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Community-based monitoring of contaminants in marine sediment and biota near the Milne Inlet industrial port - a pilot study



ArctiConnexion

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Photography credit

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Executive Summary

In 2024, the Qikiqtani Inuit Association (QIA) mandated ArctiConnexion to conduct an exploratory pilot study to assess the potential impacts of the Mary River Project on the sea floor and marine life near the Milne Inlet industrial port (Qingua). Results from previous monitoring campaigns conducted in spring/summer 2023 and spring 2024 suggest a relationship between the proximity to industrial infrastructures - Milne Port, Tote Road and Mary River Mine - and levels of total suspended solids and trace metals in snow, water and lichen samples (Coupel & L'Herault, 2024). Visual observations of red discoloration of snow samples confirmed the results.

Based on Inuit Qaujimagatuqangit (historical knowledge of the area and contemporary observation of changes), this study, conducted on Inuit-Owned Land (IOL), focused on dust-fall released from the ore stockpiles and found in Phillips Creek as potential sources of trace metals. Marine sediments and marine biota - phytoplankton and zooplankton - were sampled in Qingua (Assomption Harbour), along the Phillips Creek plume and coastal areas near the Milne port, and in a control area located in Tremblay Sound (Kangiq&uarjuk), located 40 km away from the Milne Inlet port.

We studied and compared the mineralogical and geochemical composition of an ore source sample, with marine sediments sampled in the three areas studied. To determine the potential biotic impacts of dust contamination on the marine food chain, we measured the abundance of phytoplankton and the abundance and diversity of zooplankton and quantified trace metal concentrations in zooplankton samples.

We sampled from 18 stations throughout the Phillips Creek's plume, Milne Port and Tremblay Sound. We also collected on IOL, two source sample (ground surface) and three samples of dust-fall near the ore stockpiles. Pictures of the seafloor taken at 10m and 30m revealed evidence of disturbances at the Milne Port stations. Analyses confirmed that the ore source samples, Milne Inlet sea floor sediments, and Tremblay Sound sediments, had distinct mineralogical/geochemical compositions, suggesting low deposition rates of ore dust on the sea floor.

Dust samples were rich in iron, followed by magnesium, aluminum, and traces of manganese, zinc, strontium and titanium. Ore source samples collected near the stockpiles showed high concentrations of iron, nickel and manganese in proportions substantially higher than what was found in the other marine sediments tested. The presence of chlorite-biotite minerals in the marine sediments was specific to Tremblay Sound, and certain trace metal species were unusually high at this site. Marine sediments near Milne Port showed relatively high levels of arsenic (As). Information obtained from Inuit Qaujimagatuqangit (IQ) suggest that winds and tidal-driven currents in the Milne Port area could play a role in the outward transport of dust-fall released from activities at the port area.

Chlorophyll-a levels indicate phytoplankton abundances typical for Arctic waters, and for the season. Phytoplankton abundance was significantly lower in the Phillips Creek's plume, compared to Tremblay Sound, while salinity, temperature, pH and dissolved oxygen results were similar. Indexes of alpha diversity in zooplankton, based on DNA barcoding, revealed differences among sites in the zooplankton community, including the number of species and their abundance. The abundance of narwhal, determined by environmental DNA (eDNA), was more elevated in Tremblay Sound than in Qingua, but not the abundance of ringed seal and Arctic char.

Trace metals concentrations in the zooplankton from Tremblay Sound were below detection limits for most metals. Aluminum, copper, lead, iron, manganese, uranium, chromium, nickel, zinc and arsenic were found at detectable levels in copepods at one station located close to the mouth of Phillips Creek. Cadmium, zinc and arsenic levels were found at detectable levels at stations near the Milne Inlet port.

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1. Introduction/background



In 2024, ArctiConnexion was mandated to work with the Qikiqtani Inuit Association (QIA) to develop a comprehensive monitoring program with the goal of assessing the environmental impacts of the Mary River Project. The Mary River Mine, located 120 km southwest of Pond Inlet, has been in operation since 2015. Land users/hunters from Mittimatalik have reported that the extraction, processing and transport of six million tonnes of iron ore annually (Neary, 2020) releases iron-rich red dust that is then carried by the wind.

Dust deposition can potentially impact terrestrial, aquatic and marine ecosystems. In the literature, life-cycle assessments of iron mines have noted the emission of chrome, zinc and lead in the air, as well as the release of cadmium, arsenic, nickel and copper in the water (Ferreira and Leite, 2015). Nonessential metals (e.g. Hg or Cd) are of particular concern because they can bioaccumulate in organisms and bio-magnify throughout food webs. At extreme concentrations, they can cause damage to a range of species (e.g. microorganism, plant, fish, human), including DNA alterations bonded to carcinogenic effects (Rahman and Singh et al., 2019; Balali-Mood et al., 2021). When they reach fresh or salt water systems, trace metals can be adsorbed by inorganic (iron-oxide-enriched) or organic particles, and are then transported over long distances and released far from their point of origin (Michel et al., 1997; Cagnin et al., 2017).

Findings from previous monitoring conducted in the spring/summer of 2023 and spring of 2024 revealed a correlation between the proximity to industrial infrastructure and levels of environmental contamination. Visual red discolouration of snow was associated with trace metal levels (e.g. aluminum, iron, lead, manganese, copper) in snow and lichen samples collected near Milne Port, along the Tote Road, and at the Mary River Mine (Coupel & L'Herault, 2024). In the spring, before snow melt, waters from Phillips Creek River and lakes located along the Tote Road appeared unaffected by dust contamination. However, water samples collected in the summer of 2023 from Phillips Creek, which drains a large watershed encompassing the project area (the Tote Road, Milne Inlet Port), showed elevated levels of total suspended solids (TSS). These included aluminum and iron at concentrations exceeding the CCME guideline for the protection of aquatic life. In addition, sediments from Phillips Creek contained elevated concentrations of iron and manganese compared to smaller streams in the region.

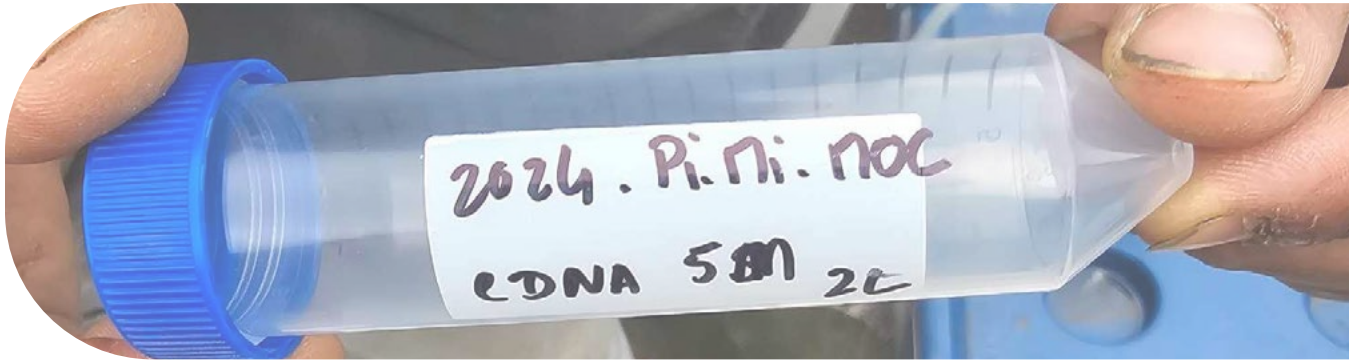
Before the mine and industrial development in the area, Qingua was a prime hunting ground for Inuit because of its rich fish populations and populations of diverse marine species like narwhal, seal and bowhead whales. In the past decade, local land users have observed a marked decline in these species (Tester & L'Hérault, 2023). In order to get to the root of the problem, we targeted the marine sediments and the marine biota; the phytoplankton and zooplankton located at the base of the marine food chain in the vicinity of Milne Inlet Port.

To our knowledge, no independent study has yet been undertaken to investigate the potential metal contamination of the project area and its effects on the marine ecosystem of Qingua. The main goal of the study was to investigate the potential deposition on the marine sediments, and the biological uptake of fugitive dust released from the ore stockpiles and carried by the waters of Phillips Creek, as potential sources of contamination. Our specific objectives were to:

1. investigate the visual composition of the sea floor in the Phillips Creek plume and Milne Inlet Port area (Qingua);
2. determine the mineralogical and geochemical composition of an iron ore source sample, and of the seafloor sediment in the Phillips Creek plume and Milne Inlet Port area (Qingua);
3. investigate trace metal contamination in the marine sediments and zooplankton;
4. investigate potential biological impacts of contamination for phytoplankton and zooplankton abundance and diversity;
5. investigate a control 'unaffected' area identified by local Elders and land users – Tremblay Sound (Kangiq&uarjuk) – to compare the observations made in Milne Inlet.

Our study was led by staff from the Inuit Stewardship Program, in partnership with land users from Pond Inlet. Inuit Qaujimagatuqangit (IQ). This direction was central to our approach. It guided every aspect of the program, including the sampling location, protocols and interpretation of the results.

2. Methods



2.1. Sampling Design

To assess the impact of red dust deposition on the marine environment, multiple stations were sampled in the summer of 2024 in Qingua, along the Phillips Creek's plume and near the Milne Port, and Tremblay Sound (**Figure 1**). Qingua is presumed to be affected by the deposition of iron-rich red dust originating from Baffinland Iron Mine (BIM) operations at Milne Port, including stockpiling and loading. Tremblay Sound was selected as the control site by the community-based field crew, based on Inuit Qaujimagatuqangit. Tremblay Sound is defined by local land users as unpolluted and undisturbed because of its distance from the Milne Port and the absence of marine shipping. It was selected based on its ecological and physical similarities with Qingua. IQ knowledge holders reported that Tremblay Sound hosts populations of Arctic char, narwhal and seal, as does Qingua. Similar to Phillips Creek in Qingua, the presence of the Kangiq&uarjuk river in Tremblay Sound discharges fresh water into the marine ecosystem.

2.2. Source, Dust-fall and Sediments

To measure the geochemical signature of the fugitive dust, we collected three dust-fall samples using a dust collector made of a large piece of clean organic cotton fabric mounted on wood poles for 48h. The dust collector was handled with gloves and stored in a Ziploc bag. Wearing gloves, we scrubbed three random areas of 10x10 cm each using non-sterile 4X4 cotton swabs (Medicom ©) provided by ALS laboratory. To measure the geochemical and mineralogical composition of the source iron ore, we collected two ground surface samples near the stockpiles at the Milne Inlet industrial port using gloves and stored in a whirlpack bag. All samples were collected on Inuit Owned Land (IOL)(**Figure 1B**).

We studied the marine sediments at three stations located eastward from the port at 0km (M0), 1.6km (M1) and 3.3km (M3) at 10m and 30m deep. The influence of the Phillips Creek as a conveyor of sediments in Milne Inlet was examined by studying stations located along the sediments plume extending

from the creek's mouth (P0) northward at 0.5 km (P0.5), 1 km (P1), 1.5 km (P1.5), and 2 km (P2) (Figure 1B). In Tremblay Sound, three stations at 0km (T0), 1.5km (T1) and 3.4km (T3) were sampled on the western side of the sound. At each station we studied the seafloor at 10m and 30m.

