	0.24	10	8
	0.225	11	8	0.24	10.5	6	0.22	10.5	9	0.24	10.5	7	0.22	10.5	9	0.22	10	7	0.22	10	8	0.24	10	9
	0.225	11	8	0.24	10.5	6	0.22	10.5	8	0.24	10.5	11	0.22	10.5	8	0.22	10	12	0.22	10	9	0.24	10	7
	0.225	11	12	0.24	10.5	10	0.22	10.5	12	0.24	10.5	11	0.22	10.5	7	0.22	10	5	0.22	10	6	0.24	10	10
2021-09-10	0.25	11	-	0.24	10.6	-	0.25	11	-	0.25	10.5	-	0.25	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.25	11	-	0.24	10.6	-	0.25	11	-	0.25	10.5	-	0.25	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.25	11	-	0.24	10.6	-	0.25	11	-	0.25	10.5	-	0.25	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.25	11	-	0.24	10.6	-	0.25	11	-	0.25	10.5	-	0.25	10	-	0.24	10	-	0.25	10	-	0.25	10	-
2021-09-11	0.26	11	8	0.24	10.6	7	0.25	10	11	0.25	10.5	8	0.24	10	9	0.25	10	11	0.25	10	11	0.24	10	8
	0.26	11	8	0.24	10.6	10	0.25	10	12	0.25	10.5	8	0.24	10	8	0.25	10	7	0.25	10	9	0.24	10	10
	0.26	11	7	0.24	10.6	9	0.25	10	8	0.25	10.5	9	0.24	10	8	0.25	10	8	0.25	10	10	0.24	10	6
	0.26	11	11	0.24	10.6	9	0.25	10	12	0.25	10.5	10	0.24	10	9	0.25	10	6	0.25	10	6	0.24	10	7
2021-09-12	0.24	10	-	0.24	10.5	-	0.25	11	-	0.24	10.5	-	0.24	10	-	0.24	10	-	0.25	11	-	0.24	10	-
	0.24	10	-	0.24	10.5	-	0.25	11	-	0.24	10.5	-	0.24	10	-	0.24	10	-	0.25	11	-	0.24	10	-
	0.24	10	-	0.24	10.5	-	0.25	11	-	0.24	10.5	-	0.24	10	-	0.24	10	-	0.25	11	-	0.24	10	-
	0.24	10	-	0.24	10.5	-	0.25	11	-	0.24	10.5	-	0.24	10	-	0.24	10	-	0.25	11	-	0.24	10	-
2021-09-13	0.24	10.5	7	0.24	10.6	10	0.25	11	7	0.25	10.5	7	0.24	10	8	0.24	10	9	0.25	10.5	11	0.24	10	7
	0.24	10.5	6	0.24	10.6	9	0.25	11	9	0.25	10.5	7	0.24	10	10	0.24	10	8	0.25	10.5	9	0.24	10	7
	0.24	10.5	7	0.24	10.6	10	0.25	11	8	0.25	10.5	13	0.24	10	9	0.24	10	13	0.25	10.5	8	0.24	10	13
	0.24	10.5	6	0.24	10.6	7	0.25	11	9	0.25	10.5	8	0.24	10	11	0.24	10	6	0.25	10.5	6	0.24	10	8
2021-09-14	0.22	10.5	-	0.25	10.6	-	0.23	10.5	-	0.25	10.5	-	0.22	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.22	10.5	-	0.25	10.6	-	0.23	10.5	-	0.25	10.5	-	0.22	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.22	10.5	-	0.25	10.6	-	0.23	10.5	-	0.25	10.5	-	0.22	10	-	0.24	10	-	0.25	10	-	0.25	10	-
	0.22	10.5	-	0.25	10.6	-	0.23	10.5	-	0.25	10.5	-	0.22	10	-	0.24	10	-	0.25	10	-	0.25	10	-
2021-09-15	0.25	10	10	0.25	10.6	9	0.24	10	11	0.24	10.5	9	0.24	10	12	0.26	10	10	0.25	10.5	7	0.24	9.9	8
	0.25	10	10	0.25	10.6	8	0.24	10	8	0.24	10.5	9	0.24	10	11	0.26	10	9	0.25	10.5	8	0.24	9.9	8
	0.25	10	7	0.25	10.6	12	0.24	10	7	0.24	10.5	7	0.24	10	7	0.26	10	7	0.25	10.5	7	0.24	9.9	8
	0.25	10	7	0.25	10.6	12	0.24	10	12	0.24	10.5	10	0.24	10	8	0.26	10	6	0.25	10.5	7	0.24	9.9	8
2021-09-16	0.26	10	-	0.25	1.9	-	0.26	10	-	0.26	10.1	-	0.27	10	-	0.26	10	-	0.26	10	-	0.27	10	-
	0.26	10	-	0.25	1.9	-	0.26	10	-	0.26	10.1	-	0.27	10	-	0.26	10	-	0.26	10	-	0.27	10	-



Table A3.1 (Cont'd.)

Date	Table 1			Table 2			Table 3			Table 4			Table 5			Table 6			Table 7			Table 8		
	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)	mAmp	Volts	Stream Velocity (cm/s)
2021-09-17	0.26	10	-	0.25	1.9	-	0.26	10	-	0.26	10.1	-	0.27	10	-	0.26	10	-	0.26	10	-	0.27	10	-
	0.26	10	-	0.25	1.9	-	0.26	10	-	0.26	10.1	-	0.27	10	-	0.26	10	-	0.26	10	-	0.27	10	-
	0.25	10.5	12	0.26	11.1	10	0.24	11	9	0.25	11	8	0.26	10.5	11	0.26	11	12	0.26	11	10	0.25	10.4	9
	0.25	10.5	13	0.26	11.1	8	0.24	11	8	0.25	11	9	0.26	10.5	7	0.26	11	11	0.26	11	9	0.25	10.4	9
	0.25	10.5	8	0.26	11.1	11	0.24	11	6	0.25	11	10	0.26	10.5	8	0.26	11	9	0.26	11	11	0.25	10.4	6
2021-09-18	0.25	10.5	13	0.26	11.1	11	0.24	11	11	0.25	11	9	0.26	10.5	7	0.26	11	9	0.26	11	10	0.25	10.4	9
	0.26	10.5	-	0.25	10.3	-	0.26	11	-	0.26	11	-	0.28	11	-	0.26	10.5	-	0.26	10.5	-	0.26	10.4	-
	0.26	10.5	-	0.25	10.3	-	0.26	11	-	0.26	11	-	0.28	11	-	0.26	10.5	-	0.26	10.5	-	0.26	10.4	-
	0.26	10.5	-	0.25	10.3	-	0.26	11	-	0.26	11	-	0.28	11	-	0.26	10.5	-	0.26	10.5	-	0.26	10.4	-
	0.26	10.5	-	0.25	10.3	-	0.26	11	-	0.26	11	-	0.28	11	-	0.26	10.5	-	0.26	10.5	-	0.26	10.4	-
2021-09-19	0.265	10.5	8	0.25	10.2	8	0.23	11	13	0.27	11	8	0.24	10.1	10	0.26	10.5	7	0.23	10.5	11	0.26	10.4	6
	0.265	10.5	8	0.25	10.2	8	0.23	11	10	0.27	11	8	0.24	10.1	8	0.26	10.5	6	0.23	10.5	8	0.26	10.4	6
	0.265	10.5	10	0.25	10.2	10	0.23	11	6	0.27	11	9	0.24	10.1	6	0.26	10.5	9	0.23	10.5	5	0.26	10.4	7
	0.265	10.5	11	0.25	10.2	6	0.23	11	10	0.27	11	10	0.24	10.1	9	0.26	10.5	6	0.23	10.5	6	0.26	10.4	6
	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
2021-09-20	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
	0.26	10	-	0.26	10.8	-	0.26	11	-	0.26	11	-	0.26	10	-	0.26	10	-	0.27	11	-	0.25	10.4	-
2021-09-21	0.26	9	6	0.26	9.9	9	0.26	10.5	11	0.26	10.5	9	0.26	10	10	0.26	10	10	0.26	10.5	10	0.26	10.4	8
	0.26	9	9	0.26	9.9	11	0.26	10.5	9	0.26	10.5	8	0.26	10	9	0.26	10	7	0.26	10.5	6	0.26	10.4	7
	0.26	9	7	0.26	9.9	13	0.26	10.5	6	0.26	10.5	8	0.26	10	10	0.26	10	11	0.26	10.5	11	0.26	10.4	15
	0.26	9	12	0.26	9.9	8	0.26	10.5	11	0.26	10.5	8	0.26	10	6	0.26	10	6	0.26	10.5	4	0.26	10.4	6
	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
2021-09-22	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
	0.26	10	-	0.26	11.3	-	0.24	10.5	-	0.24	10.5	-	0.24	10	-	0.26	11	-	0.26	11.5	-	0.24	10.4	-
2021-09-23	0.28	10	8	0.28	11	8	0.26	10	10	0.26	10.5	10	0.26	10	11	0.26	10	9	0.26	10	9	0.26	10.3	10
	0.28	10	11	0.28	11	10	0.26	10	8	0.26	10.5	8	0.26	10	8	0.26	10	7	0.26	10	10	0.26	10.3	8
	0.28	10	9	0.28	11	13	0.26	10	7	0.26	10.5	8	0.26	10	6	0.26	10	7	0.26	10	9	0.26	10.3	8
	0.28	10	11	0.28	11	8	0.26	10	7	0.26	10.5	10	0.26	10	7	0.26	10	7	0.26	10	9	0.26	10.3	7
	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
2021-09-24	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
	0.27	10	-	0.27	10.6	-	0.27	10	-	0.27	10.5	-	0.26	10	-	0.25	9.5	-	0.26	10	-	0.27	10.3	-
2021-09-25	0.25	10	11	0.26	10.5	11	0.26	10	10	0.25	10.5	9	0.26	10	10	0.26	10	9	0.24	10	11	0.25	10.4	11
	0.25	10	12	0.26	10.5	9	0.26	10	10	0.25	10.5	11	0.26	10	8	0.26	10	11	0.24	10	10	0.25	10.4	10
	0.25	10	10	0.26	10.5	13	0.26	10	7	0.25	10.5	8	0.26	10	6	0.26	10	9	0.24	10	6	0.25	10.4	8
	0.25	10	10	0.26	10.5	12	0.26	10	10	0.25	10.5	8	0.26	10	8	0.26	10	11	0.24	10	7	0.25	10.4	11
	0.25	10	10	0.26	10.5	12	0.26	10	10	0.25	10.5	8	0.26	10	8	0.26	10	11	0.24	10	7	0.25	10.4	11

Note: - = not applicable



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## **Appendix A3.2**

### **Water Temperature and PAR Data in Mesocosm Treatments**

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Figure A3.2.1 Mesocosm tables 1-4, River water tanks, and T-OSPW tanks Hobo tidbit temperature and Meteorological station temperature time series, 2021.

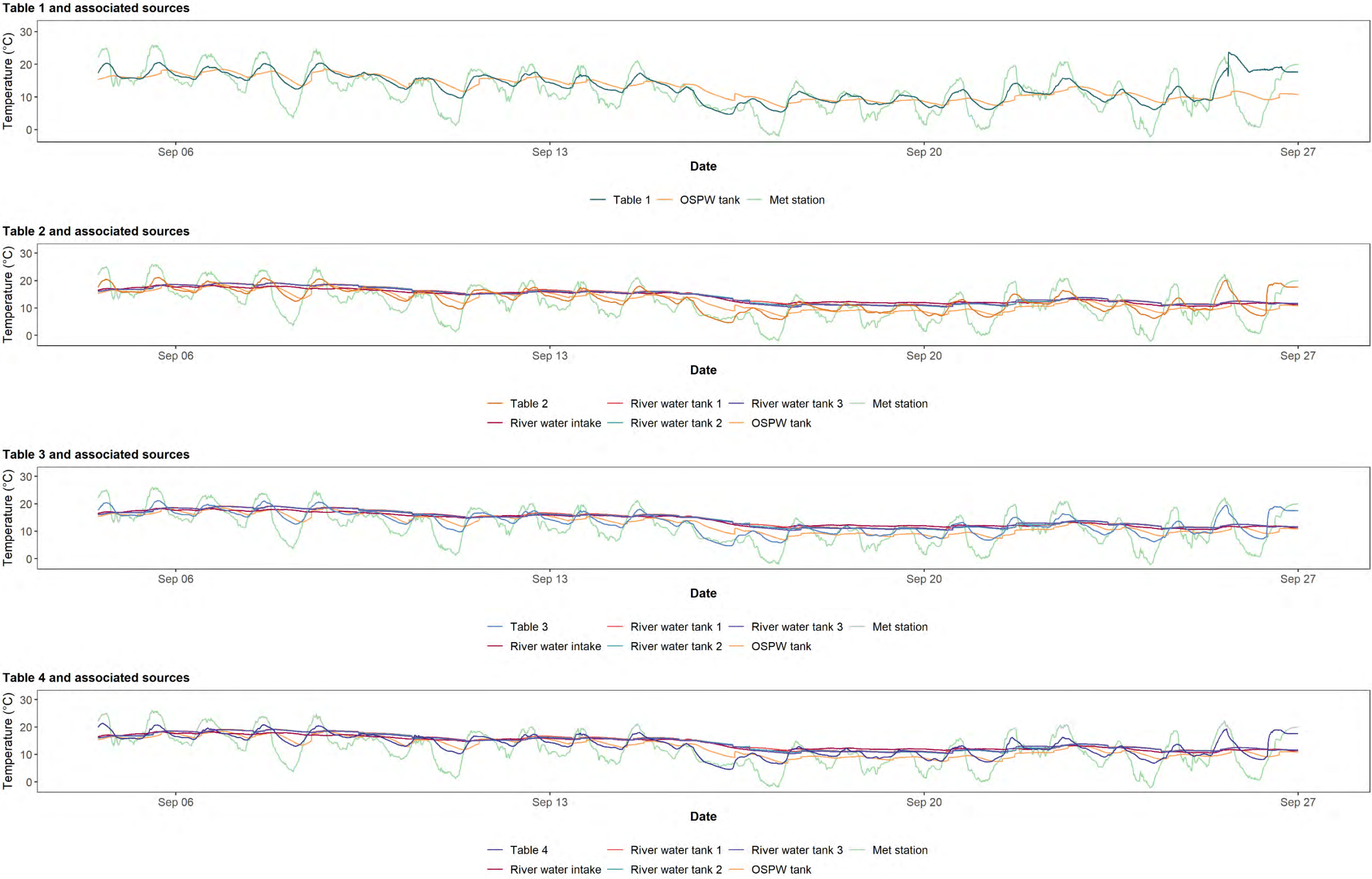




Figure A3.2.2 Mesocosm tables 5-8, River water tanks, and T-OSPW tanks Hobo tidbit temperature and Meteorological station temperature time series, 2021.

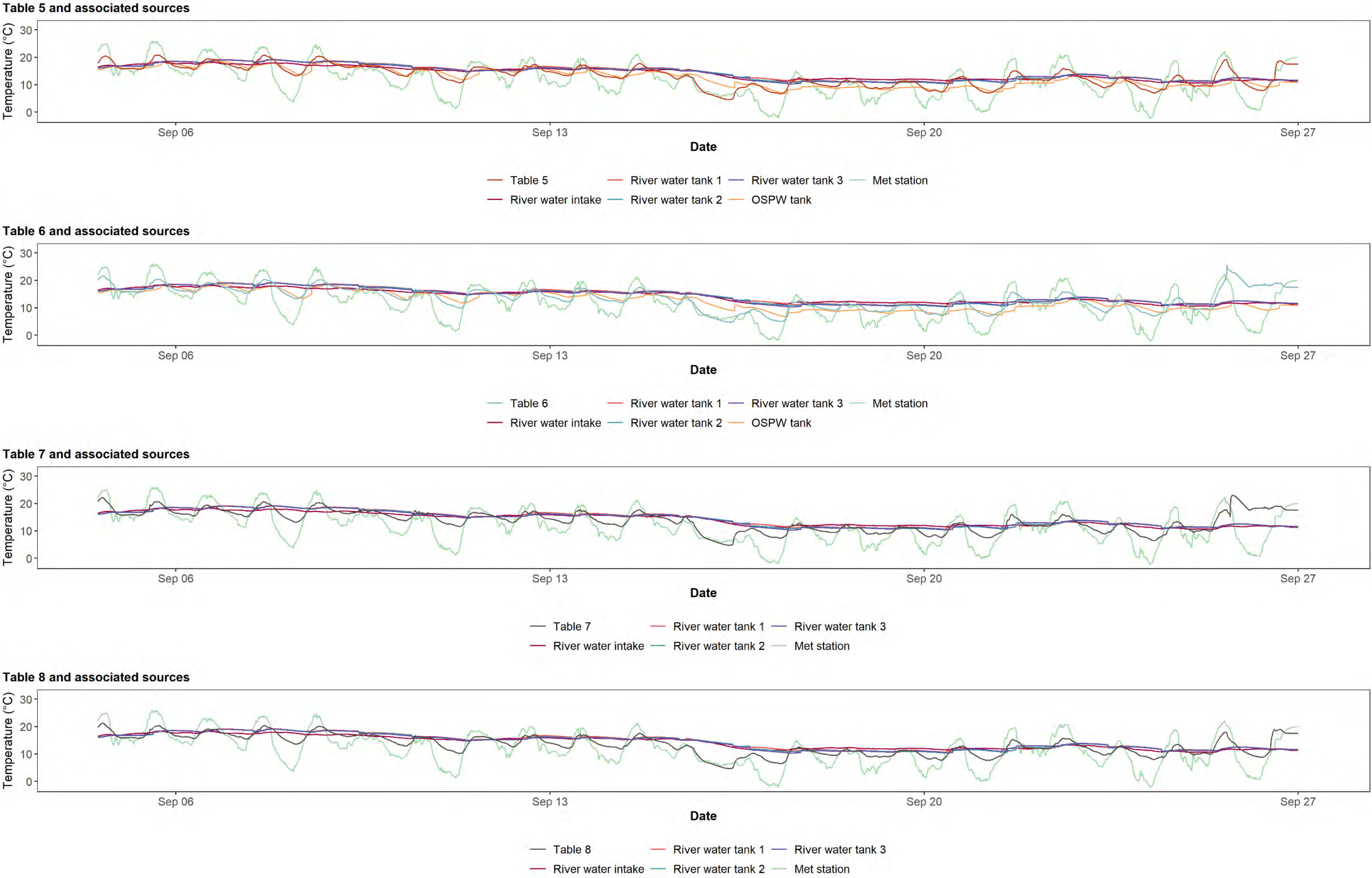
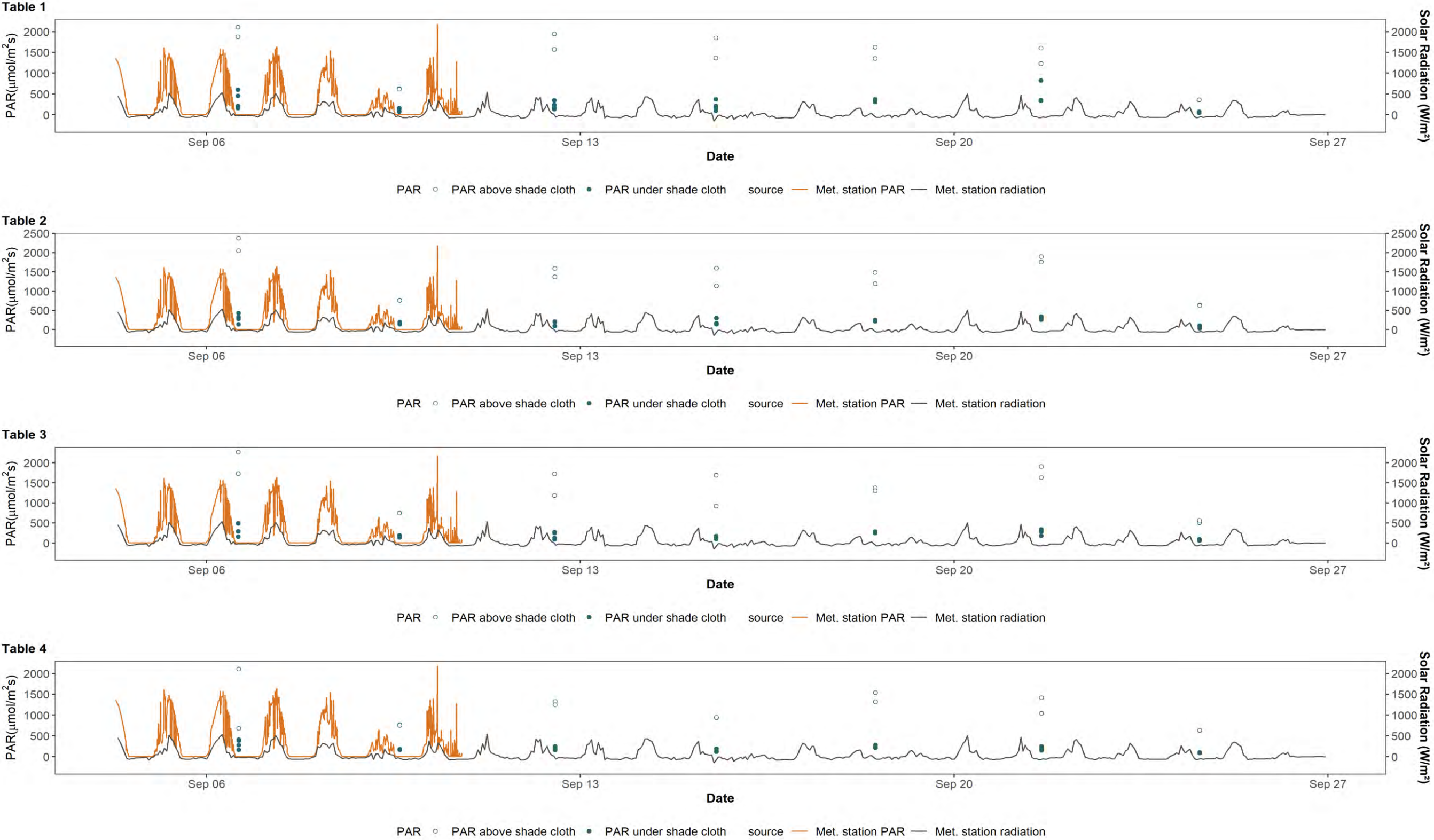




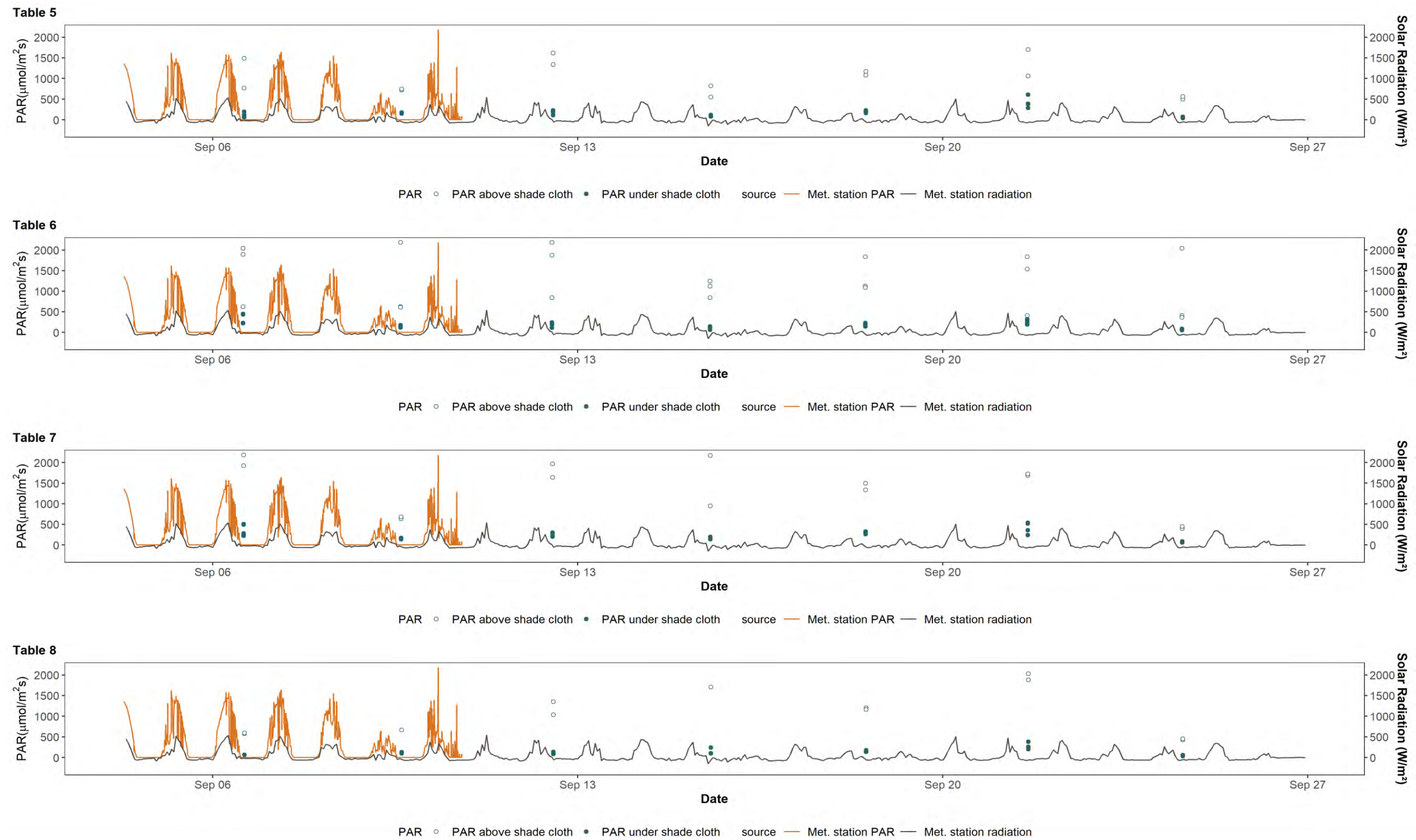
Figure A3.2.3 Mesocosm tables 1-4, In situ and Meteorological station Photosynthetic Active Radiation time series, 2021.



the PAR sensor stopped recording on 2021-09-11 and that solar radiation data was taken from ADW1\_Met Latitude (WGS 84)57 05'25.0N Longitude (WGS 84)111 37'55.7W )



Figure A3.2.4 Mesocosm tables 5-8, In situ and Meteorological station Photosynthetic Active Radiation time series, 2021.



the PAR sensor stopped recording on 2021-09-11 and that solar radiation data was taken from ADW1\_Met Latitude (WGS 84)57 05'25.0N Longitude (WGS 84)111 37'55.7W )



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## **Appendix A3.3**

### **Periphyton Chl-a and Ash-Free Dry Weight Results**

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**Environmental**

## CERTIFICATE OF ANALYSIS

**Work Order** : **VA21C2833**  
**Client** : **Hatfield Consultants LLP**  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 32  
**No. of samples analysed** : 32

**Page** : 1 of 5  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 13:00  
**Date Analysis Commenced** : 21-Oct-2021  
**Issue Date** : 29-Oct-2021 09:05

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
µg	micrograms

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	1A CHL-A	1B CHL-A	1C CHL-A	1D CHL-A	2A CHL-A
(Matrix: Biota)										
					Client sampling date / time	25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2833-001	VA21C2833-002	VA21C2833-003	VA21C2833-004	VA21C2833-005
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		78.9	50.6	35.6	41.3	40.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue					Client sample ID	2B CHL-A	2C CHL-A	2D CHL-A	3A CHL-A	3B CHL-A
(Matrix: Biota)										
					Client sampling date / time	26-Sep-2021	26-Sep-2021	26-Sep-2021	25-Sep-2021	25-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2833-006	VA21C2833-007	VA21C2833-008	VA21C2833-009	VA21C2833-010
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		45.9	53.3	45.8	45.4	52.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue					Client sample ID	3C CHL-A	3D CHL-A	4A CHL-A	4B CHL-A	4C CHL-A
(Matrix: Biota)										
					Client sampling date / time	25-Sep-2021	25-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2833-011	VA21C2833-012	VA21C2833-013	VA21C2833-014	VA21C2833-015
						Result	Result	Result	Result	Result
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg		53.2	69.6	45.6	61.6	99.8

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	4D CHL-A	5A CHL-A	5B CHL-A	5C CHL-A	5D CHL-A
Client sampling date / time					26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C2833-016	VA21C2833-017	VA21C2833-018	VA21C2833-019	VA21C2833-020	
Plant Pigments					Result	Result	Result	Result	Result	
chlorophyll a	479-61-8	E870	0.010	µg	81.5	70.7	82.1	125	51.2	

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	6A CHL-A	6B CHL-A	6C CHL-A	6D CHL-A	7A CHL-A
Client sampling date / time					25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C2833-021	VA21C2833-022	VA21C2833-023	VA21C2833-024	VA21C2833-025	
Plant Pigments					Result	Result	Result	Result	Result	
chlorophyll a	479-61-8	E870	0.010	µg	312	110	224	147	60.7	

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	7B CHL-A	7C CHL-A	7D CHL-A	8A CHL-A	8B CHL-A
Client sampling date / time					25-Sep-2021	25-Sep-2021	25-Sep-2021	26-Sep-2021	26-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C2833-026	VA21C2833-027	VA21C2833-028	VA21C2833-029	VA21C2833-030	
Plant Pigments					Result	Result	Result	Result	Result	
chlorophyll a	479-61-8	E870	0.010	µg	178	103	172	104	55.9	

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: <b>Tissue</b>					Client sample ID	8C CHL-A	8D CHL-A	----	----	---
(Matrix: <b>Biota</b> )										
					Client sampling date / time	26-Sep-2021	26-Sep-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C2833-031	VA21C2833-032	-----	-----	-----	-----
					Result	Result	----	----	----	----
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg	93.7	154	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: <b>VA21C2833</b>	Page	: 1 of 7
Client	: <b>Hatfield Consultants LLP</b>	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 15-Oct-2021 13:00
PO	: ----	Issue Date	: 29-Oct-2021 09:05
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 32		
No. of samples analysed	: 32		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

### Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

### Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota** Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 2A CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 2B CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 2C CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 2D CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 4A CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 4B CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 4C CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓





Matrix: **Biota** Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 4D CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 5A CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 5B CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 5C CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 5D CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 8A CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 8B CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 8C CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 8D CHL-A	E870	26-Sep-2021	21-Oct-2021	28 days	25 days	✓	21-Oct-2021	28 days	0 days	✓





Matrix: **Biota** Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 1A CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 1B CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 1C CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 1D CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 3A CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 3B CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 3C CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 3D CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 6A CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓





Matrix: **Biota**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 6B CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 6C CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 6D CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 7A CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 7B CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 7C CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry										
Opaque HDPE tube 7D CHL-A	E870	25-Sep-2021	21-Oct-2021	28 days	26 days	✓	21-Oct-2021	28 days	0 days	✓

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS)							
Chlorophyll-a by Fluorometry	E870	325430	2	33	6.0	5.0	✔
Method Blanks (MB)							
Chlorophyll-a by Fluorometry	E870	325430	2	33	6.0	5.0	✔





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a by Fluorometry	E870  Vancouver - Environmental	Biota	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chlorophyll-a Extraction	EP870  Vancouver - Environmental	Biota	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.



## QUALITY CONTROL REPORT

**Work Order** : **VA21C2833**

**Page** : 1 of 3

**Client** : Hatfield Consultants LLP  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 32  
**No. of samples analysed** : 32

**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 13:00  
**Date Analysis Commenced** : 21-Oct-2021  
**Issue Date** : 29-Oct-2021 09:05

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia





General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

- Key :
- Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
  - CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
  - DQO = Data Quality Objective.
  - LOR = Limit of Reporting (detection limit).
  - RPD = Relative Percentage Difference
  - # = Indicates a QC result that did not meet the ALS DQO.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Plant Pigments (QCLot: 325430)						
chlorophyll a	479-61-8	E870	0.01	µg	<0.010	----
Plant Pigments (QCLot: 325431)						
chlorophyll a	479-61-8	E870	0.01	µg	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Biota

Sub-Matrix: <b>Biota</b>					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Plant Pigments (QCLot: 325430)									
chlorophyll a	479-61-8	E870	0.01	µg	1 µg	101	80.0	120	----
Plant Pigments (QCLot: 325431)									
chlorophyll a	479-61-8	E870	0.01	µg	1 µg	101	80.0	120	----





## Chain of Custody (COC) / Analytical Request Form

COC Number: 21 -

Page 1 of 3

Canada Toll Free: 1 800 668 9878

Report To		Reports / Recipients		Turnaround Time (TAT) Requested		Analysis Request					
Company:	Hatfield Consultants	Select Report Format:	<input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)	<input type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply		AFFIX ALS BARCODE LABEL HERE (ALS use only)					
Contact:	Morgan Edwards	Merge QC/QCI Reports with COA	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A	<input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum							
Phone:	604-926-3261	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		<input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum							
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	<input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum							
Street:	200-850 Harbourside Dr.	Email 1 or Fax	medwards@hatfieldgroup.com	<input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum							
City/Province:	North Vancouver, BC	Email 2	zmueller@hatfieldgroup.com	Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.							
Postal Code:	V7P 0A3	Email 3		Date and Time Required for all E&P TATs:		dd-mm-yy hh:mm am/pm					
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Recipients		For all tests with rush TATs requested, please contact your AM to confirm availability.							
	Copy of Invoice with Report <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	Analysis Request							
Company:	Hatfield Consultants	Email 1 or Fax	accounting-canada@hatfieldgroup.com	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below							
Contact:		Email 2	medwards@hatfieldgroup.com								
Project Information		Oil and Gas Required Fields (client use)									
ALS Account # / Quote #:	Q86407	AFE/Cost Center:	PO#								
Job #:		Major/Minor Code:	Routing Code:								
PO / AFE:		Requisitioner:									
LSD:		Location:									
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler:								
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS			<div>Environmental Division Vancouver Work Order Reference <b>VA21C2833</b></div> <div>Telephone : + 1 604 253 4100</div>	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1A CHL-A		25-Sep-21		Tissue	1	R					
1B CHL-A		25-Sep-21		Tissue	1	R					
1C CHL-A		25-Sep-21		Tissue	1	R					
1D CHL-A		25-Sep-21		Tissue	1	R					
2A CHL-A		26-Sep-21		Tissue	1	R					
2B CHL-A		26-Sep-21		Tissue	1	R					
2C CHL-A		26-Sep-21		Tissue	1	R					
2D CHL-A		26-Sep-21		Tissue	1	R					
3A CHL-A		25-Sep-21		Tissue	1	R					
3B CHL-A		25-Sep-21		Tissue	1	R					
3C CHL-A		25-Sep-21		Tissue	1	R					
3D CHL-A		25-Sep-21		Tissue	1	R					
Drinking Water (DW) Samples <sup>1</sup> (client use)		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)		SAMPLE RECEIPT DETAILS (ALS use only)							
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO		Please combine all filters within each separate tube		Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED							
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO							
				Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A							
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (ALS use only)		FINAL SHIPMENT RECEPTION (ALS use only)							
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:			
Z. MUELLER	2021-10-12					JA	15/10/2021	-1°C			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

ALS 2020 FORM 1





www.alsglobal.com

# Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 21 -

Page 2 of 3

<b>Report To</b> Contact and company name below will appear on the final report		<b>Reports / Recipients</b>			<b>Turnaround Time (TAT) Requested</b>			<b>AFFIX ALS BARCODE LABEL HERE</b> (ALS use only)													
Company: Hatfield Consultants		Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			<input type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply <input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum <input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum <input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum <input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum <input type="checkbox"/> Same day [E2] if received by 10am M-S - 200% rush surcharge.																
Contact: Morgan Edwards		Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A																			
Phone: 604-926-3261		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																			
Company address below will appear on the final report		Email 1 or Fax: mcedwards@hatfieldgroup.com																			
Street: 200-850 Harbourside Dr.		Email 2: zmueller@hatfieldgroup.com																			
City/Province: North Vancouver, BC		Email 3:																			
Postal Code: V7P 0A3																					
<b>Invoice To</b>		<b>Invoice Recipients</b>																			
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: accounting-canada@hatfieldgroup.com																			
Company: Hatfield Consultants		Email 2: medwards@hatfieldgroup.com																			
Contact:																					
<b>Project Information</b>		<b>Oil and Gas Required Fields (client use)</b>																			
ALS Account # / Quote #: Q86407		AFE/Cost Center: PO#																			
Job #:		Major/Minor Code: Routing Code:																			
PO / AFE:		Requisitioner:																			
LSD:		Location:																			
ALS Lab Work Order # (ALS use only):		ALS Contact:			Sampler:																
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	<b>NUMBER OF CONTAINERS</b> CHLOA-FVA	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										<b>SAMPLES ON HOLD</b>	<b>EXTENDED STORAGE REQUIRED</b>	<b>SUSPECTED HAZARD (see notes)</b>			
	4A CHL-A	26-Sep-21		Tissue		1	R														
	4B CHL-A	26-Sep-21		Tissue		1	R														
	4C CHL-A	26-Sep-21		Tissue		1	R														
	4D CHL-A	26-Sep-21		Tissue		1	R														
	5A CHL-A	26-Sep-21		Tissue		1	R														
	5B CHL-A	26-Sep-21		Tissue		1	R														
	5C CHL-A	26-Sep-21		Tissue		1	R														
	5D CHL-A	26-Sep-21		Tissue		1	R														
	6A CHL-A	25-Sep-21		Tissue		1	R														
	6B CHL-A	25-Sep-21		Tissue		1	R														
	6C CHL-A	25-Sep-21		Tissue		1	R														
	6D CHL-A	25-Sep-21		Tissue		1	R														
<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Notes / Specify Limits for result evaluation by selecting from drop-down below</b> (Excel COC only)			<b>SAMPLE RECEIPT DETAILS (ALS use only)</b>																
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO		Please combine all filters within each separate tube			Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED																
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO					Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO																
					Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A																
					INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: -1°C																
<b>SHIPMENT RELEASE (client use)</b>		<b>INITIAL SHIPMENT RECEPTION (ALS use only)</b>			<b>FINAL SHIPMENT RECEPTION (ALS use only)</b>																
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:	JA 15/10/2021 11:50am												

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

AUG 2020 PRINT



COC Number: **21 -**

Page 3 of 3

**Canada Toll Free: 1 800 668 9878**

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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**.