At each station, seafloor sediments were collected using a Ponar grab sampler at a depth of 10 m, (i.e., below the influence of the tides and the sea ice cover). Due to harsh weather conditions and strong currents, sampling at 30 m deep was not possible. We collected replicate samples of the top 2 cm of each sediment grab taken using a 60 mL syringe (EZE-Core). EZE-Core were used as core samplers following protocol provided by ALS. Samplers used gloves and one new syringe for every sample collected to minimize the risk of cross-contamination. Sediment was removed from the EZE-Core and transferred into a whirl pack bag for geochemical and mineralogical analyses (see section 2.6).

The full detail of stations, sample types and analyses are summarized in **Table 1**.

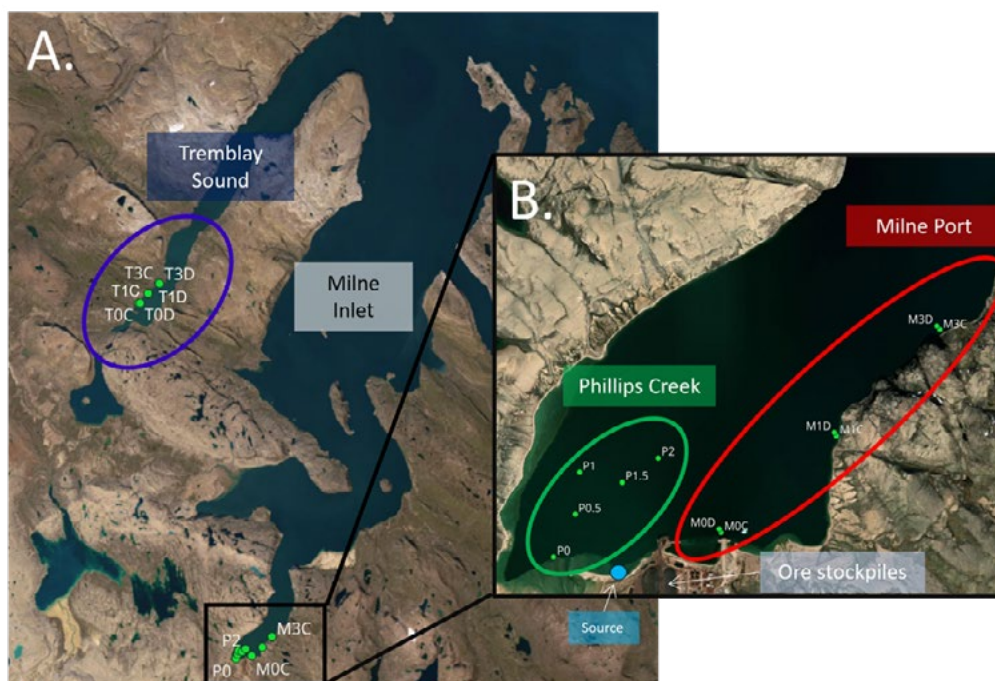


Figure 1. **A** - Map showing the location of sampling stations in Qingua (P; Phillips creek plume, M; Milne Port) and Tremblay Sound-Kangiġuarjuk (in blue); **B** - Enlargement of the Milne port area showing the position of the Milne Port stations (in red), Phillips Creek plume stations (in green) and the location of a sample collected near the iron ore stockpiles (Source).

2.3. Seafloor composition

We investigated the extent of dust contamination in Qingua by first deploying a GoPro camera (Gopro Hero 12) mounted on an abs-made frame, and equipped with a flashlight.

2.4. Phytoplankton

At each station, 1L of seawater was sampled at 1m and 5m using a Niskin bottle. Water samples were filtered within 5h onsite using 0.7µm a glass microfiber filter (Whatman GF/F 47mm) and were stored in a 15 ml Falcon tube. During fieldwork, filters were kept in a cooler on ice pack and kept in the dark to avoid photodegradation. Back in the community, filters were

kept frozen at -20°C all the way up to reaching the lab for analyses.

Chlorophyll-a reflects the phytoplankton biomass. Chl-a was analyzed following the EPA-445 method referenced at ALS Environmental Inc. Laboratory in Winnipeg, MB, within 28 days following the filtration. Chlorophyll was extracted using 90% acetone during 2 to 24h. Samples were centrifuged 15min at 675g and an aliquot of the supernatant was transferred to a glass cuvette for the fluometry reading. The measurements were done at 436/10nm excitation and 685/10nm emission (Turner Designs, Sunnyvale, CA) that nearly eliminate the spectral interference caused by the presence of pheo a and chlorophyll b and c. We used no acidification procedure because they degrade the Chl-a pigment. Concentrations of chlorophyll-a were calculated based on the volume filtered in the field.

An additional 2L of seawater was sampled and filtered within 5h onsite onto a 0.45µm mixed cellulose ester membrane and stored in a 15 mL Falcon tube prefilled with 95% ethanol as preservative prior to DNA extraction (eDNA) analysis. eDNA analyses were processed at the Canadian Centre for DNA Barcoding (CCDB, Guelph University).

Concentrations of Chl-a were compared among areas using a Kruskal-Wallis's test followed by post hoc comparisons using Dunn's test with Bonferroni correction.

2.5. Zooplankton

Net tows were done around the location of our deep stations in Milne Port (MOD, M1D, M3D) and Tremblay Sound (TOD, T1D, T3D) and at two stations in the Phillips Creek plume (P0 and P2). We sampled zooplankton using a 200µm mesh net towed obliquely throughout the water column from 15m deep, up to the surface. The open end of the net was attached to a quick release, itself attached to a 20m rope held in the boat. Four to five successive tows were performed using the following pattern; the net was sunk using a weight attached to the end bucket while the boat was steady. Once the net reached its full depth, the boat started to move at a steady speed of 5 km/h for approximately 1 minute, or until the net resurfaced, providing an oblique sample of the zooplankton. The boat would then stop to allow the net to sink again, and the second tow would be initiated following the same steps all the way to the fifth tow.

At the end of the fifth tow the net was retrieved onboard and rinsed using seawater to concentrate the zooplankton in the bucket. A visual inspection of the material collected in the bucket was performed to ensure the collection of at least 15ml of zooplankton. If additional volume was needed, we performed extra 1-min tows using the method described above.

The 15ml zooplankton samples were transferred from the bucket to a 180µm sieve to rinse and drain the seawater from the tissue. We equally split and transferred 5ml of sample into three Falcon tubes. The first was prefilled with 5ml of 95% ethanol used to preserve the organic structures prior to classification (95% ethanol was discarded 24h post sampling, and replaced with new ethanol). The second tube was prefilled with 5ml of 95% ethanol as preservative prior to DNA extraction for barcoding. The third tube was empty and was used for trace metal analysis. Zooplankton samples were kept in a cooler on ice packs until they were brought back to the community, where they were kept frozen at -18°C until it reached the lab for analyses.

Table 1. List of sampling stations and parameters collected near the project area and a control area in September 2024. The numbers indicate the number of replicates collected for each site per parameter.

Site	Nb Stations	Location	Station ID	Sediment		Phytoplankton		Zooplankton		
				Mineralogy	Metals	Chlorophyll-a		Metals	Classifica-tion	eDNA
						1m	5m			
MILNE INLET	11	Phillips Creek (plume)	P0	2	1	1	1	1	1	1
			P0.5	2	1	1	1			
			P1	2	1	1	1			
			P1.5	2	1	1	1			
			P2	2	1	1	1	1	1	1
		Milne Port Coast (>10m)	M0C	2	1	1	1			
			M1C	2	1	1	1			
			M3C	2	1	1	1			
		Milne Port Deep (>30m)	MOD			1	1	1	*	1
			M1D			1	1	1	1	1
M3D						1	1	1		
TREMBLAY SOUND	6	Coast (>10m)	TOC	2	1	1	1			
			T1C	2	1	1	1			
			T3C	2	1	1	1			
		Deep (>30m)	T0D			1	1	1	1	1
			T1D			1	1	1	1	1
			T3D			1	1	1	*	1
MILNE PORT SOURCE	1	Dust-fall	Source		3					
	1	Dust on ground	Source	2	1					
TOTAL	18	0	0	24	14	16	16	8	6	8

*Zooplankton sample collected but presenting preservation issue. Classification was not possible.

2.6. Traces metals

Total trace metal concentrations in the sea floor sediments and in zooplankton were measured at ALS Environmental Inc. Laboratory in Vancouver, BC. ALS is a Canadian Association for Laboratory Accreditation certified laboratory.

Dust-fall swab samples were digested with nitric (HNO₃) and hydrochloric acid (HCL), and analyzed by Collision/Reaction Cell ICPMS for trace metals. For mercury analysis, swab samples were digested with HNO₃ and HCl, followed by CVAAS analysis. Units are converted in ug/cm² based on the size of an area wiped equal to 10 cm x 10 cm.

Sediment samples were dried and sieved through a 2 mm mesh and coarse particles were discarded. One gram (dry weight) of material was digested with nitric acid and hydrochloric acid (HCl). Trace metal concentrations were determined using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) with a

Collision/Reaction Cell (EPA 6020B (mod)). To quantify total mercury concentrations, sediments underwent the same drying, sieving and digestion process. Mercury was analyzed using Cold Vapor Atomic Absorption Spectrometry (CVAAS, EPA 200.2/1631 Appendix 4)

Zooplankton sludge samples (the zooplankton tissues diluted in 5ml ultrapure water) were digested with nitric acid (HNO₃) and hydrochloric acid (HCl) and analyzed using ICP-MS with a Collision/Reaction Cell. For total mercury analysis, sludge samples were preserved with HCl and/or BrCl, digested with HNO₃ and HCl at 95°C, and analyzed using CVAAS. At station P2, tissues of one amphipod were digested with HNO₃, HCl, and hydrogen peroxide (H₂O₂) before ICP-MS analysis with a Collision/Reaction Cell. For total mercury analysis, the amphipod tissues were homogenized, digested with HNO₃, HCl, and H₂O₂, and analyzed using CVAAS.

The detailed reports of trace metal analyses provided by ALS, including raw data, methodology, detection limits, COC and QC-QA, are described in Appendix 4.

2.7. Mineralogy

Prior to bulk mineralogical analyses, samples were wet sieved with a 2 mm mesh and coarse particles were discarded. Bulk mineral associations were studied by quantitative X-ray diffraction (qXRD) following the method developed by Eberl (2003). We targeted mineral assemblage of quartz (Qz), K-feldspar (Kfs), plagioclase (Pl), calcite (Cal), dolomite (Dol), amphibole (Am), pyroxene (Px), Fe-bearing molecules (Fe-b), kaolinite (Kln), illite (Ill, including muscovite), chlorite (Chl), and biotite (Bt).

In addition, a total of 13 major and trace elements (Mg, Al, Si, K, Ca, Ti, Mn, Fe, V, Cr, Zn, Sr, Zr) were analyzed by energy dispersive X-ray fluorescence (ED-XRF) spectrometry using a PANalytical Epsilon 3-XL and following the procedure used by Gamboa et al. (2017).

Hierarchical cluster analysis was then performed with mineralogical and geochemical data to group samples with similar mineral compositions throughout the studied area (Montero-Serrano et al., 2010) using the R package “stats” (R Core Team, 2025). The analysis included 9 key minerals (quartz, plagioclase, K-feldspar, calcite, dolomite, Fe-bearing minerals, illites, kaolinite, and chlorite+biotite) and 12 chemical elements (Mg, Al, K, Si, Ti, Ca, Fe, Mn, Sr, Zr, Cr, Zn), along with loss on ignition (LOI, the percentage of mass loss when a sample is heated to high temperature, mainly reflecting organic matter and volatile content). The R package FingerPro (Lizaga et al., 2020) was employed to estimate the contributions of potential sediment sources to various sediment mixtures. FingerPro is a standard linear multivariate unmixing model that quantifies the relative contributions of sediment sources by analyzing a comprehensive range of parameters, including mineralogical and chemical data.

To assess the influence of grain size on the chemical composition of the sediments, two surface sediment samples (P2 and P0.5) in the Phillips Creek plume were submitted for grain-size and chemical analysis (See Appendix 1).

2.8. Diversity

2.8.1. VISUAL CLASSIFICATION

For each zooplankton sample, we counted the number of organisms using a binocular microscope. A subsample of 30 to 50 randomly picked and well-preserved organisms was examined in more detail to identify the taxonomic level (see Appendix 3). Classification was done to the Class and Order levels using a zooplankton identification key handbook provided by Laval University (Marceau, 2012, Slotwinski, 2014). The diversity observed was extrapolated to the remaining sample.

2.8.2. BARCODING

Barcoding analyses were performed on the samples collected from zooplankton samples taken from Tremblay Sound and Milne Inlet to assess the presence and diversity of the species (Valentini et al. 2009). Samples were stored at -80°C prior to analysis. Zooplankton samples (50ml and 15ml tubes with ethanol) and eDNA samples (paper filters, 5 cm diameter) were sent to the Canadian Centre for DNA Barcoding (University of Guelph, ON) for eDNA analysis. After being placed in DNEasy PowerWater Bead Tube, DNA was extracted following the method of Ivanova et al., 2006. DNA was then amplified with four primers that all amplify a fragment of the barcode region of the cytochrome c oxidase subunit I (COI) gene: MZplankF2t1/ZplankR1t1(350 bp) to target zooplankton, Prey_AnnelidF1_t1/Prey_AmphipodR1_t1 (193 bp) to target amphipods, Prey_MolluscF1_t1/Prey_MolluscR1_t1 (161 bp) to target molluscs (Prosser et al., 2013) and AquaF2_t1/C-FishR1_t1 to target fish and mammals (Ivanova et al., 2007, Ivanova et al., 2012). PCR reaction for each sample was replicated five times to achieve five independent PCR and sequencing replicates. Amplicons for individual sample were tagged with IonCode universal molecular identifiers (UMIs), then pooled and normalized to 1ng/ul prior to sequencing. Size selection was performed using the BluePippin (Sage Science) with a 2% agarose cassette

targeting sequences between 200-600 base pairs. The sequencing run was performed on an Ion Torrent S5 next-generation sequencer (200 base-read library preparation kit, 200 bp Chef protocol, 530 chip). The resulting sequence reads were filtered to remove low quality reads, trimmed to remove primer and adapter sequences (reads lacking either a forward or reverse primer were excluded from analysis), and then filtered for a minimum size of 100 bp and a maximum size of 300 bp. The processed reads were then clustered into primary OTUs with a minimum identity of 97%. A consensus sequence was generated for each of the new OTUs and assigned taxonomy by the VSEARCH SINTAX algorithm (V5 version) using a comprehensive BOLD reference library (BOLD_Public_10-Nov-2023_3BINReps_sintax.fasta, www.boldsystems.org). Taxonomic assignments were only considered likely to be correct if they had a probability of 0.65% or higher.

The results were such that each individual raw read was assigned to a haplotype. Additionally, the raw reads were associated to their source sample by the UMIs (with perfect matching), after which they could be cross-referenced to their associated haplotype to generate a taxonomic composition for each sample. Results were received in the form of a table of haplotype occurrences per sample with taxonomic identification and associated sequence. From this, replicate samples were merged to generate a single representative taxonomic profile for each biological sample. Taxonomic abundances, taxonomic information, and associated metadata were integrated into a phyloseq object to streamline the subsequent analysis. To improve interpretability, rare taxa were filtered out, and abundances were normalized as relative abundances, enabling meaningful comparisons across samples. Community alpha diversity was assessed using three indices (calculated from the non-filtered phyloseq): Chao1, which estimates species richness including undetected rare taxa; Shannon, which reflects both richness and evenness; and Pielou's evenness, which measures how evenly individuals are distributed among taxa. Beta diversity, representing the differentiation between sample

groups based on their taxonomic composition, was assessed using Principal Coordinates Analysis (PcoA) based on Bray-Curtis dissimilarities. PERMANOVA tests were conducted to statistically evaluate the differences between communities' composition. The 50 most abundant taxa across samples were visualized through barplots, grouped by species, to highlight major trends in community composition.

3. Results



3.1. Composition of the seafloor

In this study, the seafloor of Tremblay Sound is assumed to be 'undisturbed' and 'unpolluted' according to Inuit Qaujimagatuqangit (**Figure 2**). Based on this assumption, we expected that our control site would show 'undisturbed' and 'unpolluted' seafloor features. However, we were careful in our comparisons with Milne Inlet and Tremblay Sound stations because we expected site-specific differences that are natural and related to site-specific oceanic features and conditions. Our comparisons are based solely on visual inspections.

The 10m deep stations at Tremblay Sound featured a compact mud bed with bunches of benthic plants, shells, ophiuroids and echinoids (urchins). The 30m deep stations featured an abundance of ophiuroids with relatively few other features but the presence of periphyton; a carpet of organic material typically made of microalgae, heterotrophic microbes, cyanobacteria and detritus (McDowell et al., 2020) (**Figure 2**). The

seafloor near the Milne Port was somehow similar to the seafloor observed in Tremblay Sound (**Figure 3**). It featured a compact mud bed, sparse benthic vegetation, shells, and ophiuroids. However, at 10m deep, benthic vegetation seemed more abundant near Milne Port and tubiform calcareous structures were observed (**Figure 2 vs 3**). At 30m, the periphyton appeared denser and darker on the seafloor near Milne Port than in Tremblay Sound. Whether the darker tones of periphyton were caused by site-specific conditions or, potentially by the deposition and encrustation of dust on the sea floor near the industrial port remains uncertain. Fertilization of the periphyton by certain elements is also possible (Fe, K) (Larsen et al., 2015). At stations M1D (30m) and M3D (30m), we observed crushed brick-like material that likely originates from the blasting of rock during the deep-sea port construction (**Figure 3**). Along the sediment plume at the mouth of Phillips Creek, the sea bed was made of mud consisting of silt material (**Figure 4, Appendix 1**). Stations P1 and P2 were visually devoid of vegetation and periphyton, but these structures were observed at station P0 (**Figure 4**).

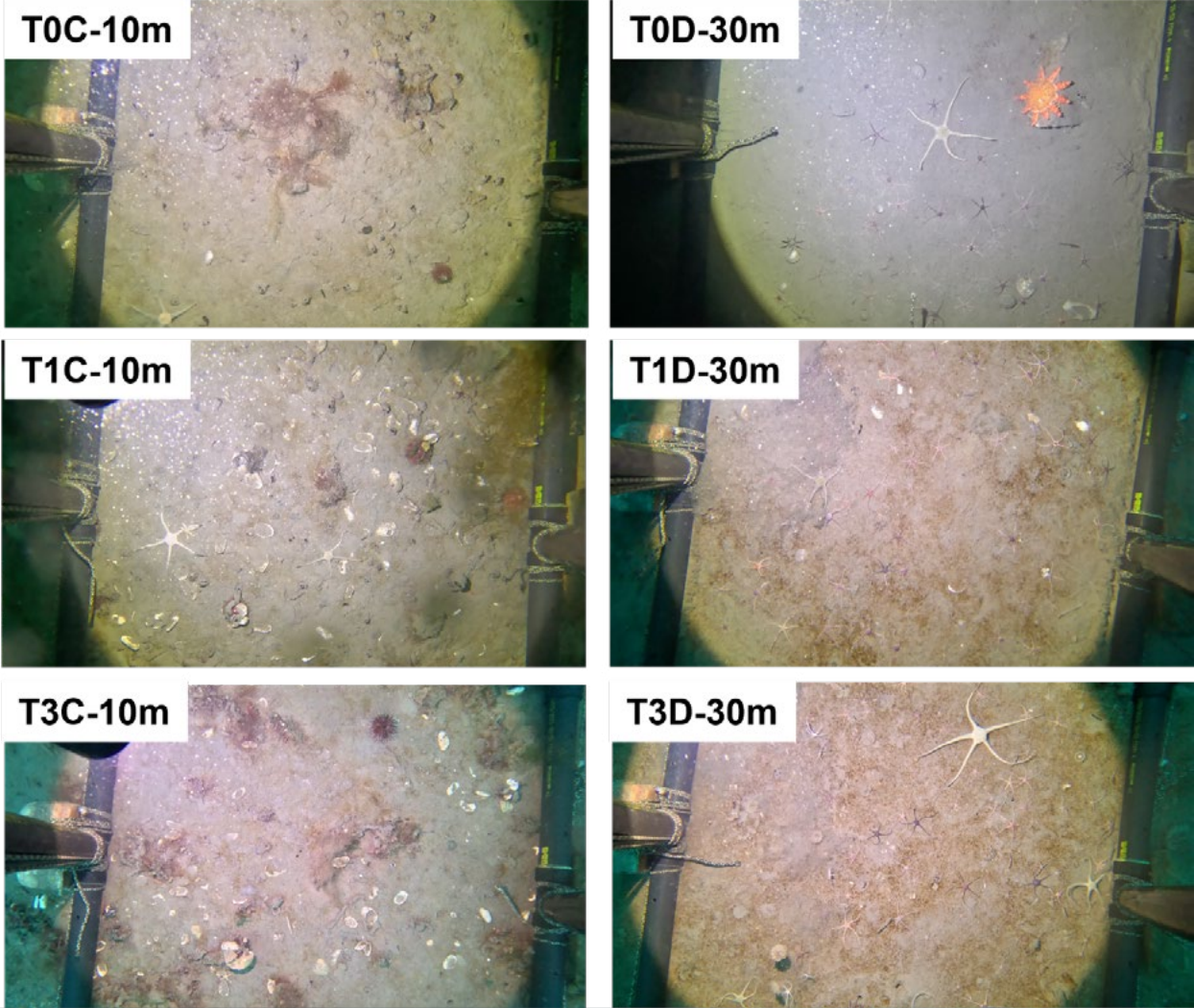


Figure 2. Seafloor at Tremblay Sound (T0C10m; top left picture, T0D30m; top right picture, T1C10m; middle left picture, T1D30m; middle right picture, T3C10m; bottom left picture, T3D30m; bottom right picture)