AUG 2020 09:04





**Environmental**

## CERTIFICATE OF ANALYSIS

**Work Order** : **VA21C2831**  
**Client** : **Hatfield Consultants LLP**  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 32  
**No. of samples analysed** : 32

**Page** : 1 of 5  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 11:50  
**Date Analysis Commenced** : 25-Oct-2021  
**Issue Date** : 01-Nov-2021 16:21

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
g/sample	grams per sample

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Workorder Comments

Preliminary weights were not available for ashfree dry-weight calculations, so average and deviation values were used from other filters of the same type for calculation purposes.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	1A AFDW	1B AFDW	1C AFDW	1D AFDW	2A AFDW
(Matrix: Biota)										
					Client sampling date / time	25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-001	VA21C2831-002	VA21C2831-003	VA21C2831-004	VA21C2831-005
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0273	0.0176	0.0094	0.0414	0.0390
ash weight	----	E137	0.0010	g/sample		0.130	0.0586	0.0652	0.219	0.251
weight, dry	----	E137	0.0010	g/sample		0.157	0.0762	0.0746	0.260	0.290

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue					Client sample ID	2B AFDW	2C AFDW	2D AFDW	3A AFDW	3B AFDW
(Matrix: Biota)										
					Client sampling date / time	26-Sep-2021	26-Sep-2021	26-Sep-2021	25-Sep-2021	25-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-006	VA21C2831-007	VA21C2831-008	VA21C2831-009	VA21C2831-010
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0324	0.0624	0.0517	0.0956	0.0762
ash weight	----	E137	0.0010	g/sample		0.185	0.467	0.295	0.694	0.529
weight, dry	----	E137	0.0010	g/sample		0.217	0.530	0.346	0.790	0.605

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue					Client sample ID	3C AFDW	3D AFDW	4A AFDW	4B AFDW	4C AFDW
(Matrix: Biota)										
					Client sampling date / time	25-Sep-2021	25-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-011	VA21C2831-012	VA21C2831-013	VA21C2831-014	VA21C2831-015
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0283	0.0402	0.0659	0.0093	0.0561
ash weight	----	E137	0.0010	g/sample		0.250	0.332	0.473	0.0858	0.459
weight, dry	----	E137	0.0010	g/sample		0.278	0.372	0.539	0.0951	0.515

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	4D AFDW	5A AFDW	5B AFDW	5C AFDW	5D AFDW
Client sampling date / time						26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-016	VA21C2831-017	VA21C2831-018	VA21C2831-019	VA21C2831-020
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0661	0.0489	0.0606	0.0790	0.0688
ash weight	----	E137	0.0010	g/sample		0.412	0.327	0.399	0.557	0.312
weight, dry	----	E137	0.0010	g/sample		0.478	0.376	0.460	0.636	0.381

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	6A AFDW	6B AFDW	6C AFDW	6D AFDW	7A AFDW
Client sampling date / time						25-Sep-2021	25-Sep-2021	25-Sep-2021	25-Sep-2021	15-Oct-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-021	VA21C2831-022	VA21C2831-023	VA21C2831-024	VA21C2831-025
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0934	0.0792	0.0887	0.0687	0.0418
ash weight	----	E137	0.0010	g/sample		0.440	0.613	0.494	0.492	0.292
weight, dry	----	E137	0.0010	g/sample		0.533	0.693	0.583	0.561	0.334

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	7B AFDW	7C AFDW	7D AFDW	8A AFDW	8B AFDW
Client sampling date / time						25-Sep-2021	25-Sep-2021	25-Sep-2021	26-Sep-2021	26-Sep-2021
Analyte	CAS Number	Method	LOR	Unit		VA21C2831-026	VA21C2831-027	VA21C2831-028	VA21C2831-029	VA21C2831-030
						Result	Result	Result	Result	Result
<b>Physical Tests</b>										
ash free dry weight	----	E137	0.0010	g/sample		0.0683	0.0624	0.121	0.0420	0.0248
ash weight	----	E137	0.0010	g/sample		0.506	0.360	0.870	0.177	0.190
weight, dry	----	E137	0.0010	g/sample		0.574	0.422	0.991	0.220	0.215

Please refer to the General Comments section for an explanation of any qualifiers detected.





## Analytical Results

Sub-Matrix: Tissue					Client sample ID	8C AFDW	8D AFDW	----	----	---
(Matrix: Biota)										
					Client sampling date / time	26-Sep-2021	26-Sep-2021	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C2831-031	VA21C2831-032	-----	-----	-----	-----
					Result	Result	----	----	----	----
Physical Tests										
ash free dry weight	----	E137	0.0010	g/sample	0.156	0.0753	----	----	----	----
ash weight	----	E137	0.0010	g/sample	0.762	0.446	----	----	----	----
weight, dry	----	E137	0.0010	g/sample	0.919	0.522	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.



## QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: <b>VA21C2831</b>	Page	: 1 of 7
Client	: <b>Hatfield Consultants LLP</b>	Laboratory	: Vancouver - Environmental
Contact	: Morgan Edwards	Account Manager	: Brent Mack
Address	: 200 - 850 Harbourside Drive North Vancouver BC Canada V7P 0A3	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 926 3261	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 15-Oct-2021 11:50
PO	: ----	Issue Date	: 01-Nov-2021 16:21
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-HATF100-008 (Standing Offer BC/YK)		
No. of samples received	: 32		
No. of samples analysed	: 32		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

### Key

**Anonymous:** Refers to samples which are not part of this work order, but which formed part of the QC process lot.

**CAS Number:** Chemical Abstracts Services number is a unique identifier assigned to discrete substances.

**DQO:** Data Quality Objective.

**LOR:** Limit of Reporting (detection limit).

**RPD:** Relative Percent Difference.

## Summary of Outliers

### Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

### Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

### Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

### Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.





## Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota** Evaluation: \* = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 7A AFDW	E137	15-Oct-2021	----	----	----		25-Oct-2021	180 days	11 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 2A AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 2B AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 2C AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 2D AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 4A AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 4B AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 4C AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 4D AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 5A AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 5B AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 5C AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 5D AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 8A AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 8B AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 8C AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✓





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 8D AFDW	E137	26-Sep-2021	----	----	----		25-Oct-2021	180 days	30 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 1A AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 1B AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 1C AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 1D AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 3A AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 3B AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 3C AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 3D AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔





Matrix: **Biota** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 6A AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 6B AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 6C AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 6D AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 7B AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 7C AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔
Physical Tests : Ash-free Dry Weight by Gravimetry										
Original packaging 7D AFDW	E137	25-Sep-2021	----	----	----		25-Oct-2021	180 days	31 days	✔

**Legend & Qualifier Definitions**

Rec. HT: ALS recommended hold time (see units).





## Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Control Samples (LCS)							
Ash-free Dry Weight by Gravimetry	E137	329097	2	32	6.2	5.0	✔
Method Blanks (MB)							
Ash-free Dry Weight by Gravimetry	E137	329097	2	32	6.2	5.0	✔





## Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Ash-free Dry Weight by Gravimetry	E137  Vancouver - Environmental	Biota	APHA 10200 I (mod)	"Ash-free dry weight is determined gravimetrically after drying the submitted sample at 105°C. The residue is then ignited at 500°C and the ash rewetted to restore water of hydration to clays and other minerals. The ash weight is determined gravimetrically after bringing the rewetted ash to constant weight at 104°. The ash-free dry weight is the difference between the dry weight and the ash weight.



## QUALITY CONTROL REPORT

**Work Order** : **VA21C2831**

**Page** : 1 of 3

**Client** : Hatfield Consultants LLP  
**Contact** : Morgan Edwards  
**Address** : 200 - 850 Harbourside Drive  
                   North Vancouver BC Canada V7P 0A3  
**Telephone** : 604 926 3261  
**Project** : ----  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : VA21-HATF100-008 (Standing Offer BC/YK)  
**No. of samples received** : 32  
**No. of samples analysed** : 32

**Laboratory** : Vancouver - Environmental  
**Account Manager** : Brent Mack  
**Address** : 8081 Lougheed Highway  
                   Burnaby, British Columbia Canada V5A 1W9  
**Telephone** : 778-370-3279  
**Date Samples Received** : 15-Oct-2021 11:50  
**Date Analysis Commenced** : 25-Oct-2021  
**Issue Date** : 01-Nov-2021 16:21

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia





General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

- Key :
- Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
  - CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
  - DQO = Data Quality Objective.
  - LOR = Limit of Reporting (detection limit).
  - RPD = Relative Percentage Difference
  - # = Indicates a QC result that did not meet the ALS DQO.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Biota

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 329097)						
ash free dry weight	----	E137	0.001	g/sample	<0.0010	----
ash weight	----	E137	0.001	g/sample	<0.0010	----
weight, dry	----	E137	0.001	g/sample	<0.0010	----
Physical Tests (QCLot: 329098)						
ash free dry weight	----	E137	0.001	g/sample	<0.0010	----
ash weight	----	E137	0.001	g/sample	<0.0010	----
weight, dry	----	E137	0.001	g/sample	<0.0010	----





Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Biota

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 329097)									
ash free dry weight	----	E137	0.001	g/sample	0.0405 g/sample	94.6	70.0	130	----
ash weight	----	E137	0.001	g/sample	0.0745 g/sample	107	70.0	130	----
weight, dry	----	E137	0.001	g/sample	0.115 g/sample	102	70.0	130	----
Physical Tests (QCLot: 329098)									
ash free dry weight	----	E137	0.001	g/sample	0.0405 g/sample	98.0	70.0	130	----
ash weight	----	E137	0.001	g/sample	0.0745 g/sample	102	70.0	130	----
weight, dry	----	E137	0.001	g/sample	0.115 g/sample	101	70.0	130	----



## Chain of Custody (COC) / Analytical Request Form

COC Number: 21 -

Page 1 of 3



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Report To		Reports / Recipients		Turnaround Time (TAT) Requested		AFFIX ALS BARCODE LABEL HERE (ALS use only)	
Contact and company name below will appear on the final report		Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)		<input type="checkbox"/> Routine [R] If received by 3pm M-F - no surcharges apply <input type="checkbox"/> 4 day [P4] If received by 3pm M-F - 20% rush surcharge minimum <input type="checkbox"/> 3 day [P3] If received by 3pm M-F - 25% rush surcharge minimum <input type="checkbox"/> 2 day [P2] If received by 3pm M-F - 50% rush surcharge minimum <input type="checkbox"/> 1 day [E] If received by 3pm M-F - 100% rush surcharge minimum <input type="checkbox"/> Same day [E2] If received by 10am M-S - 200% rush surcharge.			
Company:	Hatfield Consultants	Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A					
Contact:	Morgan Edwards	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked					
Phone:	604-926-3261	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX					
Company address below will appear on the final report		Email 1 or Fax medwards@hatfieldgroup.com					
Street:	200-850 Harbourside Dr.	Email 2 zmueller@hatfieldgroup.com					
City/Province:	North Vancouver, BC	Email 3					
Postal Code:	V7P 0A3						
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Recipients		Date and Time Required for all E&P TATs: dd-mm-yy hh:mm am/pm			
	Copy of Invoice with Report <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		For all tests with rush TATs requested, please contact your AM to confirm availability.			
Company:	Hatfield Consultants	Email 1 or Fax accounting-canada@hatfieldgroup.com					
Contact:		Email 2 medwards@hatfieldgroup.com					
Project Information		Oil and Gas Required Fields (client use)					
ALS Account # / Quote #:	Q86407	AFE/Cost Center: PQ#:					
Job #:		Major/Minor Code: Routing Code:					
PO / AFE:		Requisitioner:					
LSD:		Location:					
ALS Lab Work Order # (ALS use only):		ALS Contact:		Sampler:			
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS		
	1A AFDW	25-Sep-21		Tissue	1 R		
	1B AFDW	25-Sep-21		Tissue	1 R		
	1C AFDW	25-Sep-21		Tissue	1 R		
	1D AFDW	25-Sep-21		Tissue	1 R		
	2A AFDW	26-Sep-21		Tissue	1 R		
	2B AFDW	26-Sep-21		Tissue	1 R		
	2C AFDW	26-Sep-21		Tissue	1 R		
	2D AFDW	26-Sep-21		Tissue	1 R		
	3A AFDW	25-Sep-21		Tissue	1 R		
	3B AFDW	25-Sep-21		Tissue	1 R		
	3C AFDW	25-Sep-21		Tissue	1 R		
	3D AFDW	25-Sep-21		Tissue	1 R		
Drinking Water (DW) Samples <sup>1</sup> (client use)		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)		SAMPLE RECEIPT DETAILS (ALS use only)			
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO		Please combine all the filters for each separate tube		Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO			
				Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A			
				INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
						-1°C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (ALS use only)		FINAL SHIPMENT RECEPTION (ALS use only)			
Released by: ZACHARY QLOER	Date: OCT 12 2021	Time:	Received by:	Date:	Time:	Received by: JA	Date: 12/10/2021
							11:50

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

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# Chain of Custody (COC) / Analytical Request Form

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COC Number: 21 -

Page 2 of 3

Report To		Reports / Recipients		Turnaround Time (TAT) Requested		AFFIX ALS BARCODE LABEL HERE (ALS use only)	
Contact and company name below will appear on the final report							
Company:	Hatfield Consultants	Select Report Format:	<input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)	<input type="checkbox"/> Routine [R] If received by 3pm M-F - no surcharges apply <input type="checkbox"/> 4 day [P4] If received by 3pm M-F - 20% rush surcharge minimum <input type="checkbox"/> 3 day [P3] If received by 3pm M-F - 25% rush surcharge minimum <input type="checkbox"/> 2 day [P2] If received by 3pm M-F - 50% rush surcharge minimum <input type="checkbox"/> 1 day [E] If received by 3pm M-F - 100% rush surcharge minimum <input type="checkbox"/> Same day [E2] If received by 10am M-S - 200% rush surcharge.			
Contact:	Morgan Edwards	Merge QC/QCI Reports with COA	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A				
Phone:	804-926-3261	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked					
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				
Street:	200-850 Harbourside Dr.	Email 1 or Fax	medwards@hatfieldgroup.com				
City/Province:	North Vancouver, BC	Email 2	zmueller@hatfieldgroup.com				
Postal Code:	V7P 0A3	Email 3					
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Recipients		Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.			
	Copy of Invoice with Report <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		Date and Time Required for all E&P TATs:		dd-mm-yy hh:mm am/pm	
Company:	Hatfield Consultants	Email 1 or Fax accounting-canada@hatfieldgroup.com		For all tests with rush TATs requested, please contact your AM to confirm availability.			
Contact:		Email 2 medwards@hatfieldgroup.com					
Project Information		Oil and Gas Required Fields (client use)		Analysis Request			
ALS Account # / Quote #:	Q86407	AFE/Coast Center:	PO#	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below			
Job #:		Major/Minor Code:	Routing Code:				
PO / AFE:		Requisitioner:					
LSD:		Location:					
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler:				
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS		
	4A AFDW	26-Sep-21		Tissue	1	R	
	4B AFDW	26-Sep-21		Tissue	1	R	
	4C AFDW	26-Sep-21		Tissue	1	R	
	4D AFDW	26-Sep-21		Tissue	1	R	
	5A AFDW	26-Sep-21		Tissue	1	R	
	5B AFDW	26-Sep-21		Tissue	1	R	
	5C AFDW	26-Sep-21		Tissue	1	R	
	5D AFDW	26-Sep-21		Tissue	1	R	
	6A AFDW	25-Sep-21		Tissue	1	R	
	6B AFDW	25-Sep-21		Tissue	1	R	
	6C AFDW	25-Sep-21		Tissue	1	R	
	6D AFDW	25-Sep-21		Tissue	1	R	
Drinking Water (DW) Samples <sup>1</sup> (client use)		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)		SAMPLE RECEIPT DETAILS (ALS use only)			
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO		Please combine all the filters for each separate tube		Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO			
				Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A			
				INITIAL COOLER TEMPERATURES °C			
				FINAL COOLER TEMPERATURES °C			
				-1.5			
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (ALS use only)		FINAL SHIPMENT RECEPTION (ALS use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Time:
						JA	15/10/2021 11:50am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALG 2020 FEB



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## **Appendix A3.4**

### **Taxonomic Data (Periphyton)**

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**Quality control report of zooplankton enumeration in QA samples for Nautilus Environmental Syncrude OSPW Testing, 2021.**

<b>Biologica QA Sample Number</b>	<b>Client QA Sample Number</b>	<b>Replicate</b>	<b>Abundance (Original Replicate)</b>	<b>Abundance (QA Replicate)</b>	<b>Percent Agreement</b>
fz21-180-020	OSPW Tank-2	2	248	214	<b>86.29</b>

Percent Agreement:  $\{100 - [(difference\ in\ abundance\ between\ samples) / total\ abundance\ of\ original\ sample] \times 100\} \%$





## Abbreviations & Definitions

### Worksheets:

- |                                |                                                                            |
|--------------------------------|----------------------------------------------------------------------------|
| 1. Abbreviations & Definitions | Glossary of terms and outline of report.                                   |
| 2. Data - Long                 | Raw data in long format with abundance calculations.                       |
| 3. QAQC                        | Quality control report of periphyton enumeration in QA samples.            |
| 4. Microscope Factors          | Procedure and calculations for conversion of count data to abundance data. |

### Data:

- |                       |                                                                                                                                        |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Unit                  | A colony, filament, or single cell.                                                                                                    |
| Abundance             | Raw periphyton cell count * Microscope Factor* Sample volume                                                                           |
| Microscope Factor (F) | A conversion factor involving sub-sample volumes and the area of the chamber scanned required to translate cell counts into densities. |
| Field of View (FOV)   | The area that is observable through a microscope at any one moment.                                                                    |
| cf.                   | Confertim, possibly for species.                                                                                                       |





Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Cell	50	1	8,540,428	8,540,428	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	59	5	10,077,705	46,512,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Cell	9	1	1,537,277	1,537,277	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	9	2	1,537,277	3,733,387	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	111	1	18,959,750	18,959,750	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	334.92	400x	12	0.5	510	Colony	1	24	170,809	4,099,405	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	334.92	400x	12	0.5	510	Colony	1	8	170,809	1,366,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	334.92	400x	12	0.5	510	Colony	1	4	170,809	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	67	7	11,444,174	75,446,774	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	4	1,020	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1A Styro	25-Sep-21	pp21-112-013	Blue-green Algae	Cyanophyta		Cyanophyte		2.00	100x	Whole chamber scan	0.5	510	Filament	1	32	1,020	32,640	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Cell	48	1	8,198,811	8,198,811	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	41	5	7,003,151	32,347,888	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Cell	4	1	683,234	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	10	3	1,708,086	4,270,214	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	111	1	18,959,750	18,959,750	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Aphanocapsa sp.	334.92	400x	12	0.5	510	Colony	1	8	170,809	1,366,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	334.92	400x	12	0.5	510	Colony	1	6	170,809	1,024,851	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	85	9	14,518,728	125,690,700	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	8	1,020	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro	25-Sep-21	pp21-112-014	Blue-green Algae	Cyanophyta			Cyanophyte	2.00	100x	Whole chamber scan	0.5	510	Filament	1	8	1,020	8,160	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Cell	57	1	9,736,088	9,736,088	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	46	4	7,857,194	28,061,406	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Cell	9	1	1,537,277	1,537,277	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	11	3	1,878,894	4,697,235	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	113	1	19,301,367	19,301,367	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	334.92	400x	12	0.5	510	Colony	1	4	170,809	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	52	8	8,882,045	71,056,361	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	6	1	6,120	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1B Styro-QA	25-Sep-21	pp21-112-014-QA	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	10	1,020	10,200	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	267.93	400x	15	0.5	510	Cell	2	1	273,294	273,294	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	267.93	400x	15	0.5	510	Cell	32	1	4,372,699	4,372,699	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	267.93	400x	15	0.5	510	Colony	42	4	5,739,168	21,521,879	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	267.93	400x	15	0.5	510	Cell	15	1	2,049,703	2,049,703	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	267.93	400x	15	0.5	510	Colony	11	2	1,503,115	3,306,854	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	267.93	400x	15	0.5	510	Cell	129	1	17,627,444	17,627,444	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	267.93	400x	15	0.5	510	Colony	2	4	273,294	1,093,175	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	267.93	400x	15	0.5	510	Filament	88	6	12,024,923	72,564,189	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1C Styro	25-Sep-21	pp21-112-015	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	267.93	400x	15	0.5	510	Cell	1	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	267.93	400x	15	0.5	510	Cell	59	1	8,062,164	8,062,164	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	267.93	400x	15	0.5	510	Colony	61	4	8,335,458	33,341,831	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	267.93	400x	15	0.5	510	Cell	8	1	1,093,175	1,093,175	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	267.93	400x	15	0.5	510	Colony	9	2	1,229,822	2,986,710	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	267.93	400x	15	0.5	510	Cell	105	1	14,347,919	14,347,919	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	267.93	400x	15	0.5	510	Filament	65	9	8,882,045	77,347,810	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	1D Styro	25-Sep-21	pp21-112-016	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	200.95	400x	20	0.5	510	Cell	2	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	200.95	400x	20	0.5	510	Cell	165	1	16,910,048	16,910,048	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	200.95	400x	20	0.5	510	Colony	3	11	307,455	3,279,524	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	200.95	400x	20	0.5	510	Filament	24	11	2,459,643	28,062,294	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	6	1	6,120	6,120	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	2	1,020	2,040	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	2	1,020	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	8	1,020	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2A Styro	25-Sep-21	pp21-112-017	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	4	1	4,080	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	334.92	400x	12	0.5	510	Cell	14	1	2,391,320	2,391,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Cell	13	1	2,220,511	2,220,511	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	26	5	4,441,023	21,782,158	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Cell	5	1	854,043	854,043	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	7	2	1,195,660	2,391,320	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	71	1	12,127,408	12,127,408	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Blue-green Algae	Cyanophyta	Chroococcales	Aphanothecaceae	Aphanothece sp.	334.92	400x	12	0.5	510	Colony	1	30	170,809	5,124,257	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	334.92	400x	12	0.5	510	Colony	4	4	683,234	2,732,937	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	193	12	32,966,052	384,828,203	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2B Styro	25-Sep-21	pp21-112-018	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	7	1,020	7,140	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	574.15	400x	7	0.5	510	Cell	2	1	585,629	585,629	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	574.15	400x	7	0.5	510	Cell	8	1	2,342,517	2,342,517	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	574.15	400x	7	0.5	510	Colony	19	9	5,563,479	50,239,900	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	574.15	400x	7	0.5	510	Cell	6	1	1,756,888	1,756,888	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	574.15	400x	7	0.5	510	Colony	10	2	2,928,147	7,027,552	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	574.15	400x	7	0.5	510	Colony	1	3	292,815	878,444	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	574.15	400x	7	0.5	510	Cell	1	1	292,815	292,815	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	574.15	400x	7	0.5	510	Cell	76	1	22,253,915	22,253,915	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Chlorophyta	Trebouxiophyceae ordo incertae sedis	Trebouxiophyceae incertae sedis	Crucigenia sp.	574.15	400x	7	0.5	510	Colony	1	4	292,815	1,171,259	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	574.15	400x	7	0.5	510	Colony	2	6	585,629	3,513,776	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	574.15	400x	7	0.5	510	Cell	2	1	585,629	585,629	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	574.15	400x	7	0.5	510	Filament	194	9	56,806,047	531,704,602	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	3	5	3,060	16,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	4	1	4,080	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2C Styro	25-Sep-21	pp21-112-019	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040		



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	287.07	400x	14	0.5	510	Colony	2	6	292,815	1,756,888	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	287.07	400x	14	0.5	510	Cell	3	1	439,222	439,222	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	287.07	400x	14	0.5	510	Filament	147	13	21,521,879	288,262,739	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	6	1	6,120	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	2	3	2,040	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x	Whole chamber scan	0.5	510	Cell	7	1	7,140	7,140	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Green Algae	Charophyta	Desmidiaceae	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	4	1,020	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	2D Styro	25-Sep-21	pp21-112-020	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	2	18	2,040	36,720	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	236.41	400x	17	0.5	510	Cell	9	1	1,085,137	1,085,137	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	236.41	400x	17	0.5	510	Cell	26	1	3,134,839	3,134,839	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	236.41	400x	17	0.5	510	Cell	1	1	120,571	120,571	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	236.41	400x	17	0.5	510	Cell	17	1	2,049,703	2,049,703	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	236.41	400x	17	0.5	510	Cell	1	1	120,571	120,571	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	236.41	400x	17	0.5	510	Cell	34	1	4,099,405	4,099,405	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	236.41	400x	17	0.5	510	Cell	1	1	120,571	120,571	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	236.41	400x	17	0.5	510	Cell	7	1	843,995	843,995	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	236.41	400x	17	0.5	510	Colony	5	5	602,854	3,255,410	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	236.41	400x	17	0.5	510	Cell	2	1	241,141	241,141	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	236.41	400x	17	0.5	510	Cell	3	1	361,712	361,712	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	236.41	400x	17	0.5	510	Cell	4	1	482,283	482,283	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	236.41	400x	17	0.5	510	Cell	46	1	5,546,254	5,546,254	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	236.41	400x	17	0.5	510	Colony	1	4	120,571	482,283	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	236.41	400x	17	0.5	510	Filament	110	9	13,262,782	125,146,254	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	6	1	6,120	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	2	5	2,040	10,200	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	9	1	9,180	9,180	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	18	1	18,360	18,360	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	2	3	2,040	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Charophyta	Chlorellales	Oocystaceae	Nephrocytium sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	8	1,020	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	2	4	2,040	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3A Styro	25-Sep-21	pp21-112-021	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	9	1,020	9,180	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	267.93	400x	15	0.5	510	Cell	16	1	2,186,350	2,186,350	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis sp.	267.93	400x	15	0.5	510	Cell	1	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	267.93	400x	15	0.5	510	Cell	45	1	6,149,108	6,149,108	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	267.93	400x	15	0.5	510	Colony	1	2	136,647	273,294	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	267.93	400x	15	0.5	510	Cell	1	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	267.93	400x	15	0.5	510	Cell	19	1	2,596,290	2,596,290	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	267.93	400x	15	0.5	510	Cell	36	1	4,919,287	4,919,287	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Diatoms	Bacillariophyta	Diatoms	Pennate diatom	Pennate diatom	267.93	400x	15	0.5	510	Cell	1	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	267.93	400x	15	0.5	510	Colony	3	2	409,941	819,881	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	267.93	400x	15	0.5	510	Colony	2	3	273,294	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetradron minimum	267.93	400x	15	0.5	510	Cell	1	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	267.93	400x	15	0.5	510	Colony	1	2	136,647	273,294	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	267.93	400x	15	0.5	510	Cell	8	1	1,093,175	1,093,175	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	267.93	400x	15	0.5	510	Cell	32	1	4,372,699	4,372,699	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3B Styro	25-Sep-21	pp21-112-022	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	267.93	400x	15	0.5	510	Colony	2	8	273,294	2,18	



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	334.92	400x	12	0.5	510	Cell	33	1	5,636,683	5,636,683	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	334.92	400x	12	0.5	510	Cell	24	1	4,099,405	4,099,405	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	334.92	400x	12	0.5	510	Cell	52	1	8,882,045	8,882,045	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta			Pennate diatom	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	4	8	683,234	5,124,257	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	3	2	512,426	1,024,851	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	334.92	400x	12	0.5	510	Cell	2	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	334.92	400x	12	0.5	510	Cell	6	1	1,024,851	1,024,851	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	29	1	4,953,448	4,953,448	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	334.92	400x	12	0.5	510	Filament	1	8	170,809	1,366,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	334.92	400x	12	0.5	510	Colony	2	2	341,617	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	76	10	12,981,451	124,621,926	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x		0.5	510	Colony	12	3	12,240	41,966	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Gyrosigma sp.	2.00	100x		0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula cf. radiosa	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x		0.5	510	Cell	13	1	13,260	13,260	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x		0.5	510	Cell	4	1	4,080	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Stephanodiscales	Stephanodisceaceae	Stephanodiscus sp.	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	2.00	100x		0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x		0.5	510	Cell	13	1	13,260	13,260	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x		0.5	510	Filament	1	5	1,020	5,100	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	2.00	100x		0.5	510	Colony	1	4	1,020	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Blue-green Algae	Cyanophyta	Oscillatoriales	Oscillatoriaceae	Phormidium sp.	2.00	100x		0.5	510	Filament	1	70	1,020	71,400	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3C Styro	25-Sep-21	pp21-112-023	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	2.00	100x		0.5	510	Colony	4	24	4,080	97,920	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	334.92	400x	12	0.5	510	Cell	8	1	1,366,468	1,366,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	334.92	400x	12	0.5	510	Cell	21	1	3,586,980	3,586,980	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	334.92	400x	12	0.5	510	Cell	13	1	2,220,511	2,220,511	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	334.92	400x	12	0.5	510	Cell	39	1	6,661,534	6,661,534	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Cell	3	1	512,426	512,426	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	334.92	400x	12	0.5	510	Colony	6	4	1,024,851	4,099,405	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Cell	4	1	683,234	683,234	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	334.92	400x	12	0.5	510	Colony	3	3	512,426	1,708,086	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	334.92	400x	12	0.5	510	Colony	1	4	170,809	683,234	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	334.92	400x	12	0.5	510	Colony	2	4	341,617	1,366,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Kirchneriella sp.	334.92	400x	12	0.5	510	Cell	1	1	170,809	170,809	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	334.92	400x	12	0.5	510	Cell	3	1	512,426	512,426	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	334.92	400x	12	0.5	510	Cell	5	1	854,043	854,043	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	334.92	400x	12	0.5	510	Cell	50	1	8,540,428	8,540,428	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	334.92	400x	12	0.5	510	Colony	1	6	170,809	1,024,851	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	334.92	400x	12	0.5	510	Filament	145	8	24,767,241	189,013,158	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	2.00	100x		0.5	510	Colony	1	14	1,020	14,280	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x		0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x		0.5	510	Cell	7	1	7,140	7,140	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	2.00	100x		0.5	510	Colony	4	5	4,080	19,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	2.00	100x		0.5	510	Cell	5	1	5,100	5,100	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sp. 1	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	2.00	100x		0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x		0.5	510	Cell	6	1	6,120	6,120	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	2.00	100x		0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x		0.5	510	Cell	5	1	5,100	5,100	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	3D Styro	25-Sep-21	pp21-112-024	Blue-green Algae	Cyanophyta	Nostocales	Nostocaceae	Anabaena sp.	2.00	100x		0.5	510	Filament	3	7	3,060	21,420	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021																			



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	108.62	400x	37	0.5	510	Colony	1	2	55,397	110,795	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	108.62	400x	37	0.5	510	Colony	2	2	110,795	221,589	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	108.62	400x	37	0.5	510	Cell	2	1	110,795	110,795	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	108.62	400x	37	0.5	510	Cell	2	1	110,795	110,795	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	108.62	400x	37	0.5	510	Cell	24	1	1,329,537	1,329,537	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	108.62	400x	37	0.5	510	Filament	53	7	2,936,061	20,147,451	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	4	1	4,080	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	9	1	9,180	9,180	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	2	1,020	2,040	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	2	1,020	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4A Styro	25-Sep-21	pp21-112-025	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	2.00	100x	Whole chamber scan	0.5	510	Colony	1	16	1,020	16,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	93.47	400x	43	0.5	510	Cell	13	1	619,678	619,678	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	93.47	400x	43	0.5	510	Cell	10	1	476,675	476,675	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	93.47	400x	43	0.5	510	Cell	15	1	715,013	715,013	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	93.47	400x	43	0.5	510	Cell	2	1	95,335	95,335	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	93.47	400x	43	0.5	510	Cell	4	1	190,670	190,670	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	93.47	400x	43	0.5	510	Colony	5	2	238,338	476,675	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	93.47	400x	43	0.5	510	Cell	5	1	238,338	238,338	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	93.47	400x	43	0.5	510	Cell	176	1	8,389,481	8,389,481	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	93.47	400x	43	0.5	510	Cell	18	1	858,015	858,015	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	93.47	400x	43	0.5	510	Cell	4	1	190,670	190,670	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta			Pennate diatom	93.47	400x	43	0.5	510	Cell	2	1	95,335	95,335	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	93.47	400x	43	0.5	510	Cell	3	1	143,003	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	93.47	400x	43	0.5	510	Cell	3	1	143,003	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	93.47	400x	43	0.5	510	Colony	5	4	238,338	1,001,018	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	93.47	400x	43	0.5	510	Colony	4	2	190,670	381,340	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	93.47	400x	43	0.5	510	Colony	1	2	47,668	95,335	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	93.47	400x	43	0.5	510	Cell	3	1	143,003	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	93.47	400x	43	0.5	510	Cell	17	1	810,348	810,348	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	93.47	400x	43	0.5	510	Colony	1	4	47,668	190,670	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	93.47	400x	43	0.5	510	Filament	2	5	95,335	476,675	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	2.00	100x	Whole chamber scan	0.5	510	Colony	1	27	1,020	27,540	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4B Styro	25-Sep-21	pp21-112-026	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	13	1	13,260	13,260	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	100.48	400x	40	0.5	510	Cell	30	1	1,537,277	1,537,277	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	100.48	400x	40	0.5	510	Cell	3	1	153,728	153,728	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	100.48	400x	40	0.5	510	Cell	10	1	512,426	512,426	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	100.48	400x	40	0.5	510	Cell	22	1	1,127,337	1,127,337	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	100.48	400x	40	0.5	510	Cell	3	1	153,728	153,728	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	100.48	400x	40	0.5	510	Colony	1	3	51,243	153,728	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	100.48	400x	40	0.5	510	Cell	4	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	100.48	400x	40	0.5	510	Cell	128	1	6,559,049	6,559,049	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	100.48	400x	40	0.5	510	Cell	19	1	973,609	973,609	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Diatoms	Bacillariophyta			Pennate diatom	100.48	400x	40	0.5	510	Cell	4	1	204,970	204,970	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	4C Styro	25-Sep-21	pp21-112-027	Green Algae	Chlorophyta	Chaetophorales	Chaetophoraceae	Chaetophora sp.	100.48	400x	40	0.5	510	Filament	1	4	51,243	204	



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	80.38	400x	50	0.5	510	Cell	21	1	860,875	860,875	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria crotonensis	80.38	400x	50	0.5	510	Cell	1	1	40,994	40,994	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	80.38	400x	50	0.5	510	Cell	29	1	1,188,828	1,188,828	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	80.38	400x	50	0.5	510	Colony	2	2	81,988	163,976	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	80.38	400x	50	0.5	510	Cell	1	1	40,994	40,994	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	80.38	400x	50	0.5	510	Cell	5	1	204,970	204,970	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	80.38	400x	50	0.5	510	Colony	4	4	163,976	655,905	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	80.38	400x	50	0.5	510	Cell	1	1	40,994	40,994	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	80.38	400x	50	0.5	510	Cell	6	1	245,964	245,964	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	80.38	400x	50	0.5	510	Cell	8	1	327,952	327,952	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	80.38	400x	50	0.5	510	Cell	160	1	6,559,049	6,559,049	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	80.38	400x	50	0.5	510	Cell	6	1	245,964	245,964	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	80.38	400x	50	0.5	510	Cell	5	1	204,970	204,970	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta			Pennate diatom	80.38	400x	50	0.5	510	Cell	3	1	122,982	122,982	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	80.38	400x	50	0.5	510	Cell	1	1	40,994	40,994	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	80.38	400x	50	0.5	510	Cell	2	1	81,988	81,988	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	80.38	400x	50	0.5	510	Cell	3	1	122,982	122,982	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	80.38	400x	50	0.5	510	Colony	1	4	40,994	163,976	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	80.38	400x	50	0.5	510	Colony	1	4	40,994	163,976	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	80.38	400x	50	0.5	510	Colony	1	8	40,994	327,952	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	80.38	400x	50	0.5	510	Cell	2	1	81,988	81,988	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	80.38	400x	50	0.5	510	Cell	6	1	245,964	245,964	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	80.38	400x	50	0.5	510	Colony	1	4	40,994	163,976	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	8	1	8,160	8,160	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	4D Styro	25-Sep-21	pp21-112-028	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	200.95	400x	20	0.5	510	Cell	19	1	1,947,218	1,947,218	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	200.95	400x	20	0.5	510	Cell	12	1	1,229,822	1,229,822	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	200.95	400x	20	0.5	510	Cell	19	1	1,947,218	1,947,218	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	200.95	400x	20	0.5	510	Cell	2	1	204,970	204,970	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	200.95	400x	20	0.5	510	Colony	1	2	102,485	204,970	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Cell	7	1	717,396	717,396	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Colony	17	4	1,742,247	7,481,415	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	200.95	400x	20	0.5	510	Cell	8	1	819,881	819,881	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	200.95	400x	20	0.5	510	Cell	141	1	14,450,404	14,450,404	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	200.95	400x	20	0.5	510	Cell	11	1	1,127,337	1,127,337	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	200.95	400x	20	0.5	510	Cell	5	1	512,426	512,426	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta			Pennate diatom	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	200.95	400x	20	0.5	510	Colony	1	4	102,485	409,941	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	200.95	400x	20	0.5	510	Cell	2	1	204,970	204,970	
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Blue-green Algae	Cyanophyta	Synechococcales	Chamaesiphonaceae	Chamaesiphon sp.	200.95	400x	20	0.5	510	Colony	2	6	204,970	1,229,822	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	200.95	400x	20	0.5	510	Colony	1	8	102,485	819,881	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	200.95	400x	20	0.5	510	Filament	6	9	614,911	5,226,742	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	23	1	23,460	23,460	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	13	1	13,260	13,260	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro	25-Sep-21	pp21-112-029	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	200.95	400x	20	0.5	510	Cell	18	1	1,844,732	1,844,732	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	200.95	400x	20	0.5	510	Cell	12	1	1,229,822	1,229,822	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	200.95	400x	20	0.5	510	Cell	14	1	1,434,792	1,434,792	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	200.95	400x	20	0.5	510	Colony	1	4	102,485	409,941	1
Limnotek	Syn crude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	200.95	400x	20	0.5	510	Colony	1	2</			



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	200.95	400x	20	0.5	510	Cell	5	1	512,426	512,426	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	200.95	400x	20	0.5	510	Filament	6	5	614,911	3,177,039	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	21	1	21,420	21,420	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	8	1	8,160	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	2	1,020	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5A Styro-QA	25-Sep-21	pp21-112-029-QA	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	8	1,020	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	200.95	400x	20	0.5	510	Cell	8	1	819,881	819,881	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	200.95	400x	20	0.5	510	Cell	4	1	409,941	409,941	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	200.95	400x	20	0.5	510	Cell	12	1	1,229,822	1,229,822	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	200.95	400x	20	0.5	510	Colony	2	2	204,970	409,941	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	200.95	400x	20	0.5	510	Cell	5	1	512,426	512,426	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Cell	8	1	819,881	819,881	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Colony	17	6	1,742,247	10,555,969	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	200.95	400x	20	0.5	510	Cell	5	1	512,426	512,426	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	200.95	400x	20	0.5	510	Cell	172	1	17,627,444	17,627,444	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	200.95	400x	20	0.5	510	Cell	12	1	1,229,822	1,229,822	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	200.95	400x	20	0.5	510	Cell	4	1	409,941	409,941	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta			Pennate diatom	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	200.95	400x	20	0.5	510	Colony	1	4	102,485	409,941	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	200.95	400x	20	0.5	510	Cell	2	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	200.95	400x	20	0.5	510	Filament	5	7	512,426	3,382,010	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	16	1	16,320	16,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	11	1	11,220	11,220	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5B Styro	25-Sep-21	pp21-112-030	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	160.76	400x	25	0.5	510	Cell	17	1	1,393,798	1,393,798	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	160.76	400x	25	0.5	510	Cell	10	1	819,881	819,881	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	160.76	400x	25	0.5	510	Cell	10	1	819,881	819,881	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	160.76	400x	25	0.5	510	Cell	4	1	327,952	327,952	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	160.76	400x	25	0.5	510	Cell	25	1	2,049,703	2,049,703	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	160.76	400x	25	0.5	510	Colony	62	4	5,083,263	18,426,828	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	160.76	400x	25	0.5	510	Cell	2	1	163,976	163,976	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	160.76	400x	25	0.5	510	Cell	129	1	10,576,466	10,576,466	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	160.76	400x	25	0.5	510	Cell	5	1	409,941	409,941	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	160.76	400x	25	0.5	510	Colony	1	4	81,988	327,952	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	160.76	400x	25	0.5	510	Cell	3	1	245,964	245,964	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	2.00	100x	Whole chamber scan	0.5	510	Colony	1	36	1,020	36,720	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosirella sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	60	1,020	61,200	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	24	1	24,480	24,480	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5C Styro	25-Sep-21	pp21-112-031	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	8	1	8,160	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	160.76	400x	25	0.5	510	Cell	14	1	1,147,834	1,147,834	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	160.76	400x	25	0.5	510	Cell	2	1	163,976	163,976	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Planothidium sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.											