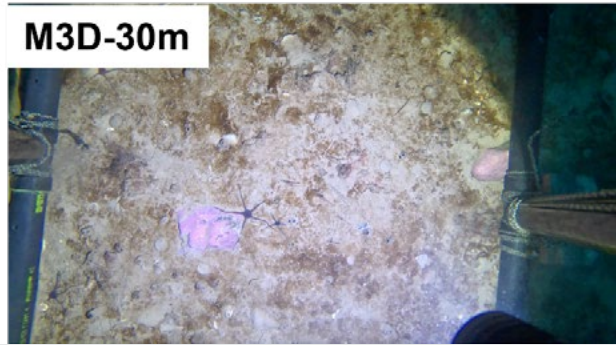
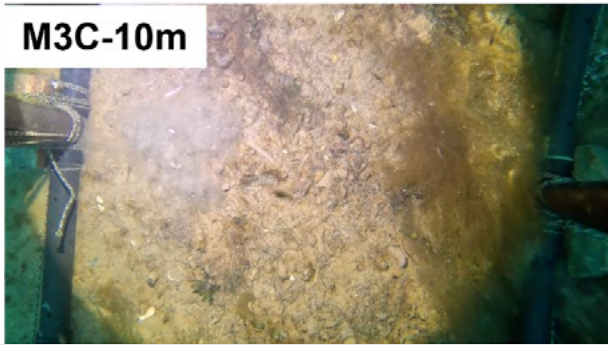
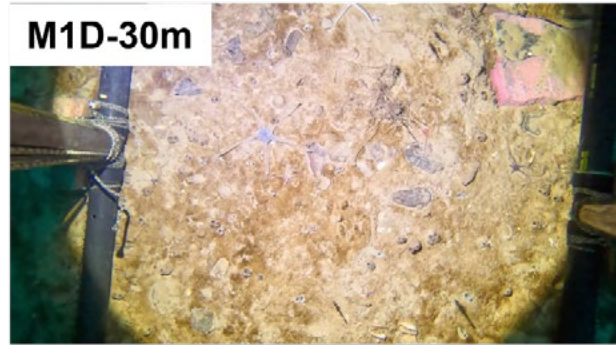
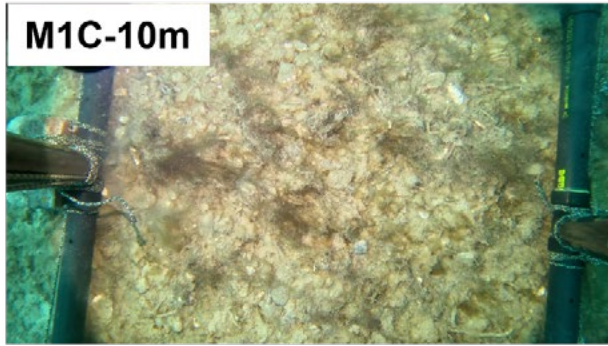
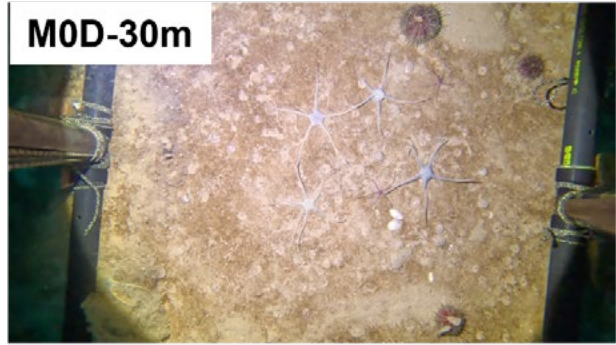
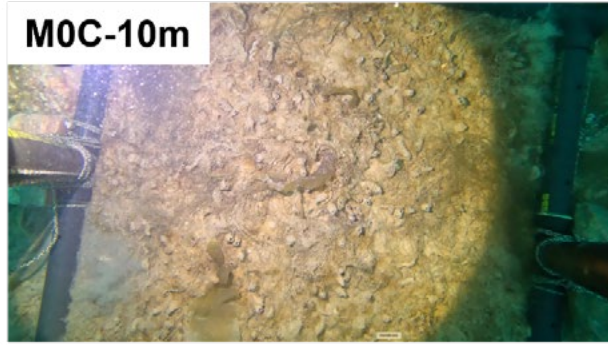


Figure 3. Seafloor at Milne Port (M0C10m; top left picture, M0D30m; top right picture, M1C10m; middle left picture, M1D30m; middle right picture, M3C10m; bottom left picture, M3D30m; bottom right picture)

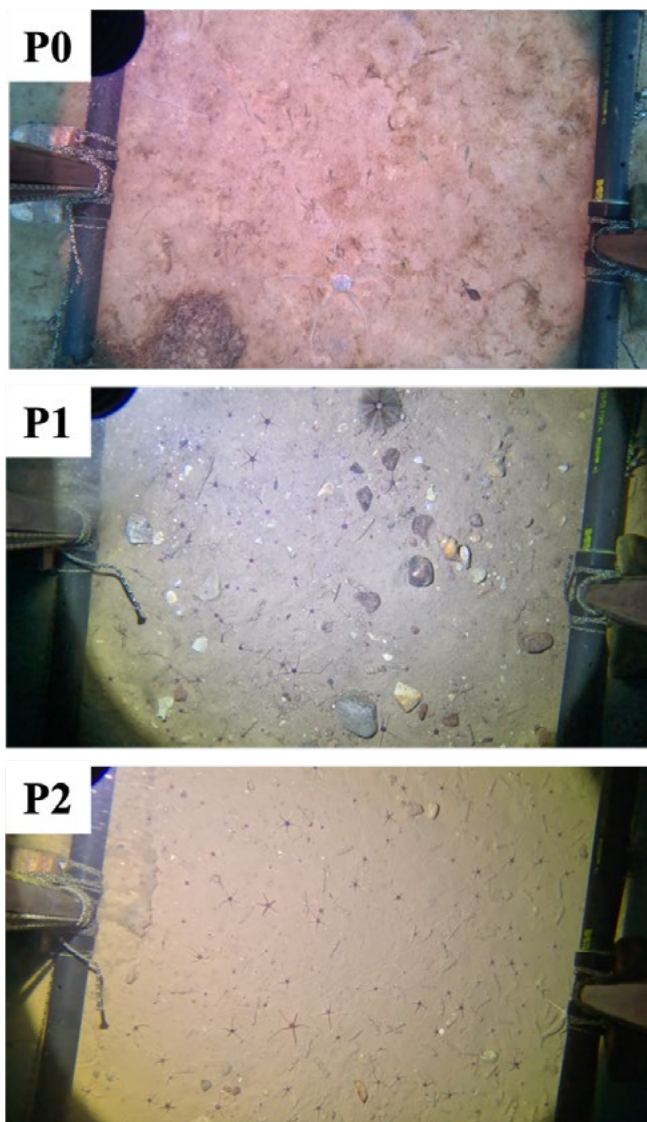


Figure 4. Seafloor in the sediment plume near the mouth of Philips Creek (station P0; top picture, station P1km; middle picture, station P2km; bottom picture). Note: the red taint at P0 is caused by the hallow produced by the camera flashlight equipped with a red filter.

3.2. Composition of sediments and source

3.2.1 Mineralogy

3.2.1.1 BULK MINERALOGY

A comprehensive analysis of sediment mineralogy and geochemistry was conducted.

Sediments from the source samples collected near the stockpiles were predominantly composed of Fe-bearing minerals (mainly hematite and magnetite; 64–79%), along with chlorite+biotite (10–12%) and quartz (1–14%) (**Figure 5**). In contrast, sediments from Milne Inlet (stations from Phillips Creek and Milne Port) and Tremblay Sound were primarily composed of quartz (21–76%), dolomite (8–40%), K-feldspar (7–15%), calcite (1–14%), and plagioclase (2–7%), with minor amounts of Fe-bearing minerals (~1%) (**Figure 5**). Sediments from Tremblay Sound contained higher proportions of illite (20–32%) and chlorite+biotite (10–17%) compared to Milne Inlet.

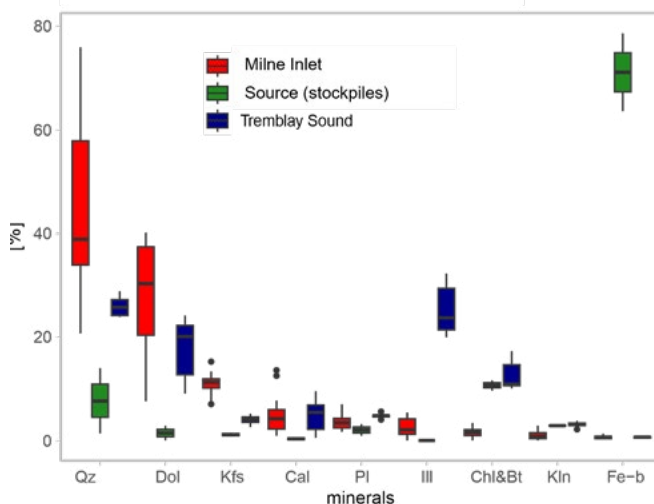


Figure 5. Boxplots showing the distribution of main mineral associations (wt.%: weight percentage) in sediments sampled on the sea floor and ore source samples determined by Quantitative X-ray diffraction. Red boxplots correspond to Milne Inlet stations, green to the source of iron ore near the stockpiles and blue to Tremblay Sound. Qz: quartz, Dol: dolomite, Kfs: K-feldspar, Cal: calcite, Pl: plagioclase, Ill: illite, Chl&Bt: chlorite+biotite, Kln: Kaolinite, Fe-b: iron-bearing minerals

3.2.1.2 GEOCHEMICAL COMPOSITION

Sediments from the source sampled near the stockpiles were predominantly composed of iron (53-64%) and silicium (1-7%) and cobalt (833-1040 mg/kg, not shown) (**Figure 6**). The composition of the major elements in the sediments sampled on the sea floor of Milne Inlet and Tremblay Sound was similar and dominated by Silicium (~15-39 wt.%), Calcium (2-13 wt.%), Magnesium (1-6 wt.%), Aluminum (2-8 wt.%), Potassium (1-3 wt.%), and iron (0-4 wt.%) (**Figure 6**). Just like the concentration of iron, nickel (31 mg/kg) and manganese (531 mg/kg) were more concentrated in the source sample than in sea floor sediments (ranging 6 to 26 mg/kg and 50 to 304 mg/kg for nickel and manganese, respectively) (**Figure 8**). Concentrations of iron, mercury, cadmium and chromium were similar among all sea floor sediments sampled (**Figure 8**).

However, concentrations of aluminum, arsenic, copper, lead, nickel, manganese and zinc in sediments sampled in Tremblay Sound were two to three times concentrations observed at Milne Port and Phillips Creek (**Figure 8**). Concentrations of other trace metals in the source sample were within or below the range of those measured in sediments. Notably, cadmium and mercury were undetectable in the source sample.

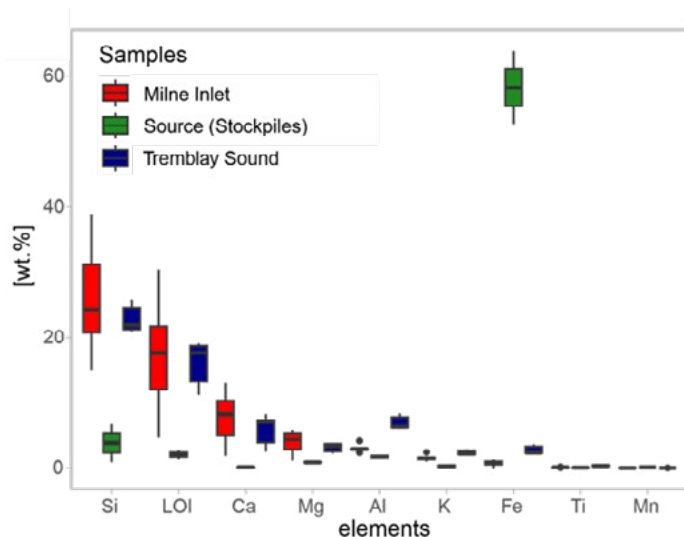


Figure 6. Boxplots showing the distribution of major (wt.%) elements in the sediment samples determined by Energy dispersive X-ray fluorescence (EDXRF). Red boxplots correspond to Milne inlet stations, green ones to Mary River

Mine and blue ones to Tremblay Sound. Si: Silicium, LOI: loss on ignition, Ca: Calcium, Mg: Magnesium, Al: Aluminium, K: Potassium, Fe: Iron, Ti: Titanium, Mn: Manganese

Table 2 presents the result of trace metals concentrations in dust-fall. Results indicated that dust samples were rich in iron followed by magnesium and aluminum. We detected traces of manganese, zinc, strontium and titanium in the samples. Concentrations of the other metal species tested were below the limit of detection.

Table 2. Trace metals concentrations ($\mu\text{g}/\text{cm}^2/\text{d}$) measured in three dust-fall samples collected in September 2024 near the stockpiles at the Mine Inlet industrial port. Average and standard deviations are provided. "<" indicates concentration below the Limit of Detection. (See Appendix 4 for details).

METALS	Mean (n = 3)	SD
Iron	2.455	1.187
Calcium	0.600	0.173
Magnesium	0.367	0.095
Aluminum	0.165	0.048
Manganese	0.0104	0.0034
Titanium	0.0029	0.0005
Zinc	0.0021	0.0001
Strontium	0.0015	0.0002
Sodium	<1	NaN
Potassium	< 0.5	NaN
Phosphorus	< 0.075	NaN
Antimony	< 0.05	NaN
Arsenic	< 0.05	NaN
Bismuth	< 0.05	NaN
Selenium	< 0.05	NaN
Thallium	<0.05	NaN
Nickel	< 0.0125	NaN
Molybdenum	< 0.0075	NaN
Tin	< 0.0075	NaN
Vanadium	< 0.0075	NaN
Chromium	< 0.005	NaN
Barium	< 0.0025	NaN
Cadmium	< 0.0025	NaN
Cobalt	< 0.0025	NaN
Copper	< 0.0025	NaN
Lithium	< 0.0025	NaN
Silver	< 0.0025	NaN
Beryllium	< 0.00125	NaN
Lead	< 0.001	NaN
Mercury	< 0.000025	NaN

3.2.1.3 CLUSTER ANALYSIS AND SOURCE ATTRIBUTION

Hierarchical cluster analysis (HCA) of mineralogical and chemical data identified three distinct clusters with unique mineralogical and geochemical signatures (**Figure 7**):

- Source sample cluster: Enriched in Fe-bearing minerals (hematite, magnetite), leading to elevated Fe concentrations.
- Milne Inlet cluster: Characterized by high quartz-dolomite content and elevated Si and Ca concentrations.
- Tremblay Sound cluster: Notable for its higher illite and chlorite+biotite content, along with Ca-Fe enrichment, where Fe is associated with chlorite+biotite.

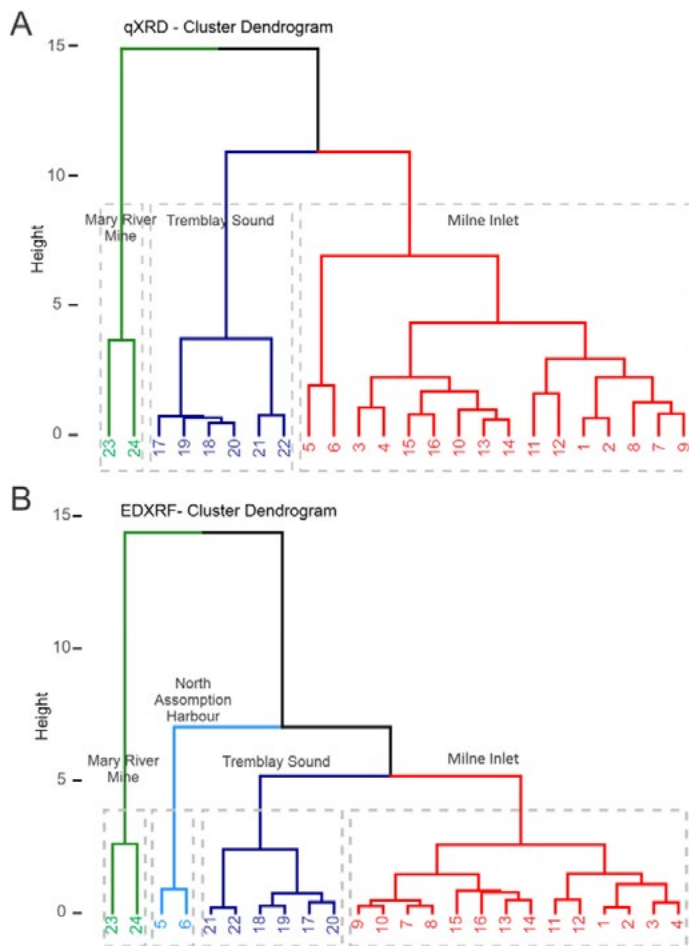


Figure 7. Cluster dendrograms generated with A) bulk mineralogy (qXRD) and B) geochemical elements (EDXRF) data. Source sample in green, Milne Inlet in red and Tremblay Sound in blue.

3.2.1.4 FINGERPRINTING ANALYSIS

We used FingerPro to determine how similar or different the compositions of the three regional clusters were, based on the same dataset. If a source composition significantly differed from the others, minimal overlap would be expected, ideally resulting in an estimated fraction of 1.0 per source. Conversely, if compositions are similar across multiple areas, the assigned fractions would be distributed among them. Results from Table 2 indicate that the compositions of the source, Milne Inlet and Tremblay Sound were very different to each other. Results indicate that there was no detectable influence of the ore source composition on the sediment composition of Milne Inlet or Tremblay Sound.

Table 3. Fraction of source data explained by running FingerPro against the three clusters (or sources). Fraction averages ± 0.1 are shown. The model was able to unmix the sediment mixtures providing consistent results with values of goodness of fit (GOF) greater than 80% for all simulations.

	Milne Inlet	Tremblay Sound	Source
Milne Inlet	1	0	0
Tremblay Sound	0.1	0.9	0
Source	0	0	1

3.2.2 Trace metals

In Milne Inlet, arsenic levels in sediments from four stations (P0.5, P1.5, P2, MOC) were slightly above the Interim Sediment Quality Guidelines (ISQG) defined by the Canadian Council of Ministers of the Environment (CCME). Arsenic levels in Tremblay Sound sediments exceeded the ISQG but remained below the Probable Effect Level (PEL) threshold (**Figure 8**). All other metals, with available guidelines, were present at concentrations below the CCME ISQGs. Interestingly, concentrations of metals with no guidelines (Al, Ni and Mn) were higher at our control stations than in the sediments at Milne port and Phillips Creek plume (**Figure 8**). Concentrations of iron in the source sample exceeded twenty times the sediment sampled at other stations. This result suggests low deposition rate of iron dust on the seafloor in Qingua.

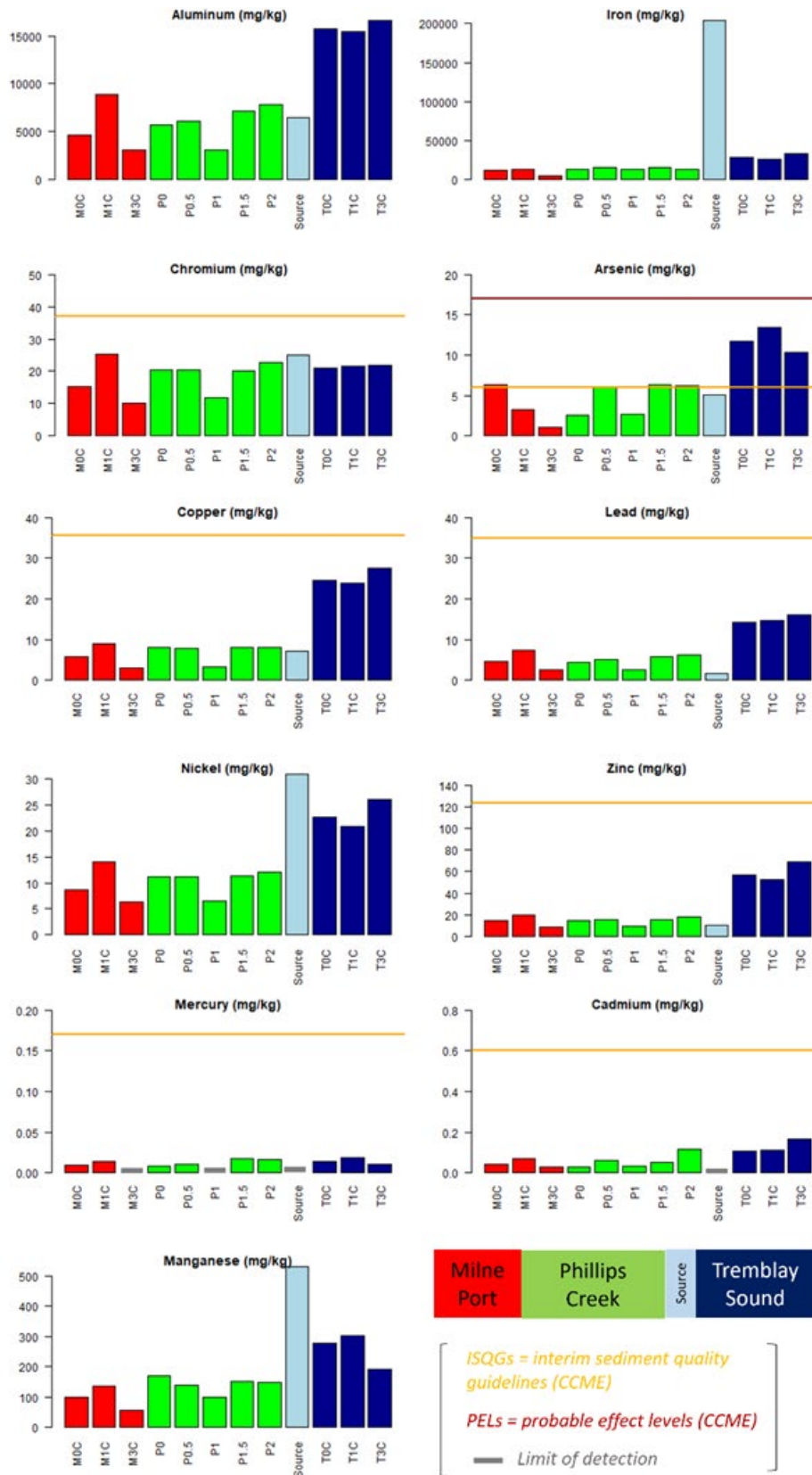


Figure 8. Major elements and trace metals concentration (mg/kg) in the source sample (pale blue) and in sediments sampled on the seafloor of Milne Inlet (Phillips Creek plume in green, Milne Port in red) and Tremblay Sound (in blue). Orange lines illustrate the Interim Sediment Quality Guidelines (ISQG) defined by the Canadian Council of Ministers of the Environment (CCME). Red line illustrates the probable effect levels for Arsenic defined by the CCME. Concentration of other trace metals tested remained below the detection limit.