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Green Algae	Chlorophyta	Chlorellales	Chlorellaceae	Dictyosphaerium sp.	160.76	400x	25	0.5	510	Colony	1	2	81,988	163,976	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	160.76	400x	25	0.5	510	Cell	9	1	737,893	737,893	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	160.76	400x	25	0.5	510	Filament	8	6	655,905	4,029,130	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria capucina	2.00	100x	Whole chamber scan	0.5	510	Colony	1	10	1,020	10,200	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	2.00	100x	Whole chamber scan	0.5	510	Colony	1	52	1,020	53,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	22	1	22,440	22,440	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	5D Styro	25-Sep-21	pp21-112-032	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Gyrosigma sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	93.47	400x	43	0.5	510	Cell	39	1	1,859,033	1,859,033	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	93.47	400x	43	0.5	510	Cell	11	1	524,343	524,343	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	93.47	400x	43	0.5	510	Cell	42	1	2,002,035	2,002,035	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Fragilariales	Staurosiraceae	Staurosira sp.	93.47	400x	43	0.5	510	Colony	1	7	47,668	333,673	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	93.47	400x	43	0.5	510	Cell	3	1	143,003	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	93.47	400x	43	0.5	510	Cell	7	1	333,673	333,673	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	93.47	400x	43	0.5	510	Colony	13	7	619,678	4,426,268	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	93.47	400x	43	0.5	510	Cell	4	1	190,670	190,670	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	93.47	400x	43	0.5	510	Cell	2	1	95,335	95,335	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	93.47	400x	43	0.5	510	Cell	115	1	5,481,763	5,481,763	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	93.47	400x	43	0.5	510	Cell	17	1	810,348	810,348	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta			Pennate diatom	93.47	400x	43	0.5	510	Cell	3	1	143,003	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	93.47	400x	43	0.5	510	Colony	1	3	47,668	143,003	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Tetradron minimum	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium arcuatum	93.47	400x	43	0.5	510	Cell	1	1	47,668	47,668	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	93.47	400x	43	0.5	510	Cell	7	1	333,673	333,673	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	93.47	400x	43	0.5	510	Colony	2	4	95,335	381,340	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	93.47	400x	43	0.5	510	Filament	12	8	572,010	4,719,083	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	15	1	15,300	15,300	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6A Styro	25-Sep-21	pp21-112-033	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	108.62	400x	37	0.5	510	Cell	34	1	1,883,511	1,883,511	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	108.62	400x	37	0.5	510	Cell	3	1	166,192	166,192	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	108.62	400x	37	0.5	510	Cell	6	1	332,384	332,384	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	108.62	400x	37	0.5	510	Cell	11	1	609,371	609,371	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	108.62	400x	37	0.5	510	Cell	6	1	332,384	332,384	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	108.62	400x	37	0.5	510	Cell	40	1	2,215,895	2,215,895	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	108.62	400x	37	0.5	510	Colony	12	2	664,768	1,329,537	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	108.62	400x	37	0.5	510	Cell	4	1	221,589	221,589	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	108.62	400x	37	0.5	510	Cell	6	1	332,384	332,384	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	108.62	400x	37	0.5	510	Cell	135	1	7,478,645	7,478,645	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	108.62	400x	37	0.5	510	Cell	6	1	332,384	332,384	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	108.62	400x	37	0.5	510	Cell	5	1	276,987	276,987	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta			Pennate diatom	108.62	400x	37	0.5	510	Cell	2	1	110,795	110,795	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Green Algae	Chlorophyta	Chlorellales	Oocystaceae	Oocystis sp.	108.62	400x	37	0.5	510	Colony	1	2	55,397	110,795	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediastrum boryanum	108.62	400x	37	0.5	510	Colony	1	28	55,397	1,551,126	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	108.62	400x	37	0.5	510	Cell	4	1	221,589	221,589	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	108.62	400x	37	0.5	510	Cell	5	1	276,987	276,987	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Synechocystis sp.	108.62	400x	37	0.5	510	Colony	1	2	55,397	110,795	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	108.62	400x	37	0.5	510	Filament	11	8	609,371	4,722,626	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	8	1	8,160	8,160	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6B Styro	25-Sep-21	pp21-112-034	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	174.74	400x	23	0.5	510	Cell	15	1	1,336,763	1,336,763	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	174.74	400x	23	0.5	510	Cell	6	1	534,705	534,705	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	174.74	400x	23	0.5	510	Cell	15	1	1,336,763	1,336,763	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	174.74	400x	23	0.5	510	Cell	2	1	178,235	178,235	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6C Styro	25-Sep-21	pp21-112-035	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400									



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	174.74	400x	23	0.5	510	Cell	20	1	1,782,350	1,782,350	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	174.74	400x	23	0.5	510	Cell	7	1	623,823	623,823	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	174.74	400x	23	0.5	510	Cell	18	1	1,604,115	1,604,115	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	174.74	400x	23	0.5	510	Cell	8	1	712,940	712,940	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Cell	28	1	2,495,290	2,495,290	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Colony	45	3	4,010,288	10,121,203	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	174.74	400x	23	0.5	510	Cell	3	1	267,353	267,353	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	174.74	400x	23	0.5	510	Cell	10	1	891,175	891,175	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	174.74	400x	23	0.5	510	Cell	112	1	9,981,161	9,981,161	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	174.74	400x	23	0.5	510	Cell	14	1	1,247,645	1,247,645	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	174.74	400x	23	0.5	510	Cell	2	1	178,235	178,235	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta			Pennate diatom	174.74	400x	23	0.5	510	Cell	5	1	445,588	445,588	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	34	1	34,680	34,680	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Rhopalodia gibba	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	6D Styro	25-Sep-21	pp21-112-036	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	5	1,020	5,100	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	174.74	400x	23	0.5	510	Cell	17	1	1,514,998	1,514,998	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	174.74	400x	23	0.5	510	Cell	4	1	356,470	356,470	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	174.74	400x	23	0.5	510	Cell	10	1	891,175	891,175	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	174.74	400x	23	0.5	510	Cell	12	1	1,069,410	1,069,410	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	174.74	400x	23	0.5	510	Cell	5	1	445,588	445,588	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Cell	4	1	356,470	356,470	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Colony	9	7	802,058	5,534,197	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	174.74	400x	23	0.5	510	Cell	2	1	178,235	178,235	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Naviculales	Pinnulariaceae	Pinnularia sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	174.74	400x	23	0.5	510	Cell	11	1	980,293	980,293	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	174.74	400x	23	0.5	510	Cell	159	1	14,169,684	14,169,684	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	174.74	400x	23	0.5	510	Cell	14	1	1,247,645	1,247,645	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	174.74	400x	23	0.5	510	Cell	6	1	534,705	534,705	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Stephanodiscals	Stephanodiscaceae	Stephanodiscus sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta			Pennate diatom	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	174.74	400x	23	0.5	510	Colony	1	4	89,118	356,470	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	174.74	400x	23	0.5	510	Colony	1	4	89,118	356,470	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	174.74	400x	23	0.5	510	Cell	3	1	267,353	267,353	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	174.74	400x	23	0.5	510	Cell	9	1	802,058	802,058	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	174.74	400x	23	0.5	510	Filament	6	7	534,705	3,742,935	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	31	1	31,620	31,620	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	4	1	4,080	4,080	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro	25-Sep-21	pp21-112-037	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	174.74	400x	23	0.5	510	Cell	20	1	1,782,350	1,782,350	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	174.74	400x	23	0.5	510	Cell	9	1	802,058	802,058	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	174.74	400x	23	0.5	510	Cell	13	1	1,158,528	1,158,528	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	174.74	400x	23	0.5	510	Cell	3	1	267,353	267,353	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Cell	8	1	712,940	712,940	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Colony	4	6	356,470	2,049,703	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	174.74	400x	23	0.5	510	Cell	2	1	178,235	178,235	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	174.74	400x	23	0.5	510	Cell	12	1	1,069,410	1,069,410	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	174.74	400x	23	0.5	510	Cell	180	1	16,041,152	16,041,152	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7A Styro-QA	25-Sep-21	pp21-112-037-QA	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae												



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	133.97	400x	30	0.5	510	Cell	5	1	341,617	341,617	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	133.97	400x	30	0.5	510	Cell	8	1	546,587	546,587	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	133.97	400x	30	0.5	510	Colony	11	5	751,558	3,416,171	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	133.97	400x	30	0.5	510	Cell	3	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Asterionella formosa	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	133.97	400x	30	0.5	510	Cell	5	1	341,617	341,617	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	133.97	400x	30	0.5	510	Cell	168	1	11,478,335	11,478,335	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	133.97	400x	30	0.5	510	Cell	10	1	683,234	683,234	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	133.97	400x	30	0.5	510	Cell	3	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	133.97	400x	30	0.5	510	Cell	2	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta			Pennate diatom	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	133.97	400x	30	0.5	510	Cell	2	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Spirogyra sp.	133.97	400x	30	0.5	510	Filament	2	2	136,647	273,294	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	133.97	400x	30	0.5	510	Cell	4	1	273,294	273,294	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Blue-green Algae	Cyanophyta	Synechococcales	Merismopediaceae	Merismopedia sp.	133.97	400x	30	0.5	510	Colony	2	17	136,647	2,322,996	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	133.97	400x	30	0.5	510	Filament	6	7	409,941	2,732,937	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	19	1	19,380	19,380	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	3	1	3,060	3,060	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7B Styro	25-Sep-21	pp21-112-038	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyceae	Pseudopediastrum boryanum	2.00	100x	Whole chamber scan	0.5	510	Colony	1	16	1,020	16,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	287.07	400x	14	0.5	510	Cell	30	1	4,392,220	4,392,220	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	287.07	400x	14	0.5	510	Cell	2	1	292,815	292,815	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonema sp.	287.07	400x	14	0.5	510	Cell	1	1	146,407	146,407	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	287.07	400x	14	0.5	510	Cell	8	1	1,171,259	1,171,259	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	287.07	400x	14	0.5	510	Colony	1	3	146,407	439,222	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	287.07	400x	14	0.5	510	Cell	9	1	1,317,666	1,317,666	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	287.07	400x	14	0.5	510	Cell	1	1	146,407	146,407	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	287.07	400x	14	0.5	510	Cell	8	1	1,171,259	1,171,259	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	287.07	400x	14	0.5	510	Cell	18	1	2,635,332	2,635,332	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	287.07	400x	14	0.5	510	Colony	22	3	3,220,961	8,282,472	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	287.07	400x	14	0.5	510	Cell	3	1	439,222	439,222	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	287.07	400x	14	0.5	510	Cell	7	1	1,024,851	1,024,851	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	287.07	400x	14	0.5	510	Cell	171	1	25,035,655	25,035,655	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	287.07	400x	14	0.5	510	Cell	7	1	1,024,851	1,024,851	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	287.07	400x	14	0.5	510	Cell	2	1	292,815	292,815	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Diatoms	Bacillariophyta			Pennate diatom	287.07	400x	14	0.5	510	Cell	1	1	146,407	146,407	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	287.07	400x	14	0.5	510	Cell	1	1	146,407	146,407	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Green Algae	Charophyta	Desmidiales	Desmidiaceae	Cosmarium sp.	287.07	400x	14	0.5	510	Cell	2	1	292,815	292,815	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Desmodesmus sp.	287.07	400x	14	0.5	510	Colony	1	1	146,407	146,407	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	287.07	400x	14	0.5	510	Cell	1	1	146,407	146,407	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	287.07	400x	14	0.5	510	Cell	3	1	439,222	439,222	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7C Styro	25-Sep-21	pp21-112-039	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	287.07	400x	14	0.5	510	Filament	1	5	146,407	732,037	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	160.76	400x	25	0.5	510	Cell	37	1	3,033,560	3,033,560	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Encyonopsis sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	160.76	400x	25	0.5	510	Cell	3	1	245,964	245,964	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Reimeria sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	160.76	400x	25	0.5	510	Cell	13	1	1,065,845	1,065,845	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	160.76	400x	25	0.5	510	Cell	2	1	163,976	163,976	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	160.76	400x	25	0.5	510	Cell	23	1	1,885,727	1,885,727	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	160.76	400x	25	0.5	510	Colony	10	3	819,881	2,459,643	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Gyrosigma sp.	160.76	400x	25	0.5	510	Cell	1	1	81,988	81,988	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	160.76	400x	25	0.5	510	Cell	4	1	327,952	327,952	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	160.76	400x	25	0.5	510	Cell	2	1	163,976	163,976	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	160.76	400x	25	0.5	510	Cell	132	1	10,822,430	10,822,430	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	160.76	400x	25	0.5	510	Cell	6	1	491,929	491,929	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	160.76	400x	25	0.5	5						



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	3	3	3,060	7,650	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Pseudopediatrum boryanum	2.00	100x	Whole chamber scan	0.5	510	Colony	1	14	1,020	14,280	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	7D Styro	25-Sep-21	pp21-112-040	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyaceae	Stauridium tetras	2.00	100x	Whole chamber scan	0.5	510	Colony	1	16	1,020	16,320	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	200.95	400x	20	0.5	510	Cell	14	1	1,434,792	1,434,792	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	200.95	400x	20	0.5	510	Cell	13	1	1,332,307	1,332,307	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	200.95	400x	20	0.5	510	Cell	2	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Cell	11	1	1,127,337	1,127,337	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	200.95	400x	20	0.5	510	Colony	21	4	2,152,188	8,716,361	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Caloneis lewisii	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	200.95	400x	20	0.5	510	Cell	9	1	922,366	922,366	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	200.95	400x	20	0.5	510	Cell	175	1	17,934,899	17,934,899	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	200.95	400x	20	0.5	510	Cell	20	1	2,049,703	2,049,703	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Surirellales	Surirellaceae	Surirella sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta			Pennate diatom	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	200.95	400x	20	0.5	510	Cell	3	1	307,455	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	200.95	400x	20	0.5	510	Cell	1	1	102,485	102,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Blue-green Algae	Cyanophyta	Synechococcales	Pseudanabaenaceae	Pseudanabaena sp.	200.95	400x	20	0.5	510	Filament	1	3	102,485	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	10	1	10,200	10,200	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Diatoms	Bacillariophyta	Stephanodiscales	Stephanodiscaceae	Stephanodiscus sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	1	1	1,020	1,020	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8A Styro	25-Sep-21	pp21-112-041	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	11	1	11,220	11,220	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	100.48	400x	40	0.5	510	Cell	44	1	2,254,673	2,254,673	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Cocconeidales	Achnanthidiaceae	Achnanthidium sp.	100.48	400x	40	0.5	510	Cell	4	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Cocconeidales	Cocconeidaceae	Cocconeis placentula	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	100.48	400x	40	0.5	510	Cell	8	1	409,941	409,941	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	100.48	400x	40	0.5	510	Cell	15	1	768,639	768,639	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	100.48	400x	40	0.5	510	Cell	2	1	102,485	102,485	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	100.48	400x	40	0.5	510	Cell	13	1	666,153	666,153	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	100.48	400x	40	0.5	510	Colony	7	3	358,698	922,366	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	100.48	400x	40	0.5	510	Cell	6	1	307,455	307,455	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	100.48	400x	40	0.5	510	Cell	5	1	256,213	256,213	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	100.48	400x	40	0.5	510	Cell	144	1	7,378,930	7,378,930	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	100.48	400x	40	0.5	510	Cell	6	1	307,455	307,455	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	100.48	400x	40	0.5	510	Cell	2	1	102,485	102,485	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta			Pennate diatom	100.48	400x	40	0.5	510	Cell	6	1	307,455	307,455	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	100.48	400x	40	0.5	510	Cell	1	1	51,243	51,243	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	100.48	400x	40	0.5	510	Colony	1	4	51,243	204,970	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Acutodesmus sp.	100.48	400x	40	0.5	510	Colony	1	4	51,243	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Chlorophyta	Sphaeropleales	Scenedesmaceae	Scenedesmus sp.	100.48	400x	40	0.5	510	Colony	1	4	51,243	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	100.48	400x	40	0.5	510	Cell	7	1	358,698	358,698	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x	Whole chamber scan	0.5	510	Cell	20	1	20,400	20,400	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Charophyta	Desmidiiales	Closteriaceae	Closterium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	9	1	9,180	9,180	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Charophyta	Desmidiiales	Desmidiaceae	Cosmarium sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8B Styro	25-Sep-21	pp21-112-042	Green Algae	Charophyta	Zygnematales	Zygnemataceae	Mougeotia sp.	2.00	100x	Whole chamber scan	0.5	510	Filament	1	2	1,020	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Bacillariales	Bacillariaceae	Nitzschia sp.	174.74	400x	23	0.5	510	Cell	34	1	3,029,995	3,029,995	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Cymbellales	Gomphonemataceae	Gomphonema sp.	174.74	400x	23	0.5	510	Cell	4	1	356,470	356,470	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	174.74	400x	23	0.5	510	Cell	21	1	1,871,468	1,871,468	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	174.74	400x	23	0.5	510	Cell	5	1	445,588	445,588	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Cell	20	1	1,782,350	1,782,350	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	174.74	400x	23	0.5	510	Colony	25	5	2,227,938	11,532,854	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Naviculales	Amphipleuraceae	Amphipleura pellucida	174.74	400x	23	0.5	510	Cell	1	1	89,118	89,118	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	174.74	400x	23	0.5	510	Cell	5	1	445,588	445,588	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	174.74	400x	23	0.5	510	Cell	165	1	14,704,389	14,704,389	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	174.74	400x	23	0.5	510	Cell	8	1	712,940	712,940	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8C Styro	25-Sep-21	pp21-112-043	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	174.74	400x	23	0.5	510	Cell	1	1			