3.3 Biota

3.3.1 Phytoplankton abundance

Chlorophyll-a concentrations serve as an indicator of phytoplankton abundance (primary production) in the seawater column. Phytoplankton abundance determines food availability for the zooplankton that in turn support organisms of higher trophic levels. Among the sea water samples collected in Milne Inlet and Tremblay Sound stations, chlorophyll-a concentrations ranged from 0.17 to 1.58 mg/kg, with an average of 0.45 ± 0.26 mg/kg (Figure 9). These values are typical for coastal Arctic waters at the end of summer and reflect a relatively active primary production.

Chlorophyll a concentrations were significantly different between the three areas as indicated by a Kruskal-Wallis test ($\chi^2(2, n = 30) = 10.6, p = 0.0049$). The post hoc Dunn's tests revealed that the average concentration of Chl-a in Phillips Creek (0.29 ± 0.12 mg/kg) was significantly lower ($z = 3.19, p = 0.0043$) than the average concentration in Tremblay Sound (0.52 ± 0.17 mg/kg). No significant differences were found between Milne port and Phillips Creek's plume ($z = -2.25, p = 0.0728$) nor between Milne port and Tremblay Sound ($z = 0.83, p = 1.000$).

In Phillips Creek and Milne Port, chlorophyll-a concentrations did not differ between 1 m and 5 m (Figure 9). However, a notable peak in chlorophyll-a was observed at 5m deep at station M1C (1.58 mg/kg); three times the concentration observed at 1m deep (0.52 mg/kg). In Tremblay Sound, chlorophyll-a was slightly higher at 5 m (0.61 ± 0.18 mg/kg) compared to 1 m (0.42 ± 0.11 mg/kg), with marginal statistical significance ($t(10) = -2.2, p = 0.0534$).

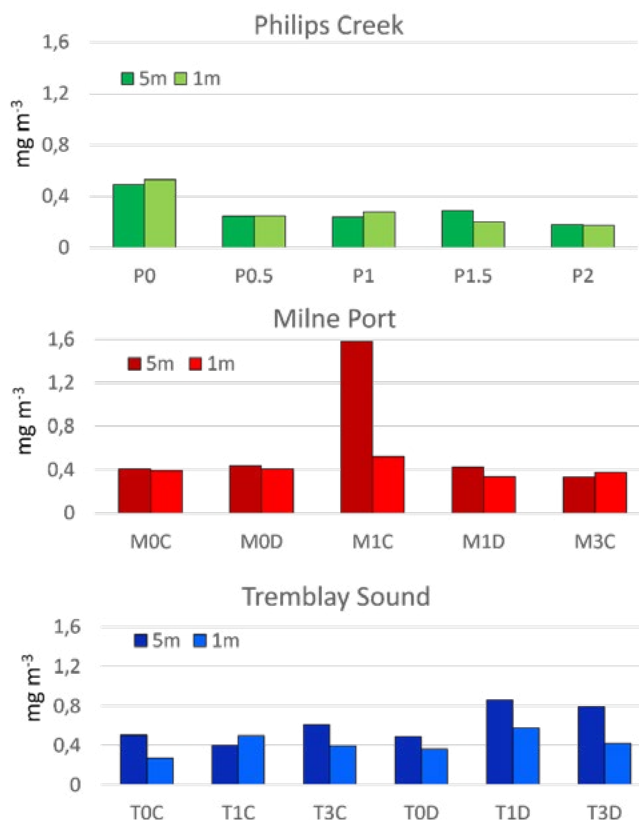


Figure 9. Concentration of chlorophyll-a (mg/m³) along the Phillips creek plume (green), Milne Port (red) and Tremblay Sound (blue). Pale and dark bar represents sampling done at 1m and 5m deep, respectively.

3.3.2 Zooplankton

3.3.2.1 ZOOPLANKTON VISUAL CLASSIFICATION

A total of six zooplankton samples were classified out of eight collected. Two samples (M0 and T3) were not well preserved, in conditions that did not allow the identification of critical structures essential to the visual classification. They were nonetheless suitable for DNA barcoding analyses (see section 3.4.2). From the six samples well preserved, two samples originated from stations P0 and P2 in Phillips Creek plume, two came from stations M1 and M3 near the Milne Port and two originated from station T0 and T1 in Tremblay Sound.

530 organisms were counted in total, with taxonomic classification performed on a subsample of 215.

Copepods dominated samples, accounting for 99% of the total count. The three major copepod orders identified were Calanoida (45%), Cyclopoida (15%), and Harpacticoida (7%), while nauplii (unidentified copepod larvae) making up the remaining 32% of the samples (Figure 10, Figure 13).

Calanoida were primarily composed of families Pseudocalanidae (*Pseudocalanus sp.* and *Microcalanus sp.*) and Acartiidae. Other Calanoida families and genera, including *Temoridae sp.*, *Metridinidae sp.*, and *Hyperboreus sp.*, were sporadically observed. Cyclopoida were dominated by the Oithonidae family. Other zooplankton species included a single amphipod (*Gammarus sp.*) collected at station P2 and a gastropod larva (*Clione limacina*) identified at station M3D.

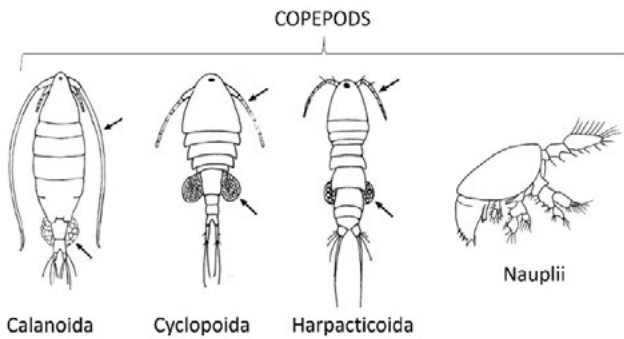


Figure 10. Schematic representation of different copepod orders.

Copepod diversity varied slightly between Milne Inlet and Phillips Creek plume stations and both areas were dominated by the order Calanoida (>70% of the samples, Figure 11). The waters of Tremblay Sound were characterized by a lower percentage of Calanoida (50%) and order Harpacticoida (3%) compared to Phillips Creek plume and Mine Port but a greater percentage of the order Cyclopoida (47%) (Figure 11).

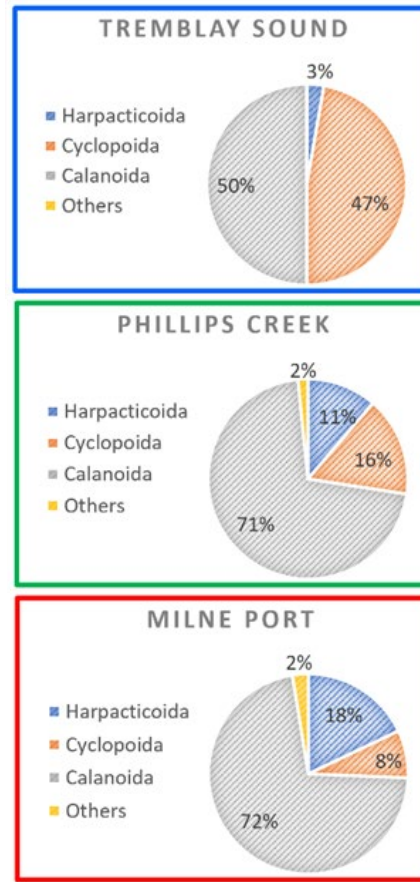


Figure 11. Count of zooplankton by order (%) in stations found in Tremblay sound (blue), Phillips creek plume (green) and Mine Inlet Port (red).

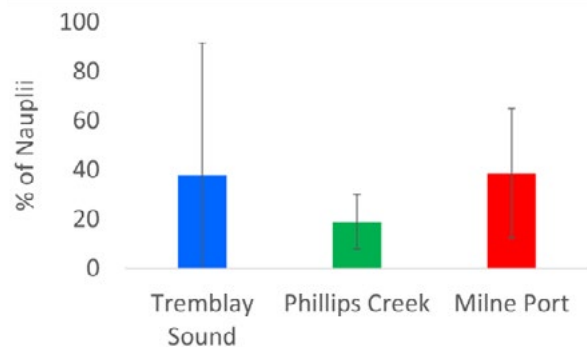


Figure 12. Histograms showing the percentage of Nauplii (copepod larvae) by area (Tremblay sound- blue, Phillips creek plume- green and Mine Port- red). Bars show standard deviation.

Beyond mere comparisons using the order level, we used the Shannon index to calculate diversity at the family level. The Shannon diversity index revealed no difference in copepod diversity between the three areas based on visual classification.

3.3.2.2 DNA BARCODING IN ZOOPLANKTON

The global abundance of zooplankton by order (%), determined with the barcoding method, differed from the results obtained by visual classification (**Figure 13**).

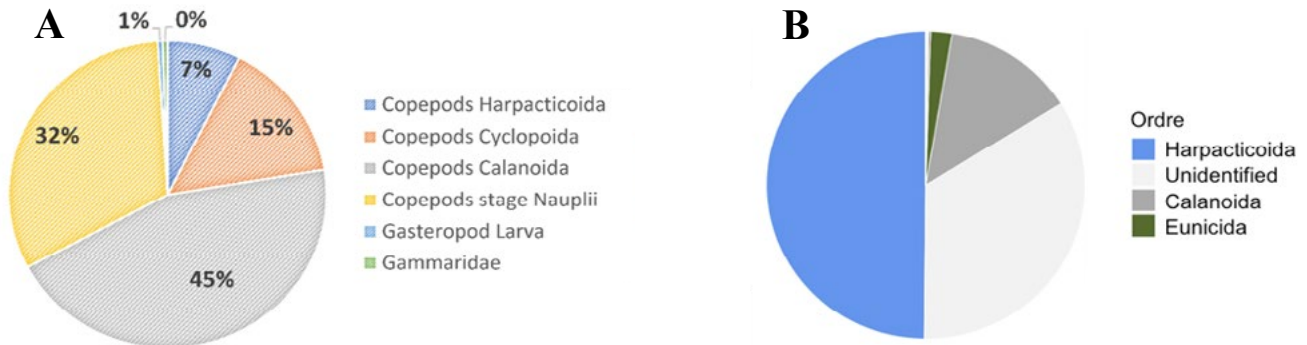


Figure 13. Total count of zooplankton by order (%) determined by visual classification (A) and barcoding (B). Results combine samples from Milne Port, Phillips Creek's plume and Tremblay Sound.

Figure 14 provides a visual representation of the 50 most abundant zooplankton taxa among areas, highlighting differences in the dominant taxa.

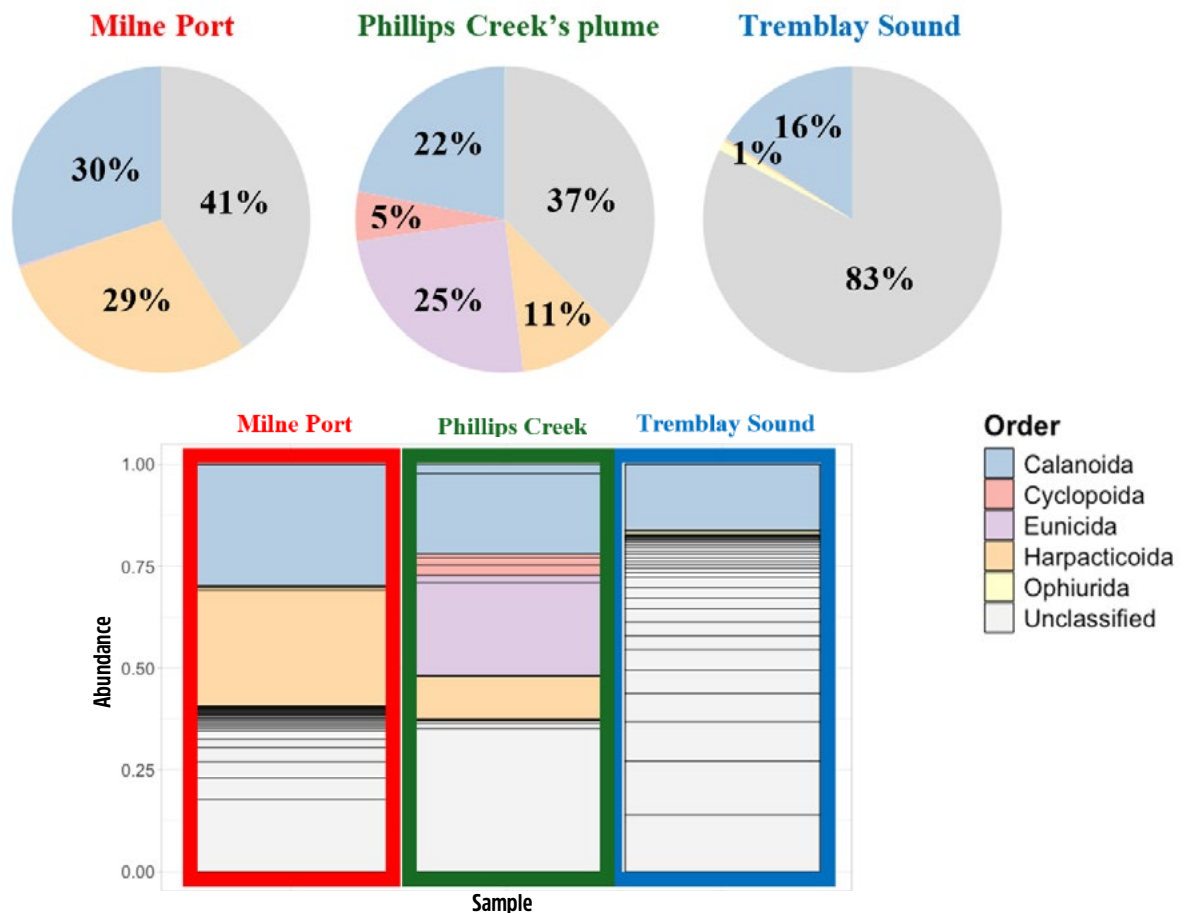
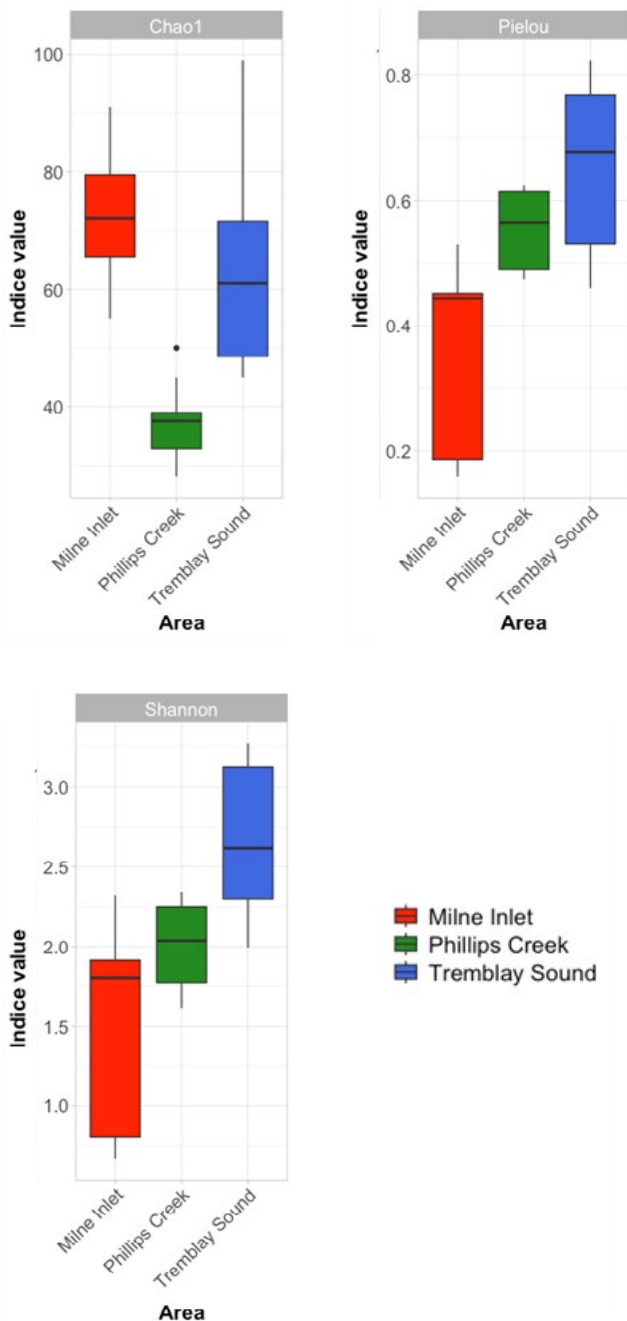


Figure 14. Visual representation of the 50 most abundant zooplankton taxa (at the order level) detected in Milne Port (red), Phillips Creek plume (green) and Tremblay Sound (blue). Unassigned taxa are shown in light grey. **Above** Pie chart representation. **Below** Abundance tables: the y-axis represents the relative abundance of the taxa. Black lines differentiate



taxa. **Figure 15.** Alpha diversity of zooplankton communities by area. The Chao1 index provides species richness (the total number of species). The Pielou's evenness index measures the equitability of a community, i.e. if the abundance of specimen for each species is evenly distributed. The Shannon index combines richness and evenness together into a single estimate of diversity. Milne Port is shown in red, Phillips Creek plume in green, and Tremblay Sound in blue

To quantify and compare the diversity of zooplankton communities between areas, three alpha diversity indexes were calculated (**Figure 15**). Due to the limited number of samples, we were not able to run statistical tests.

The Chao1 index revealed lower species richness in the Phillips Creek plume area compared to Tremblay Sound. In contrast, Milne Port had the highest estimated richness (the greatest number of species). The Pielou's evenness index revealed that the abundance of specimen for each species was more evenly distributed in Tremblay Sound than Milne Port, where a few species dominated the community. Phillips Creek plume displayed intermediate values. The Shannon's index provided an integrated measure of diversity that aligned with the results presented in Chao1 and Pielou.

Bray-Curtis dissimilarities were calculated to quantify the beta diversity, i.e. differences in the composition of zooplankton communities between areas. PERMANOVA confirmed that the dissimilarities were significant among the three areas studied ($F = 1.70$, $R^2 = 0.40$, $p = 0.006$). Each area exhibited distinct taxonomic assemblages, indicating that spatial variability structures zooplankton communities.

3.4.3 TRACE METALS IN ZOOPLANKTON

The majority of trace metal species tested in zooplankton were below the detection limit in Milne Port stations (MOD, M1D, M3D) and Tremblay Sound stations (TOD, T1D, T3D) (**Figure 16**). In contrast, zooplankton sampled from the Phillips Creek plume (P0, P2, P2-A) contained detectable levels of trace metals. Zooplankton from P0, the station closest to the Phillips Creek River mouth, exhibited the highest concentrations of aluminum (300 mg/L), lead (0.11 mg/L), iron (700 mg/L), manganese (9.3 mg/L), chromium (1.25 mg/L), and nickel (0.83 mg/L). Concentrations of Cadmium, Arsenic and Zinc were elevated in zooplankton sampled in Milne Port stations (**Figure 16**).

In contrast, zooplankton sampled at P2, located two kilometers downstream, showed relatively low concentrations of trace metals. At this station, the tissues of the single amphipod collected were relatively low in cadmium (1.00 mg/kg) and lead (0.078 mg/kg) compared to concentration found in zooplankton from other Arctic regions (Greenland Sea,

Svalbard fjord and Barents Sea (Ritterhoff and Zauke, 1997; Mohan et al., 2019; Zauke and Schmalenbach, 2006). Concentration of zinc (18.3 mg/kg), chromium (0.669 mg/kg), nickel (0.239 mg/kg) and copper (1 mg/kg) in zooplankton were also low compared to Svalbard fjord (Mohan et al., 2019).