Client	Project	Year	Client Sample ID	Date Sampled	Biologica Sample ID	Common Name	Phylum	Order	Family	Taxon	Microscope Factor (mL <sup>-1</sup> )	Magnification	Fields of View Counted	Subsample Volume (mL)	Sample Volume (mL)	Unit Code	Units Counted	Number of Cells/Unit	Unit Abundance (units/sample)	Cell Abundance (cells/sample)	Unique Taxa Count
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Fragilariales	Fragilariaceae	Fragilaria sp.	133.97	400x	30	0.5	510	Cell	17	1	1,161,498	1,161,498	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	133.97	400x	30	0.5	510	Cell	19	1	1,298,145	1,298,145	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Melosirales	Melosiraceae	Melosira sp.	133.97	400x	30	0.5	510	Colony	10	3	683,234	1,981,379	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Naviculales	Naviculaceae	Navicula sp.	133.97	400x	30	0.5	510	Cell	3	1	204,970	204,970	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Naviculales	Pinnulariaceae	Pinnularia sp.	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. moniliformis	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma cf. vulgaris	133.97	400x	30	0.5	510	Cell	186	1	12,708,157	12,708,157	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Diatoma sp.	133.97	400x	30	0.5	510	Cell	3	1	204,970	204,970	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Rhabdonematales	Tabellariaceae	Pennate diatom	133.97	400x	30	0.5	510	Cell	3	1	204,970	204,970	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Green Algae	Charophyta	Desmidiales	Closteriaceae	Closterium sp.	133.97	400x	30	0.5	510	Cell	1	1	68,323	68,323	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium contortum	133.97	400x	30	0.5	510	Cell	2	1	136,647	136,647	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Green Algae	Chlorophyta	Sphaeropleales	Selenastraceae	Monoraphidium sp.	133.97	400x	30	0.5	510	Cell	4	1	273,294	273,294	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria cf. ulna	2.00	100x		0.5	510	Cell	22	1	22,440	22,440	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Licmophorales	Ulnariaceae	Ulnaria sp.	2.00	100x	Whole chamber scan	0.5	510	Cell	9	1	9,180	9,180	
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Diatoms	Bacillariophyta	Rhopalodiales	Rhopalodiaceae	Epithemia sorex	2.00	100x	Whole chamber scan	0.5	510	Cell	2	1	2,040	2,040	1
Limnotek	Syncrude Mesocosms - Styrofoam Balls	2021	8D Styro	25-Sep-21	pp21-112-044	Green Algae	Chlorophyta	Sphaeropleales	Hydrodictyceae	Pseudopediastrum boryanum	2.00	100x	Whole chamber scan	0.5	510	Colony	1	25	1,020	25,500	1





Quality control report of periphyton enumeration in QA samples, Limnotek, Syncrude Mesocosms - Styrofoam Balls, 2021.

Client Sample ID	Biologica Sample ID	Original Abundance (units/sample)	QA Abundance (units/sample)	Percent Agreement (%)
1B Styro	pp21-112-014	51,419,497	49,374,894	96.02
5A Styro	pp21-112-029	27,197,321	27,907,577	97.39
7A Styro	pp21-112-037	24,900,505	25,081,800	99.27
Average:				97.56

Percent Agreement:  $(100 - [(difference\ in\ abundance\ between\ samples) / total\ abundance\ of\ original\ sample]) * 100\%$





### Microscope Calibration Factors:

Samples were analyzed using a Zeiss Axio Vert A.1 inverted phase contrast microscope at 400x magnification.

### Procedure:

Samples were topped up with distilled water to 510 mL to make their volumes equal.

Sub-samples (0.5 mL) were dilluetd in distilled water and settled in a 10 mL Utermohl type settling chamber for 24 hrs.

Sub-samples were systematically scanned and all cells were counted in a series of randomly located fields of view (FOV) until a minimum of 300 cells were enumerated.

Microscope factors were calculated using the following formula:

Calculation of Microscope Factors

$$F = A / (r^2 \pi N V)$$

Where:

A= the area of the settling chamber =

5.31E+08  $\mu\text{m}^2$

r= the radius of the field @ 400x =

290  $\mu\text{m}$

N= the number of fields counted

V= the volume settled (ml)

Area of 1 field

2.64E+05  $\mu\text{m}^2$

Microscope Factors

A ( $\mu\text{m}^2$ )	R ( $\mu\text{m}^2$ )	N	V (mL)	F ( $\text{mL}^{-1}$ )
5.31E+08	290	7	0.5	574.15
5.31E+08	290	12	0.5	334.92
5.31E+08	290	14	0.5	287.07
5.31E+08	290	15	0.5	267.93
5.31E+08	290	17	0.5	236.41
5.31E+08	290	20	0.5	200.95
5.31E+08	290	23	0.5	174.74
5.31E+08	290	25	0.5	160.76
5.31E+08	290	30	0.5	133.97
5.31E+08	290	37	0.5	108.62
5.31E+08	290	40	0.5	100.48
5.31E+08	290	43	0.5	93.47
5.31E+08	290	50	0.5	80.38

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**Appendix A3.5**  
**Taxonomic Data**  
**(Macroinvertebrates)**

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## Abbreviations & Definitions

### **Worksheets:**

1. Abbreviations & Definitions	Glossary of terms and outline of report.
2. Data-Long	Abundance data in long format.
3. QC-QA Report	Results of sorting efficiency.
4. Reference Collection	List of reference specimens archived and their location.
5. Biomass	Average biomass per taxon and station.

### **Life/Size Stages:**

A	Adult
Int	Intermediate - has adult features but not of typical reproductive size
J	Juvenile
L	Larvae
N	Nymph
P	Pupa
Col	Colony
Deut	Deutonymph

Total Number of Taxa	Number of unique taxa (= species richness), not including higher-order taxa for which there exists a lower-order identification (e.g. not including <i>Lumbrineris</i> sp. if there exists <i>Lumbrineris cruzensis</i> in the data)
Total Number of Organisms	Total Abundance, not including incidental taxa
DW	Dry weight

### **Major Taxonomic Groups:**

EPT	Ephemeroptera, Plecoptera, Trichoptera
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### **Miscellaneous**

AMPH	Amphibia
BRYO	Bryozoa
CNHY	Cnidaria Hydrozoa
CNXX	Cnidaria
NTEA	Nemertea
PISC	Pisces
PLTY	Platyhelminthes
PORI	Porifera
ROTI	Rotifera
TARD	Tardigrada
EGGS	Invertebrate eggs

### **Annelida**

ANHI	Annelida Hirudinea
ANOL	Annelida Oligochaeta
ANXX	Annelida



**Arthropoda**

CHAR	Chelicerata Arachnida
CHXX	Chelicerata
CRAM	Crustacea Amphipoda
CRCL	Crustacea Cladocera
CRCO	Crustacea Copepoda
CRCU	Crustacea Cumacea
CRIS	Crustacea Isopoda
CRMY	Crustacea Mysidacea
CROS	Crustacea Ostracoda
CRXX	Crustacea

**Insecta**

INCM	Insecta Collembola
INCO	Insecta Coleoptera
INDI	Insecta Diptera
INEP	Insecta Ephemeroptera
INHM	Insecta Hemiptera
INHY	Insecta Hymenoptera
INLE	Insecta Lepidoptera
INMG	Insecta Megaloptera
INOD	Insecta Odonata
INPL	Insecta Plecoptera
INTR	Insecta Tricoptera
INXX	Insecta

**Mollusca**

MOBI	Mollusca Bivalvia
MOGA	Mollusca Gastropoda
MOXX	Mollusca





Abundance data in long format with average taxon/stage biomass for Limnotek Syncrude Mesocosms (Post-Experiment), 2021.

Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.0505	0.0505	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	J	2	1	0.2122	0.4244	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Annelida	Clitellata					Oligochaeta indet.	J	1		0.0898	0.0898	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Arachnida					Acari indet.	Deut	1	1	0.0327	0.0327	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.2494	0.2494	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0071	0.0071	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0063	0.0063	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	1	1	0.0049	0.0049	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0183	0.0183	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.0392	0.0784	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.9308	0.9308	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-077	1A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	0.8355	3.3419	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1067	0.1067	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Arachnida	Trombidiformes	Sperchontidae			Sperchonopsis sp.	A	1	1	0.0872	0.0872	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0012	0.0012	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus sp.	L	1	1	0.0030	0.0030	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.0585	0.1755	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	2	1	0.7672	1.5344	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	5	1	1.1953	5.9765	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	2	1	2.6872	5.3745	Damaged, anterior portion only x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-078	1B	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.1317	0.1317	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-079	1C	Arthropoda	Insecta	Plecoptera	Pteronarcyidae	Pteronarcyinae	Pteronarcyini	Pteronarcys dorsata	N	1	1	10.7916	10.7916	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-079	1C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	1.0813	1.0813	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-079	1C	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	2		3.4568	6.9136	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-079	1C	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		1.7875	1.7875	Damaged, anterior portion only, likely Hydropsyche sp.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-080	1D	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.1605	0.1605	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-080	1D	Arthropoda	Insecta	Coleoptera	Dytiscidae	Hydroporinae	Hydroporini	Hydroporini indet.	A	1	1	0.2776	0.2776	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-080	1D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0017	0.0017	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-080	1D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	1	1	0.2872	0.2872	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-080	1D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	2	1	1.0108	2.0215	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	19	1	0.1093	2.0771	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0021	0.0042	Immature
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.2958	0.2958	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0042	0.0042	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	1	1	0.0087	0.0087	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1	1	0.0783	0.0783	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0920	0.0920	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	1	1	0.0020	0.0020	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	1.0825	4.3298	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	2	1	1.0558	2.1115	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	1		0.3798	0.3798	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0734	0.0734	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	2		0.9936	1.9873	Damaged, anterior portion only, likely Hydropsychidae indet.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-081	2A	Arthropoda	Insecta	Hemiptera				Hemiptera indet.	N	1	1	0.0021	0.0021	Terrestrial
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-082	2B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.8940	2.6819	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-082	2B	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	2.0464	2.0464	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-082	2B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	2	1	1.9212	3.8425	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-082	2B	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	3		0.4713	1.4139	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	6	1	0.1269	0.7612	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	A	1	1	0.4997	0.4997	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	J	1		0.1140	0.1140	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	2	1	0.0045	0.0091	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Cricotopus/Orthocladius sp. complex	L	1	1	0.0095	0.0095	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0076	0.0076	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.1010	0.3029	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0492	0.0492	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	2.2374	2.2374	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	1.1942	1.1942	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	1	1	4.7782	4.7782	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-083	2C	Arthropoda	Insecta	Hemiptera				Hemiptera indet.	N	5	1	0.0026	0.0131	Terrestrial
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	11	1	0.1405	1.5454	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	J	1	1	0.2215	0.2215	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	3	1	0.0011	0.0032	Immature
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0546	0.0546	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	1.1681	1.1681	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D													



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	6	1	6.2787	37.6724	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-084	2D	Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostomatinae		Lepidostoma sp.	L	1	1	0.0454	0.0454	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	8	1	0.1345	1.0764	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.1818	0.1818	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Annelida	Clitellata	Tubificida	Naididae			Naididae indet.	J	1		0.1738	0.1738	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0021	0.0042	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	18	1	0.0922	1.6590	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cyphomella sp.	L	1	1	0.0141	0.0141	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma sp.	L	1	1	0.0096	0.0096	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	1	1	0.0017	0.0017	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0065	0.0065	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.8758	0.8758	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.6509	0.6509	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Plecoptera				Plecoptera indet.	N	1	1	0.1378	0.1378	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	1.3964	5.5856	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-085	3A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	3	1	2.1980	6.5940	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Annelida	Clitellata	Tubificida	Naididae			Nais behningi	A	8	1	0.1196	0.9566	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0022	0.0022	Possibly Paracladopelma sp.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	4	1	0.2316	0.9265	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Paracladopelma sp.	L	1	1	0.0006	0.0006	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	2	1	0.0015	0.0031	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0604	0.0604	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.0179	0.0358	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-086	3B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	6	1	0.4077	2.4462	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Annelida	Clitellata	Tubificida	Naididae			Chaetogaster diastrophus	A	2	1	0.0546	0.1092	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	9	1	0.0958	0.8618	Damaged x3
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Coleoptera				Coleoptera indet.	A	1	1	0.5445	0.5445	Damaged, possibly Dytiscidae indet.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1	1	0.0013	0.0013	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0032	0.0032	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.0546	0.0546	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	1.1387	1.1387	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-087	3C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	3	1	2.7260	8.1779	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	4	1	0.1227	0.4908	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.3960	0.3960	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0011	0.0021	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.2861	0.2861	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	2	1	0.0016	0.0033	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	2	1	0.0053	0.0106	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0105	0.0105	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.7417	0.7417	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0495	0.0495	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.2007	0.2007	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	1.6167	1.6167	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	1	1	7.5746	7.5746	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	3		7.5746	22.7238	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1		0.0673	0.0673	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-088	3D	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		0.0061	0.0061	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	8	1	0.0016	0.0126	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	43	1	0.0018	0.0786	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1		0.0007	0.0007	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Brillia sp.	L	1	1	0.0155	0.0155	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Nanocladius sp.	L	1	1	0.0045	0.0045	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1	1	0.0048	0.0048	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.0448	0.1345	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	4	1	0.9463	3.7853	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	3		0.8312	2.4935	Damaged, anterior portion only x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	18	1	0.3881	6.9855	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	3	1	0.3024	0.9073	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Plecoptera				Plecoptera indet.	N	2		0.0922	0.1844	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	3	1	1.1487	3.4461	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	24	1	2.9926	71.8213	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-089	4A	Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostomatinae		Lepidostoma sp.	L	1	1	0.0784	0.0784	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	4	1	0.1104	0.4417	Damaged x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0011	0.0011	Immature, suspect Cyphomella sp.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.5908	0.5908	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cyphomella sp.						



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0441	0.0441	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0109	0.0109	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.1838	0.3675	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	1	1	0.2094	0.2094	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	9	1	0.7634	6.8702	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	10		0.3238	3.2383	Damaged x5
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	13	1	0.2141	2.7829	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Chloroperlidae indet.	N	1	1	0.0852	0.0852	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	3	1	0.1872	0.5617	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Trichoptera	Brachycentridae			Brachycentrus sp.	L	3	1	0.5035	1.5105	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	0.8931	1.7861	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	22	1	1.3454	29.5996	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	2		0.8002	1.6004	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-090	4B	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.3005	0.3005	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	6	1	0.1058	0.6346	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0027	0.0027	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.5272	0.5272	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0051	0.0051	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	L	7	1	0.0021	0.0144	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	5	1	0.0017	0.0083	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	1	1	0.0152	0.0152	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1		0.0883	0.0883	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.1413	0.1413	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0709	0.0709	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.0478	0.0478	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	10	1	0.6380	6.3801	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	1.1954	1.1954	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	1	1	0.2004	0.2004	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	1.2779	2.5557	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	33		3.0960	102.1677	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-091	4C	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0446	0.0446	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	10	1	0.1067	1.0674	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Annelida			Aeolosomatidae			Aeolosoma sp.	A	3	1	0.0554	0.1661	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	2	1	0.0013	0.0027	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	7	1	0.0035	0.0248	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	L	3	1	0.0028	0.0085	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	2	1	0.0029	0.0058	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1		0.0042	0.0042	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Nanocladius sp.	L	1	1	0.0019	0.0019	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	2		0.0045	0.0091	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1	1	0.0014	0.0014	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	L	1		0.0012	0.0012	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	4	1	0.1302	0.5206	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	0.2236	0.6709	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	1		0.2101	0.2101	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	17	1	0.4048	6.8809	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	3	1	2.1053	6.3159	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	3	1	0.3035	0.9106	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	6	1	1.0867	6.5201	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-092	4D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	39	1	2.2694	88.5053	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	2	1	0.0962	0.1923	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.5126	0.5126	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Annelida			Aeolosomatidae			Aeolosoma sp.	A	1	1	0.0511	0.0511	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	6		0.0011	0.0063	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.0025	0.0025	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1	1	0.0020	0.0020	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	1	1	0.0009	0.0009	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0282	0.0282	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	2	1	0.1384	0.2768	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	1	1	0.1568	0.1568	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	1.2667	2.5333	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	4		3.0164	12.0656	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-093	5A	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0166	0.0166	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-094	5B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	12	1	0.1287	1.5442	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-094	5B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0017	0.0033	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-094	5B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	2	1	0.0076		



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-094	5B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	3	1	0.8468	2.5403	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.3554	0.3554	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1	1	0.0011	0.0011	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.2754	0.8261	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	2	1	0.0040	0.0079	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.4766	0.4766	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-095	5C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	6	1	0.8976	5.3857	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.2392	0.2392	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	2	1	0.4920	0.9840	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.2206	0.2206	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta		Aeolosomatidae			Aeolosoma sp.	A	1	1	0.0679	0.0679	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Athericidae			Atherix sp.	L	1	1	1.3773	1.3773	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0012	0.0024	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.2693	0.8078	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	L	1	1	0.0053	0.0053	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1		0.0125	0.0125	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.1190	0.1190	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.0224	0.0448	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.7417	0.7417	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.1659	0.1659	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	4	1	0.8756	3.5024	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	1	1	0.2022	0.2022	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.6763	0.6763	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Trichoptera	Brachycentridae			Brachycentrus sp.	L	1	1	0.4034	0.4034	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-096	5D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	3	1	0.8011	2.4033	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	26	1	0.1500	3.8989	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais elinguis	A	1	1	0.1296	0.1296	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.1737	0.1737	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0006	0.0006	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.3385	0.3385	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	2	1	0.0020	0.0040	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0027	0.0027	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	L	1	1	0.0020	0.0020	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus sp.	L	1	1	0.0124	0.0124	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	5	1	0.0418	0.2092	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	1		0.2392	0.2392	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Trichoptera	Brachycentridae			Brachycentrus sp.	L	1	1	0.2121	0.2121	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	3	1	0.8471	2.5412	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	3	1	0.5488	1.6465	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-097	6A	Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostomatinae		Lepidostoma sp.	L	1	1	0.0748	0.0748	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	8	1	0.1388	1.1104	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.4465	0.4465	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Annelida	Clitellata	Tubificida	Naididae			Naididae indet.	J	1		0.1263	0.1263	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Annelida			Aeolosomatidae			Aeolosoma sp.	A	1	1	0.0592	0.0592	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	3		0.0007	0.0021	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	2	1	0.2163	0.4326	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	6		0.0018	0.0110	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	6	1	0.0029	0.0174	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	7	1	0.0034	0.0241	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	3	1	0.0775	0.2324	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	1	1	0.0487	0.0487	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0267	0.0267	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	5	1	0.2141	1.0704	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	3		1.4028	4.2085	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	2	1	0.4140	0.8280	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Plecoptera	Nemouridae	Nemourinae		Zapada cinctipes	N	1	1	0.0470	0.0470	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.6010	0.6010	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	2.7620	2.7620	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	6		0.2910	1.7460	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	5	1	1.7128	8.5640	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	31	1	4.2111	130.5449	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-098	6B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	1		0.4140	0.4140	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1370	0.1370	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	3		0.0010	0.0030	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.1082	0.3245	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	2	1	0.0017	0.003	



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	1	1	0.1788	0.1788	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	1.0711	2.1421	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	12	1	3.5345	42.4136	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostomatinae		Lepidostoma sp.	L	1	1	0.0396	0.0396	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C	Arthropoda	Insecta	Hemiptera				Homoptera indet.	N	1	1	0.2734	0.2734	Terrestrial
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-099	6C				Platyhelminthes			Platyhelminthes indet.	J	2	1	0.0032	0.0065	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Annelida	Clitellata		Enchytraeidae			Enchytraeidae indet.	A	1	1	0.0956	0.0956	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Arachnida	Sarcoptiformes				Oribatida indet.	Deut	1	1	0.0334	0.0334	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	1	1	0.0009	0.0009	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	3	1	0.0014	0.0042	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1	1	0.0868	0.0868	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.0640	0.1919	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	0.4499	1.3496	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	1		0.4267	0.4267	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	5	1	0.5166	2.5828	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	1.1299	4.5195	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-100	6D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	15	1	2.9363	44.0443	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0014	0.0014	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.2147	0.6442	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	6	1	0.0016	0.0099	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	4	1	0.0010	0.0041	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Cricotopus/Orthocladius sp. complex	L	1	1	0.0572	0.0572	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Orthocladiinae indet.	L	1		0.0018	0.0018	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0604	0.0604	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0911	0.0911	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.8037	0.8037	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	16	1	0.5289	8.4620	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	11		0.0622	0.6838	Damaged x5
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	21	1	0.1767	3.7107	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	2.4050	2.4050	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	7		0.8588	6.0114	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	23	1	2.6942	61.9660	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0426	0.0426	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-101	7A	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		1.6823	1.6823	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Annelida	Clitellata		Naididae	Naidinae		Chaetogaster diastrophus	A	2	1	0.0574	0.1148	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Annelida	Clitellata		Naididae	Naidinae		Nais behningi	A	4	1	0.1275	0.5100	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	2		0.0320	0.0640	Possibly Cyphomella sp.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.0237	0.0710	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cyphomella sp.	L	2	1	0.0346	0.0692	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	5	1	0.0019	0.0096	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	2	1	0.0011	0.0023	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	6	1	0.0010	0.0059	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Stempellinella/Zavrelia sp. complex	L	1	1	0.0009	0.0009	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1		0.0007	0.0007	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.1088	0.2176	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.7417	0.7417	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	4		0.1048	0.4193	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	9	1	0.2540	2.2860	Damaged x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	2.3512	2.3512	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	1.1220	1.1220	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Plecoptera				Plecoptera indet.	N	2		0.0615	0.1230	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	1.3771	2.7543	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	21	1	1.5050	31.6056	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0131	0.0131	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		1.1821	1.1821	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-102	7B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1		0.1088	0.1088	Covered in fungus/algae, likely dead prior to preservation
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Annelida	Clitellata		Naididae	Naidinae		Nais behningi	A	10	1	0.1314	1.3141	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	3		0.0207	0.0620	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	2	1	0.2735	0.5470	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	24	1	0.0022	0.0516	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0113	0.0113	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	3	1	0.0027	0.0081	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.1993	0.1993	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	4	1	0.0854	0.3414	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.6829	0.6829	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae									



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-103	7C	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0497	0.0497	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	2	1	0.1042	0.2085	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	5		0.0041	0.0207	Possibly Cyphomella sp. x4
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	3	1	0.0016	0.0048	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	2	1	0.0033	0.0067	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Cricotopus/Orthocladius sp. complex	L	1	1	0.0026	0.0026	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	5	1	0.0978	0.4888	Damaged x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.1424	0.1424	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	2	1	0.1544	0.3089	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.4899	0.4899	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	1		0.1224	0.1224	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	3	1	0.4933	1.4800	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	9.7946	9.7946	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	5.8685	5.8685	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	1	1	4.0724	4.0724	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	13	1	4.0724	52.9410	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-104	7D	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0512	0.0512	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais elinguis	A	10	1	0.1274	1.2744	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.4141	0.4141	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Coleoptera	Staphylinidae			Staphylinidae indet.	A	1	1	0.0345	0.0345	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0004	0.0004	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.0383	0.0383	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cyphomella sp.	L	1	1	0.0031	0.0031	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	1	1	0.0015	0.0015	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0017	0.0017	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	12	1	0.0010	0.0120	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1		0.0016	0.0016	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0991	0.0991	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	19	1	0.5454	10.3630	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	3	1	0.0980	0.2940	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	3	1	0.2013	0.6039	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	15	1	3.1456	47.1835	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-105	8A	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0537	0.0537	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Chaetogaster diastrophus	A	21	1	0.0558	1.1727	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	5	1	0.1059	0.5294	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	1		0.0197	0.0197	Possibly Cyphomella sp.
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.1056	0.1056	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Cyphomella sp.	L	1	1	0.0027	0.0027	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	3	1	0.0028	0.0083	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0022	0.0022	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Cricotopus/Orthocladius sp. complex	L	1	1	0.0026	0.0026	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Orthoclaadiinae indet.	L	1		0.0047	0.0047	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.0515	0.1029	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	0.5257	1.5770	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	6	1	0.5242	3.1449	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.2641	0.2641	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	2	1	0.2309	0.4618	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	2	1	1.0430	2.0861	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-106	8B	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	24	1	3.2866	78.8786	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.3230	0.3230	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomini indet.	L	3		0.0007	0.0022	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	3	1	0.2178	0.6535	Damaged x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	2	1	0.0013	0.0027	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0017	0.0017	Damaged
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0063	0.0063	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1	1	0.2243	0.2243	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	L	1		0.0046	0.0046	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	2	1	0.0848	0.1696	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	0.6324	1.8973	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	1		0.2464	0.2464	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	4	1	0.7549	3.0197	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	2.1907	2.1907	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	1	1	0.2020	0.2020	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	1.1680	4.6722	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-107	8C	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	8	1	3.5020	28.0164	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Coleoptera										



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Tvetenia sp.	L	2	1	0.0055	0.0111	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0511	0.0511	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	2.1138	6.3414	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	3		0.2542	0.7627	Damaged, anterior portion only x2
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	14	1	0.4334	6.0675	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	3.2559	3.2559	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	2		0.2034	0.4069	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	5	1	1.2893	6.4464	
Limnotek	Syncrude Mesocosms	Post-Experiment	2021	Whole	250	250	fb21-112-108	8D	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	14	1	4.9104	68.7458	





**Benthic report of sorting efficiency quality control and quality assurance for Limnotek Syncrude Mesocosms (Post-Experiment), 2021.**

<b>Biologica Sample ID</b>	<b>Client Sample ID</b>	<b>Sorting Efficiency QA: Random whole resorts</b>
fb21-112-077	1A	
fb21-112-078	1B	
fb21-112-079	1C	
fb21-112-080	1D	
fb21-112-081	2A	
fb21-112-082	2B	
fb21-112-083	2C	
fb21-112-084	2D	
fb21-112-085	3A	
fb21-112-086	3B	
fb21-112-087	3C	
fb21-112-088	3D	
fb21-112-089	4A	
fb21-112-090	4B	
fb21-112-091	4C	
fb21-112-092	4D	
fb21-112-093	5A	
fb21-112-094	5B	100.00%
fb21-112-095	5C	
fb21-112-096	5D	
fb21-112-097	6A	96.61%
fb21-112-098	6B	
fb21-112-099	6C	
fb21-112-100	6D	
fb21-112-101	7A	
fb21-112-102	7B	
fb21-112-103	7C	
fb21-112-104	7D	
fb21-112-105	8A	98.59%
fb21-112-106	8B	
fb21-112-107	8C	
fb21-112-108	8D	
	<b>Average:</b>	<b>98.40%</b>

**QA/QC**

Sorting efficiency:  $[(\text{total count} - \text{organisms recovered in spot check and/or re-sort}) / \text{total count}] \times 100\%$





## Abbreviations & Definitions

### Worksheets:

- |                               |                                                          |
|-------------------------------|----------------------------------------------------------|
| 1. Abbreviations & Definition | Glossary of terms and outline of report.                 |
| 2. Data-Long                  | Abundance data in long format.                           |
| 3. QC-QA Report               | Results of sorting efficiency.                           |
| 4. Reference Collection       | List of reference specimens archived and their location. |
| 5. Biomass                    | Average biomass per taxon and station.                   |

### Life/Size Stages:

A	Adult
Int	Intermediate - has adult features but not of typical reproductive size
J	Juvenile
L	Larvae
N	Nymph
P	Pupa
Col	Colony
Deut	Deutonymph
Total Number of Taxa	Number of unique taxa (= species richness), not including higher-order taxa for which there exists a lower-order identification (e.g. not including <i>Lumbrineris</i> sp. if there exists <i>Lumbrineris cruzensis</i> in the data)
Total Number of Organisms	Total Abundance, not including incidental taxa
DW	Dry weight

### Major Taxonomic Groups:

EPT	Ephemeroptera, Plecoptera, Trichoptera
-----	----------------------------------------

### Miscellaneous

AMPH	Amphibia
BRYO	Bryozoa
CNHY	Cnidaria Hydrozoa
CNXX	Cnidaria
NTEA	Nemertea
PISC	Pisces
PLTY	Platyhelminthes
PORI	Porifera
ROTI	Rotifera
TARD	Tardigrada
EGGS	Invertebrate eggs

### Annelida

ANHI	Annelida Hirudinea
ANOL	Annelida Oligochaeta
ANXX	Annelida



**Arthropoda**

CHAR	Chelicerata Arachnida
CHXX	Chelicerata
CRAM	Crustacea Amphipoda
CRCL	Crustacea Cladocera
CRCO	Crustacea Copepoda
CRCU	Crustacea Cumacea
CRIS	Crustacea Isopoda
CRMY	Crustacea Mysidacea
CROS	Crustacea Ostracoda
CRXX	Crustacea

**Insecta**

INCM	Insecta Collembola
INCO	Insecta Coleoptera
INDI	Insecta Diptera
INEP	Insecta Ephemeroptera
INHM	Insecta Hemiptera
INHY	Insecta Hymenoptera
INLE	Insecta Lepidoptera
INMG	Insecta Megaloptera
INOD	Insecta Odonata
INPL	Insecta Plecoptera
INTR	Insecta Tricoptera
INXX	Insecta

**Mollusca**

MOBI	Mollusca Bivalvia
MOGA	Mollusca Gastropoda
MOXX	Mollusca





Abundance data in long format with average taxon/stage biomass for Limnotek Syncrude Mesocosms (Pre-Experiment), 2021.

Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Replicate	Sample Date	grpcode	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.4509	0.4509	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.1946	0.1946	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	8	1	0.0036	0.0284	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1	1	0.0005	0.0005	Immature
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Tvetenia sp.	L	1	1	0.0344	0.0344	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	3	1	0.1539	0.4616	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1	1	0.0264	0.0264	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	9	1	0.0736	0.6622	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera				Brachycera indet.	P	1	1	0.0411	0.0411	Cyclorrhaphous group
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.1602	0.1602	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	11	1	0.3410	3.7511	Damaged x2
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	1	1	0.0582	0.0582	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	98		0.0778	7.6253	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	38	1	0.8740	33.2116	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INOD	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.8127	0.8127	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	3	1	1.7411	5.2234	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	7	1	1.4175	9.9227	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	16		0.3255	5.2083	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Brachycentridae			Brachycentrus sp.	L	1	1	0.0372	0.0372	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	6	1	1.4386	8.6319	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	92	1	2.2357	205.6866	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	10		0.1841	1.8406	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0546	0.0546	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0382	0.0382	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-001	KICK 1	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	5		0.7391	3.6957	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	2	1	0.2983	0.5965	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	3		0.1089	0.3266	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INCM	Arthropoda	Collembola	Collembola	Isotomidae			Isotomidae indet.	A	1	1	0.0236	0.0236	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	4	1	0.0013	0.0052	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Tvetenia sp.	L	1	1	0.0112	0.0112	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	10	1	0.1103	1.1026	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0291	0.0291	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.0843	0.2530	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	8		0.1766	1.4131	Damaged x5
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	6	1	0.2822	1.6935	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0408	0.0408	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	9	1	1.0689	9.6204	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	140		0.1225	17.1435	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	55	1	0.2102	11.5617	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	3	1	0.7593	2.2780	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	10	1	1.5569	15.5694	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	24		0.3512	8.4292	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	4	1	1.2883	5.1530	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	56	1	2.9991	167.9501	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	4		0.1999	0.7996	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0198	0.0198	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	2	1	0.0687	0.1375	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-002	KICK 2	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	4		0.9827	3.9308	Damaged, anterior portion only, likely Hydropychidae
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	ANHI	Annelida	Clitellata	Hirudinida	Glossiphoniidae	Glossiphoniinae		Glossiphonia elegans	A	1	1	1.3801	1.3801	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1082	0.1082	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.3015	0.3015	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	3	1	0.0016	0.0047	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus sp.	L	1	1	0.0050	0.0050	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthoclaadiinae		Tvetenia sp.	L	1	1	0.0595	0.0595	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	3		0.0281	0.0844	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	3	1	0.1550	0.4651	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0615	0.0615	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	5	1	0.1565	0.7823	
Limnotek																								



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Replicate	Sample Date	grpcode	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	10	1	0.0603	0.6033	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-003	KICK 3	1	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	5		0.5779	2.8894	Damaged, anterior portion only, likely Hydropsychidae
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Naidinae indet.	A	1	1	0.1138	0.1138	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1	1	0.3178	0.3178	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedium sp.	L	1	1	0.0028	0.0028	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	2	1	0.0018	0.0036	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	L	1	1	0.0024	0.0024	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia sp.	L	1	1	0.0148	0.0148	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	4	1	0.1615	0.6462	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	4	1	0.0429	0.1715	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	2	1	0.1727	0.3454	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	13	1	0.0666	0.8663	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	12		0.2494	2.9923	Damaged x2
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0318	0.0318	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	12	1	1.0328	12.3931	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	90		0.0819	7.3674	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	35	1	0.6296	22.0372	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.7090	0.7090	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlodinae	Perlodini	Isogenoides sp.	N	4	1	1.2393	4.9571	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	26		0.1473	3.8299	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	5	1	1.9887	9.9436	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	43	1	3.2601	140.1826	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	5		0.1560	0.7802	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	5	1	0.2865	1.4324	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-004	KICK 3	2	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		0.0031	0.0031	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Stempellinella/Zavrelia sp. complex	L	1	1	0.0020	0.0020	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Brillia sp.	L	1	1	0.0011	0.0011	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia sp.	L	2	1	0.0200	0.0400	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	4		0.0497	0.1988	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	5	1	0.1454	0.7268	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	5	1	0.0386	0.1932	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	2	1	0.2405	0.4809	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ametropodidae			Ametropus neavei	N	1	1	3.8391	3.8391	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	2		0.0350	0.0700	Immature
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	4	1	0.2164	0.8657	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	3		0.1899	0.5696	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Fallceon sp.	N	2	1	0.6847	1.3695	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0294	0.0294	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	22	1	0.6900	15.1798	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	86		0.0297	2.5530	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	28	1	0.3808	10.6636	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae			Paraleptophlebia sp.	N	1	1	0.0540	0.0540	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INOD	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	0.2003	0.2003	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Chloroperlidae indet.	N	1	1	0.0772	0.0772	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	3	1	0.9719	2.9156	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	22		0.1694	3.7264	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Pteronarcyidae	Pteronarcyinae	Pteronarcyini	Pteronarcys dorsata	N	1	1	25.3555	25.3555	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	0.4100	0.4100	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	25	1	1.2133	30.3313	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	5		0.2363	1.1813	Immature x3
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	3	1	0.0419	0.1258	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Polycentropodidae	Polycentropodinae		Neureclipsis sp.	L	1	1	0.4412	0.4412	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-005	KICK 4	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		0.3944	0.3944	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	4	1	0.1402	0.5608	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	1	1	0.2950	0.2950	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	J	1		0.2443	0.2443	Possibly Tubifex sp.
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Athericidae			Atherix sp.	L	1	1	13.9430	13.9430	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0017	0.0017	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK																



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Replicate	Sample Date	grpcode	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	12		0.4069	4.8823	Damaged/immature x3
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-006	KICK 5	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0620	0.0620	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae	Nais behningi	A	1	1	0.1197	0.1197		
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae			Limnodrilus sp.	J	1	1	0.3985	0.3985	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	CHAR	Arthropoda	Arachnida	Trombidiformes	Torrenticolidae			Torrenticolidae indet.	A	1	1	0.0732	0.0732	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	4	1	0.0014	0.0054	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	3		0.0333	0.0998	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	5	1	0.0517	0.2584	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0519	0.0519	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.1569	0.4706	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	7	1	0.4412	3.0886	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	11		0.0867	0.9540	Damaged x4
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Fallceon sp.	N	1	1	0.4952	0.4952	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ephemerellidae			Ephemerellidae indet.	N	1	1	0.0415	0.0415	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	81		0.0848	6.8662	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	35	1	0.4800	16.8004	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INOD	Arthropoda	Insecta	Odonata	Gomphidae			Ophiogomphus sp.	N	1	1	3.3136	3.3136	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.0572	0.0572	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	2	1	1.0880	2.1761	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	15		0.1557	2.3354	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera				Plecoptera indet.	N	3		0.0419	0.1258	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	7	1	1.4036	9.8252	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	53	1	5.0242	266.2805	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	8		0.1947	1.5574	Damaged x2
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0317	0.0317	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	2	1	0.0549	0.1098	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-007	KICK 6	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera				Trichoptera indet.	L	1		0.0253	0.0253	Damaged, anterior portion only
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1420	0.1420	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	CHAR	Arthropoda	Arachnida	Trombidiformes	Torrenticolidae			Torrenticolidae indet.	A	1	1	0.0610	0.0610	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INCM	Arthropoda	Collembola					Entomobryidae indet.	A	1	1	0.0152	0.0152	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INCO	Arthropoda	Insecta	Coleoptera				Coleoptera indet.	A	1	1	0.0204	0.0204	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0006	0.0006	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsini indet.	L	1		0.0250	0.0250	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	2	1	0.1721	0.3443	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae			Chironomidae indet.	P	1		0.0407	0.0407	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	3	1	0.1914	0.5743	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	6	1	0.3615	2.1688	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	5		0.1843	0.9213	Damaged, anterior portion only x2
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	7	1	0.3941	2.7586	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	67		0.0749	5.0199	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	36	1	0.4644	16.7175	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Chloroperlidae indet.	N	1	1	0.1384	0.1384	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.8106	0.8106	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	2	1	1.3350	2.6699	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	15		0.1995	2.9925	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	10	1	1.5214	15.2136	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	129	1	3.7308	481.2676	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	14		0.2065	2.8908	Damaged, anterior portion only x4
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-008	KICK 7	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydroptilidae			Hydroptilidae indet.	L	1	1	0.0802	0.0802	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1119	0.1119	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	CHAR	Arthropoda	Arachnida	Trombidiformes	Hygrobatiidae			Atractides sp.	A	1	1	0.0449	0.0449	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	2	1	0.0020	0.0039	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia sp.	L	2	1	0.0230	0.0460	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.0177	0.0177	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	1	1	0.0291	0.0291	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	1	1	0.2091	0.2091	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	7	1	0.2246	1.5725	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-009	KICK 8	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	6		0.27		



Client	Project	Treatment	Year	Split	Field Screen Size (µm)	Lab Screen Size (µm)	Biologica Sample ID	Client Sample ID	Replicate	Sample Date	grpcode	Phylum	Class	Order	Family	Subfamily	Tribe	Taxon	Stage	Total Abundance	Unique Taxa Count	Average DW (g)	Total DW (g)	Comments
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	7	1	0.1651	1.1560	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	6	1	0.3781	2.2688	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	2		0.5680	1.1360	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	3	1	1.3820	4.1461	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	70		0.1146	8.0185	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	11	1	0.7817	8.5992	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	1	1	0.6791	0.6791	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	1	1	1.8278	1.8278	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	14		0.2363	3.3080	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	8	1	1.3769	11.0151	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	44	1	2.1484	94.5299	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	6		0.0815	0.4891	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-010	KICK 9	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	1	1	0.0310	0.0310	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Naididae	Naididae			Nais behningi	A	2	1	0.1104	0.2209	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	2	1	0.2046	0.4092	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Athericidae			Atherix sp.	L	1	1	5.2791	5.2791	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	1	1	0.0308	0.0308	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Stictocladius sp.	L	1	1	0.0522	0.0522	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	1		0.0928	0.0928	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	1	1	0.1054	0.1054	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	4	1	0.1062	0.4247	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	1		0.9463	0.9463	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	5	1	0.4277	2.1385	Damaged, anterior portion only x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis sp.	N	5		0.2910	1.4549	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptagenia sp.	N	5	1	0.2558	1.2792	Damaged
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Heptageniidae indet.	N	59		0.1903	11.2306	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Heptageniidae			Rhithrogena sp.	N	36	1	0.3603	12.9717	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Chloroperlidae			Chloroperlidae indet.	N	1	1	0.0355	0.0355	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlidae	Perlinae	Perlini	Claassenia sabulosa	N	4	1	0.3335	1.3342	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae	Perlodinae	Perlodini	Isogenoides sp.	N	5	1	1.2087	6.0433	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Perlodidae			Perlodidae indet.	N	13		0.2193	2.8515	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INPL	Arthropoda	Insecta	Plecoptera	Plecoptera			Plecoptera indet.	N	1		0.0531	0.0531	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Glossosomatidae	Glossosomatinae	Glossosomatini	Glossosoma sp.	L	1	1	2.2267	2.2267	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Cheumatopsyche sp.	L	1	1	2.0569	2.0569	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychinae		Hydropsyche sp.	L	67	1	1.5983	107.0878	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Hydropsychidae			Hydropsychidae indet.	L	7		0.1990	1.3930	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptocerinae	Oecetini	Oecetis sp.	L	2	1	0.1704	0.3409	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-011	KICK 10	n/a	1-Sep-21	INTR	Arthropoda	Insecta	Trichoptera	Trichoptera			Trichoptera indet.	L	1		0.0380	0.0380	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Naidinae		Nais behningi	A	1	1	0.1666	0.1666	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	A	2	1	0.4404	0.8809	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Limnodrilus sp.	J	1		0.2114	0.2114	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	ANOL	Annelida	Clitellata	Tubificida	Naididae	Tubificinae		Tubificinae indet.	A	1		0.3405	0.3405	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Athericidae			Atherix sp.	L	1	1	4.8195	4.8195	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Chironomus sp.	L	1	1	0.0175	0.0175	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	L	1	1	0.0288	0.0288	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Cladotanytarsus sp.	L	5	1	0.0020	0.0101	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	L	1	1	0.0017	0.0017	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Tanytarsus sp.	L	1	1	0.0108	0.0108	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Nanocladius sp.	L	1	1	0.0090	0.0090	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Orthocladiinae indet.	L	1		0.0103	0.0103	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia sp.	L	1	1	0.0101	0.0101	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Pentaneurini indet.	L	4		0.1106	0.4425	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia group sp.	L	3	1	0.0787	0.2362	Damaged x1
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INDI	Arthropoda	Insecta	Diptera	Empididae	Hemerodromiinae	Hemerodromiini	Hemerodromia sp.	L	7	1	0.1755	1.2282	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Ameletidae			Ameletus sp.	N	2	1	0.1580	0.3160	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetidae indet.	N	13		0.3661	4.7599	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Baetis rhodani group	N	17	1	0.0509	0.8652	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400	250	fb21-112-012	KICK 11	n/a	1-Sep-21	INEP	Arthropoda	Insecta	Ephemeroptera	Baetidae			Fallceon sp.	N	1	1	0.1086	0.1086	
Limnotek	Syncrude Mesocosms	Pre-Experiment	2021	Whole	400																			



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## **Appendix A3.6**

### **Taxonomic Data (Zooplankton from Mesocosm Head Tanks)**

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**Benthic report of sorting efficiency quality control and quality assurance for Limnotek Syncrude Mesocosms (Pre-Experiment), 2021.**

<b>Biologica Sample ID</b>	<b>Client Sample ID</b>	<b>Replicate</b>	<b>Sorting Efficiency QA: Random whole resorts</b>
fb21-112-001	KICK 1	n/a	
fb21-112-002	KICK 2	n/a	
fb21-112-003	KICK 3	1	
fb21-112-004	KICK 3	2	97.48%
fb21-112-005	KICK 4	n/a	
fb21-112-006	KICK 5	n/a	
fb21-112-007	KICK 6	n/a	
fb21-112-008	KICK 7	n/a	
fb21-112-009	KICK 8	n/a	
fb21-112-010	KICK 9	n/a	
fb21-112-011	KICK 10	n/a	
fb21-112-012	KICK 11	n/a	
<b>Average:</b>			<b>97.48%</b>

**QA/QC:**

Sorting efficiency: [(total count – organisms recovered in spot check and/or re-sort) / total count] x 100%





## Abbreviations & Definitions

### Worksheets:

1. Abbreviations & Definitions	Glossary of terms and outline of report
2. Matrix-Abundance	Abundance data in matrix format, including total abundance per sample
3. Matrix-Biomass	Biomass data in matrix format, including total biomass per sample (wet weight and dry weight data) Abundance and biomass data in long format with average taxon biomass inserted in order to calculate total biomass and abundance per sample
4. Data-Long	
5. QA-QC	Quality control report of zooplankton enumeration in QA samples
6. Measurements & Biomass	Raw length measurements and biomass conversions, including references

### Abundance Data:

Total Taxa      Number of unique taxa present identified to lowest possible level. Does not include higher-order taxa of which there are identified lower-level taxa present.

Nauplius      Crustacean early larval stage

Presence      Taxa not enumerated in sample

#/sample      Count data converted to "per sample" total value

#### Copepods:

III      Copepod stage 3; with 3 abdominal segments

IV      Copepod stage 4: with 4 abdominal segments

I-IV      Copepod stage 1-4

V      Copepod stage 5: with 5 abdominal segments

Vlf      Copepod Stage 6 (reproductive, adult stage), with 6 abdominal segments. Female.

Vlm      Copepod Stage 6 (reproductive, adult stage), with 6 abdominal segments. Male.

#### Rotifers:

Individual      Non-colonial rotifer

Colony      Colonial rotifer

#### Cladocerans:

J      Juvenile

F      Adult Female

M      Adult Male

A      Adult (sex not determined)

L      Larvae

#### Biomass Measurements:

WW      Wet weight



DW	Dry weight
mg/sample	milligrams per sample
Crustaceans:	$\ln(W) = \ln(\alpha) + \beta \ln(L)$
W	Dry weight estimate (mg)
$\alpha$	Species-specific constant in biomass estimation formula for copepods (intercept) (sources in reference column)
$\beta$	Species-specific constant in biomass estimation formula for copepods (slope) (sources in reference column)
L	Length (mm)
Rotifers:	Rotifer biomass ( $\mu\text{g DW}$ ) = $(\text{length}^3 \times \text{FF}) + (\% \text{BV} \times \text{length}^3 \times \text{FF}) \times 10^{-6} \times \text{WW:DW}$
length	total length ( $\mu\text{m}$ )
FF	Species-specific constant for calculation of biomass in rotifers, source of values in reference column
%BV	Species-specific volume of appendages as a percent of body biovolume, source of values in reference column





Zooplankton raw count data for abundance and biomass calculations for Nautilus Environmental Syncrude OSPW Testing, 2021.

Client	Project	Year	Biologica Sample ID	Client Sample ID	Replicate	Date Sampled	Split	Fraction	Groupcode	Major Group	Phylum	Order	Family	Taxon	Stage	Raw Count	Split Multiplier	Total Abundance	Unique Taxa Count	Mean DW Biomass_mg	Mean WW Biomass_mg	Total DW Biomass_mg	Total WW Biomass_mg
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Bosminidae	Bosmina longirostris	F	4	1.00	4	1	0.00079	0.00395	0.00316	0.01582
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Daphniidae	Daphnia mendotae complex	F	1	1.00	1	1	0.00912	0.04560	0.00912	0.04560
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	61	1.00	61	1	0.00184	0.00919	0.11210	0.56052
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	15	1.00	15		0.00453	0.02267	0.06801	0.34004
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	3	1.00	3	1	0.01141	0.05703	0.03422	0.17110
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Eucyclops agilis	Vlf	2	1.00	2	1	0.00481	0.02403	0.00961	0.04805
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	26	1.00	26		0.00130	0.00649	0.03374	0.16868
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	2	1.00	2		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	3/80	Fine	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	Nauplius	2	26.67	53		0.00003	0.00015	0.00164	0.00822
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	3/80	Fine	ROTI	Rotifera	Rotifera	Flosculariaceae	Conochilidae	Conochilus sp.	Individual	6	26.67	160	1	0.00000	0.00004	0.00058	0.00585
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	3/80	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Keratella sp. 1		2	26.67	53	1	0.00003	0.00026	0.00139	0.01386
Nautilus	Syncrude OSPW Testing	2021	fz21-180-013	River Water Tank-1	1	27-Sep-21	3/80	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		2	26.67	53	1	0.00002	0.00021	0.00113	0.01125
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Bosminidae	Bosmina longirostris	F	1	1.00	1	1	0.00079	0.00395	0.00079	0.00395
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Chydoridae	Chydorus sp.	F	1	1.00	1	1	0.00306	0.01531	0.00306	0.01531
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	35	1.00	35	1	0.00184	0.00919	0.06432	0.32161
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	13	1.00	13		0.00453	0.02267	0.05894	0.29470
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	3	1.00	3	1	0.01141	0.05703	0.03422	0.17110
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	1	1.00	1	1	0.03119	0.15595	0.03119	0.15595
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	17	1.00	17		0.00130	0.00649	0.02206	0.11029
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	1	1.00	1		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	3/40	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Kellicottia sp.		1	13.33	13	1	0.00000	0.00003	0.00005	0.00046
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	3/40	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Keratella sp. 1		2	13.33	27	1	0.00003	0.00026	0.00069	0.00693
Nautilus	Syncrude OSPW Testing	2021	fz21-180-014	River Water Tank-2	2	27-Sep-21	3/40	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		1	13.33	13	1	0.00002	0.00021	0.00028	0.00281
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Bosminidae	Bosmina longirostris	F	1	1.00	1	1	0.00079	0.00395	0.00079	0.00395
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Chydoridae	Chydorus sp.	F	3	1.00	3	1	0.00306	0.01531	0.00919	0.04594
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	101	1.00	101	1	0.00184	0.00919	0.18562	0.92808
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	59	1.00	59	1	0.00453	0.02267	0.26750	1.33750
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Eucyclops agilis	Vlf	2	1.00	2	1	0.00481	0.02403	0.00961	0.04805
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	4	1.00	4	1	0.01771	0.08855	0.07084	0.35422
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	40	1.00	40		0.00130	0.00649	0.05190	0.25951
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	3	1.00	3		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	3/90	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		7	30.00	210	1	0.00002	0.00021	0.00443	0.04431
Nautilus	Syncrude OSPW Testing	2021	fz21-180-015	OSPW Tank-1	1	27-Sep-21	3/90	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Platylas patulus		1	30.00	30	1	0.00010	0.00096	0.00288	0.02881
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Bosminidae	Bosmina longirostris	F	1	1.00	1	1	0.00079	0.00395	0.00079	0.00395
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Chydoridae	Chydorus sp.	F	3	1.00	3	1	0.00306	0.01531	0.00919	0.04594
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	146	1.00	146	1	0.00184	0.00919	0.26832	1.34158
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	49	1.00	49		0.00453	0.02267	0.22216	1.11081
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	1	1.00	1	1	0.01141	0.05703	0.01141	0.05703
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	37	1.00	37	1	0.01771	0.08855	0.65530	3.27651
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	61	1.00	61		0.00130	0.00649	0.07915	0.39575
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	1	1.00	1		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-016	OSPW Tank-2	2	27-Sep-21	3/80	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		9	26.67	240	1	0.00002	0.00021	0.00506	0.05064
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Daphniidae	Daphnia mendotae complex	F	1	1.00	1	1	0.00912	0.04560	0.00912	0.04560
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	18	1.00	18	1	0.00184	0.00919	0.03308	0.16540
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	6	1.00	6		0.00453	0.02267	0.02720	0.13602
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	1	1.00	1	1	0.01141	0.05703	0.01141	0.05703
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	2	1.00	2	1	0.01771	0.08855	0.03542	0.17711
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	6	1.00	6		0.00130	0.00649	0.00779	0.03893
Nautilus	Syncrude OSPW Testing	2021	fz21-180-017	River Water Tank-1	1	29-Sep-21	n/a	Fine	n/a	n/a	n/a	n/a	n/a	Nothing found	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-018	River Water Tank-2	2	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	5	1.00	5	1	0.00184	0.00919	0.00919	0.04594
Nautilus	Syncrude OSPW Testing	2021	fz21-180-018	River Water Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	2	1.00	2	1	0.00453	0.02267	0.00907	0.04534
Nautilus	Syncrude OSPW Testing	2021	fz21-180-018	River Water Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	4	1.00	4		0.00130	0.00649	0.00519	0.02595
Nautilus	Syncrude OSPW Testing	2021	fz21-180-018	River Water Tank-2	2	29-Sep-21	n/a	Fine	n/a	n/a	n/a	n/a	n/a	Nothing found	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-019	OSPW Tank-1	1	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Daphniidae	Daphnia mendotae complex	F	1	1.00	1	1	0.00912	0.04560	0.00912	0.04560
Nautilus	Syncrude OSPW Testing	2021	fz21-180-019	OSPW Tank-1	1	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	68	1.00	68	1	0.00184	0.00919	0.12497	0.62484
Nautilus	Syncrude OSPW Testing	2021	fz21-1																				



Client	Project	Year	Biologica Sample ID	Client Sample ID	Replicate	Date Sampled	Split	Fraction	Groupcode	Major Group	Phylum	Order	Family	Taxon	Stage	Raw Count	Split Multiplier	Total Abundance	Unique Taxa Count	Mean DW Biomass_mg	Mean WW Biomass_mg	Total DW Biomass_mg	Total WW Biomass_mg
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	1	1.00	1	1	0.01141	0.05703	0.01141	0.05703
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	6	1.00	6		0.01771	0.08855	0.10627	0.53133
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	2	1.00	2	1	0.03119	0.15595	0.06238	0.31190
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	39	1.00	39		0.00130	0.00649	0.05060	0.25302
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	1	1.00	1		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020	OSPW Tank-2	2	29-Sep-21	3/100	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		3	33.33	100	1	0.00002	0.00021	0.00211	0.02110
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	85	1.00	85	1	0.00184	0.00919	0.15621	0.78106
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	13	1.00	13		0.00453	0.02267	0.05894	0.29470
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	1	1.00	1	1	0.01141	0.05703	0.01141	0.05703
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	6	1.00	6		0.01771	0.08855	0.10627	0.53133
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	2	1.00	2	1	0.03119	0.15595	0.06238	0.31190
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	39	1.00	39		0.00130	0.00649	0.05060	0.25302
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	1	1.00	1		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-020_QA	OSPW Tank-2_QA	2	29-Sep-21	3/100	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		2	33.33	67	1	0.00002	0.00021	0.00141	0.01407
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	12	1.00	12	1	0.00184	0.00919	0.02205	0.11027
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	14	1.00	14		0.00453	0.02267	0.06347	0.31737
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	8	1.00	8	1	0.01141	0.05703	0.09125	0.45626
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	2	1.00	2		0.01771	0.08855	0.03542	0.17711
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	4	1.00	4	1	0.03119	0.15595	0.12476	0.62379
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	44	1.00	44		0.00130	0.00649	0.05709	0.28546
Nautilus	Syncrude OSPW Testing	2021	fz21-180-021	River Water Tank-1	1	1-Oct-21	3/70	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		2	23.33	47	1	0.00002	0.00021	0.00098	0.00985
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Daphniidae	Daphnia mendotae complex	F	3	1.00	3	1	0.00912	0.04560	0.02736	0.13680
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	19	1.00	19	1	0.00184	0.00919	0.03492	0.17459
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	1	1.00	1	1	0.00453	0.02267	0.00453	0.02267
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	1	1.00	1	1	0.03119	0.15595	0.03119	0.15595
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	1	1.00	1		0.00130	0.00649	0.00130	0.00649
Nautilus	Syncrude OSPW Testing	2021	fz21-180-022	River Water Tank-2	2	1-Oct-21	n/a	Fine	n/a	n/a	n/a	n/a	n/a	Nothing found	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	338	1.00	338	1	0.00184	0.00919	0.62117	3.10585
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	6	1.00	6		0.00453	0.02267	0.02720	0.13602
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	9	1.00	9	1	0.01141	0.05703	0.10266	0.51329
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Eucyclops agilis	Vlf	2	1.00	2	1	0.00481	0.02403	0.00961	0.04805
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	3	1.00	3		0.01771	0.08855	0.05313	0.26566
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	26	1.00	26	1	0.03119	0.15595	0.81093	4.05466
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	102	1.00	102		0.00130	0.00649	0.13235	0.66175
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	2	1.00	2		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-023	OSPW Tank-1	1	1-Oct-21	3/80	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		7	26.67	187	1	0.00002	0.00021	0.00394	0.03939
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCL	Crustacea Cladocera	Arthropoda	Diplostraca	Moinidae	Moina sp.	F	181	1.00	181	1	0.00184	0.00919	0.33264	1.66319
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlm	38	1.00	38		0.00453	0.02267	0.17229	0.86144
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Acanthocyclops sp.	Vlf	13	1.00	13	1	0.01141	0.05703	0.14828	0.74142
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Eucyclops agilis	Vlf	1	1.00	1	1	0.00481	0.02403	0.00481	0.02403
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlm	2	1.00	2		0.01771	0.08855	0.03542	0.17711
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida	Cyclopidae	Tropocyclops sp.	Vlf	4	1.00	4	1	0.03119	0.15595	0.12476	0.62379
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	CRCO	Crustacea Copepoda Cyclopoida	Arthropoda	Cyclopoida		Cyclopoida indet.	I-V	98	1.00	98		0.00130	0.00649	0.12716	0.63580
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	Whole	Coarse	MEMO	Insecta Diptera	Arthropoda	Diptera	Chironomidae	Chironomidae indet.	L	3	1.00	3		n/a	n/a	n/a	n/a
Nautilus	Syncrude OSPW Testing	2021	fz21-180-024	OSPW Tank-2	2	1-Oct-21	3/110	Fine	ROTI	Rotifera	Rotifera	Ploima	Brachionidae	Notholca sp.		6	36.67	220	1	0.00002	0.00021	0.00464	0.04642