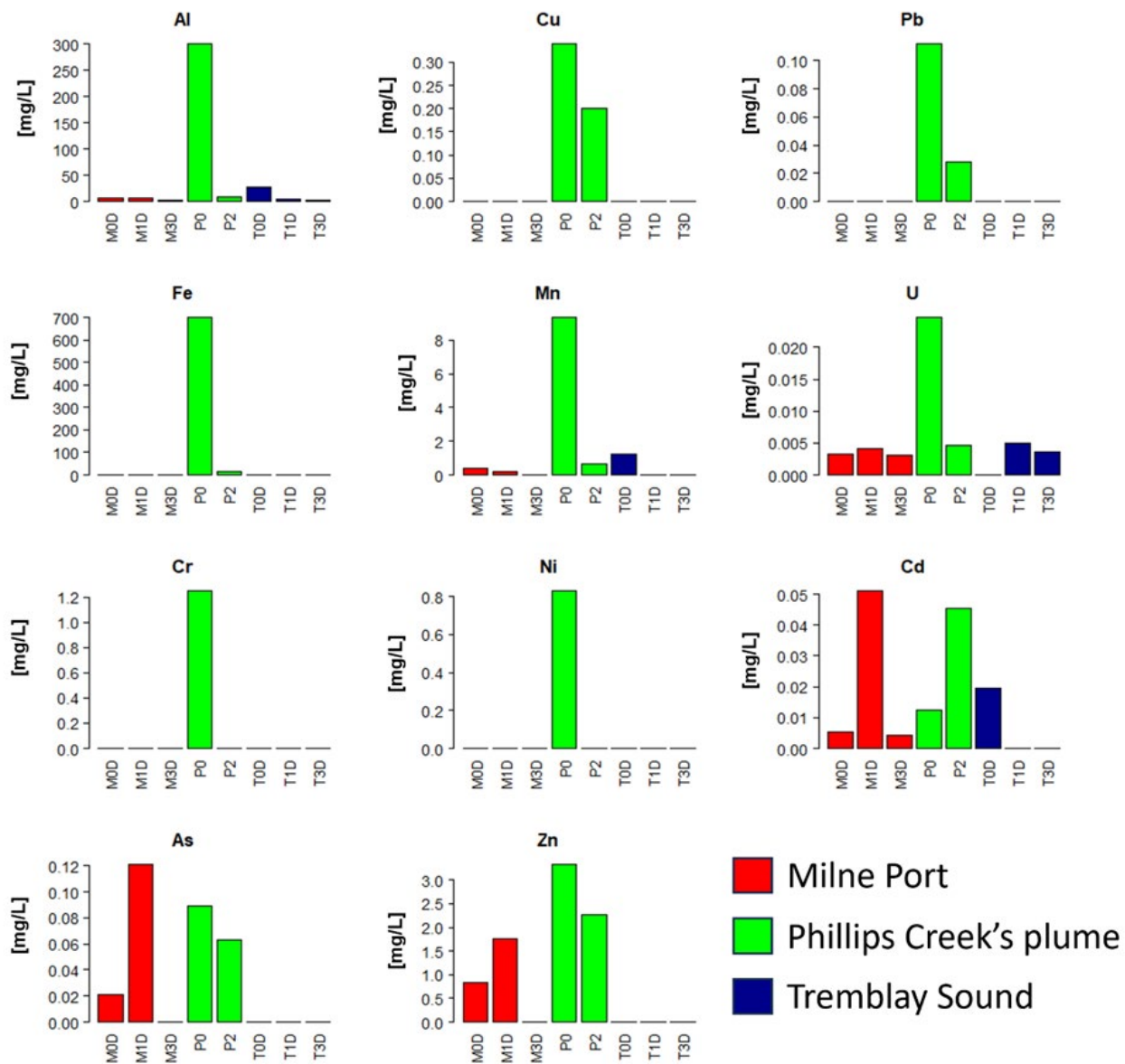


Figure 16. Trace metal concentrations (mg/L) in zooplankton from Milne Inlet port (red), Phillips Creek plume (green) and Tremblay Sound (blue). Blank results (no bars) indicate trace metal concentrations below the limit of detection (see Appendix 4 for detailed LOD data).

3.4 eDNA barcoding in fish, birds, marine mammals

The global abundance of marine mammals, birds, and fish species (%), determined by eDNA barcoding, differed between Tremblay Sound and the Qingua area (Milne Port and Phillips Creek stations combined)

(Figure 17). Of interest, the abundance of narwhal (*Monodon monoceros*) was higher in Tremblay Sound than Qingua, but not the abundance of ringed seal (*Pusa hispida*) and Arctic char (*Salvelinus alpinus*) (Figure 18).

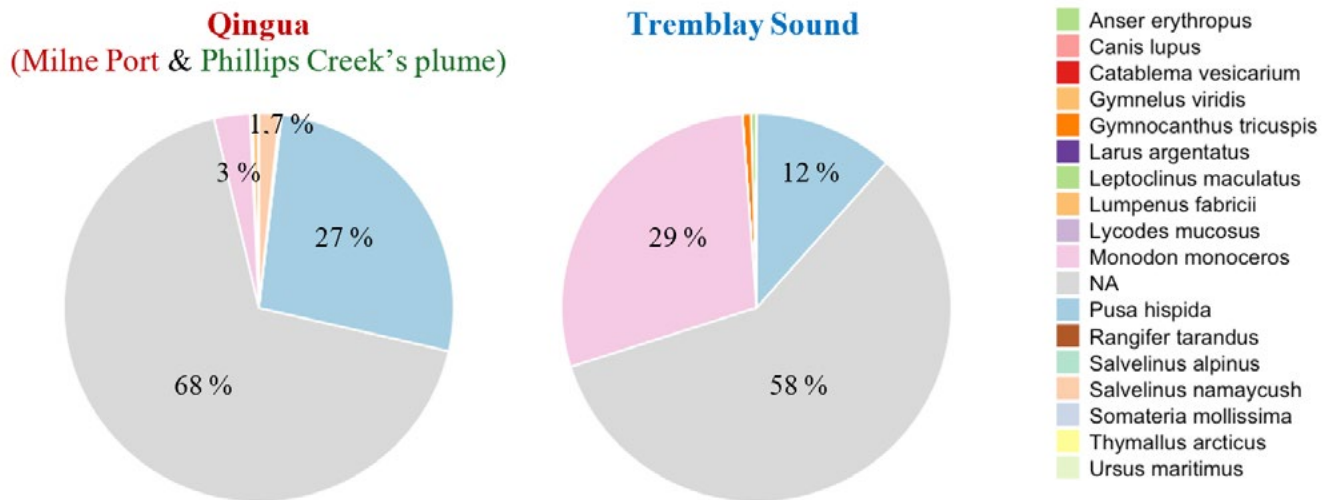


Figure 17. Abundance of Arctic marine mammals, birds, and fish species detected in Qingua (Milne Inlet & Phillips Creek's plume) and Tremblay Sound determined by eDNA barcoding (marker AquaF2 tested on seawater filtrate).

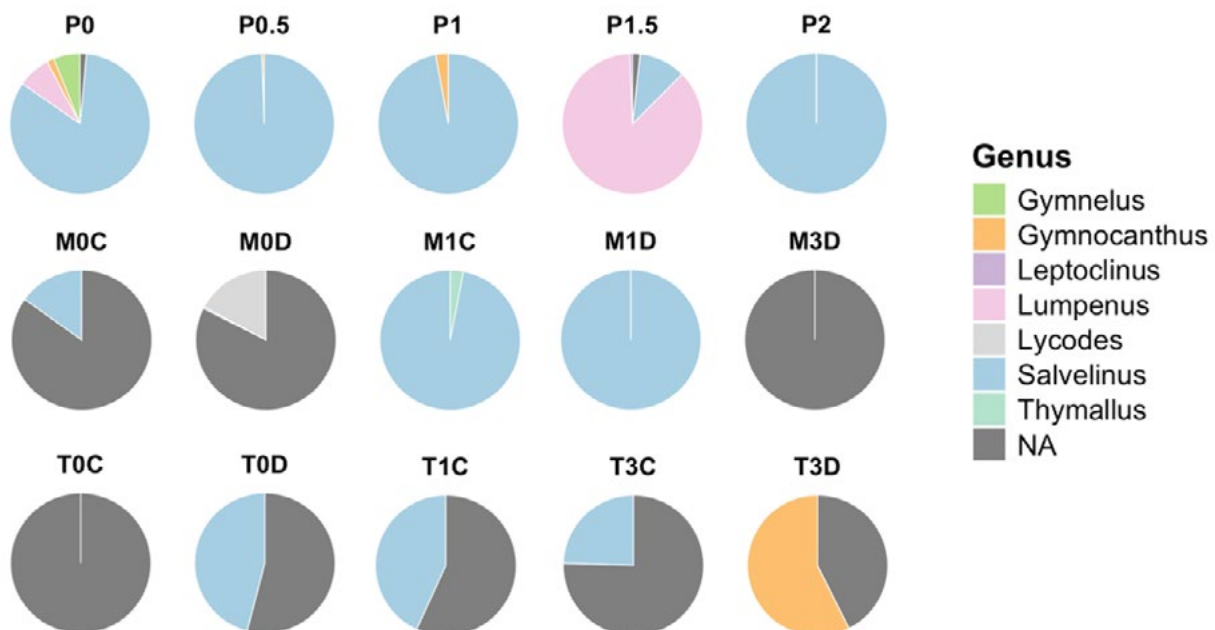


Figure 18. Abundance of Arctic fish genus detected in Milne Port stations, Phillips Creek's plume and Tremblay Sound determined by eDNA barcoding (marker AquaF2 tested on seawater filtrate). C and D indicate coastal and deep stations, respectively. Numbers indicate the distance, in km, from the first station.

4. Discussion and recommendations



4.1 Summary

The main goal of this study was to investigate the potential impacts of Baffinland's Project area, particularly the release of fugitive dust in the Milne port area, on the surrounding marine ecosystem (Qingua). Potential sources of contamination were dust-fall originating from the stockpiles, and the waters conveyed by Phillips Creek. This creek drains a large watershed flanked by kilometres of the Tote Road; an infrastructure contaminated by fugitive iron dust released by hauling trucks.

We investigated the visual composition of the seafloor and analyzed the mineralogical and geochemical composition of the marine sediments along the Phillips Creek plume, the Milne Inlet Port (Qingua) and a control area, identified by local land users and based on Inuit Qaujimagatuqangit, located in Tremblay Sound (Kangiq&uarjuk), 40 km away from Milne Port. We also investigated potential biotic impacts; trace metals levels in zooplankton, abundance of phytoplankton and diversity of zooplankton in the areas of interest.

When compared to the control area, images collected on the seafloor of Milne Port stations showed potential indications of disturbances that can be related to the activities of the mine.

Sediments sampled near the stockpiles, and dust-fall samples, were predominantly composed of up to 64% iron. Concentrations of iron, nickel and manganese were also more elevated in the source than in the marine sediments sampled. Mineralogical and geochemical analyses revealed three clusters of similarities and, consequently, a weak correspondence between the ore source and the marine sediments of Milne Inlet Port (Qingua) and Philips Creek's plume.

As expected, the mineral and geochemical signature of marine sediments from the control area were very distinct to the source sample but also very distinct from the marine sediments of Qingua. Results from these analyses appear

somehow counter-intuitive given evidences of year-long dust deposition on the sea ice and seawater in Qingua. The apparent low deposition rate of the dust-fall can be interpreted by the strong influence of the outward marine current driven by low tides and dominant winds as suggested by Inuit Qaujimajatuqangit (see 4.2 Sediments below). Trace metal levels in marine sediments were similar among areas for certain elements (Fe, Cd and Cr) but other elements (Al, As, Cu, Pb, Ni, Mn and Zn) were higher in the control area (**Figure 8**). In Milne Inlet and Tremblay Sound, arsenic levels in sediments were above the Interim Sediment Quality Guidelines (ISQG) defined by the Canadian Council of Ministers of the Environment (CCME) yet below the Probable Effect Level (PEL) guideline (CCME) (**Figure 8**).

Trace metals concentrations in zooplankton were below detection levels for most metals at the control site (Tremblay Sound) and Milne Port. Interestingly, several elements (Al, Cu, Pb, Fe, Mn, U, Cr, Ni, Zn and As) were found at detectable levels in zooplankton (copepods) from Phillips Creek's plume stations, with more elevated levels observed near the mouth of the creek (**Figure 16**). Cadmium, Zinc and Arsenic levels were also found at detectable levels in copepods sampled near Milne Port. Contrasting with marine sediments, we did not detect any traces of Arsenic in the zooplankton from Tremblay Sound.

The study of chlorophyll-a levels showed typical phytoplankton abundance for Arctic seawater and for the season. The average concentration of Chl-a in Phillips Creek was significantly lower than the average concentration measured in the waters of Tremblay Sound.

DNA barcoding of zooplankton allowed us to draw indexes of alpha and beta diversity, suggesting three distinct species assemblages among Milne port area, Philips Creek's plume and Tremblay Sound. We observed a more balanced abundance of specimen for each species in Tremblay Sound than in the Milne Inlet port. Species richness was the lowest at Phillips Creek's plume stations (**Figure 15**).

4.2 Dust, Seafloor and Sediments

Despite some visual indications of dust deposition and accumulation on the seafloor at the mouth of Phillips Creek River (PO) and near the Milne Port (**Figure 3, Figure 4**), the lack of mineralogical and geochemical evidence of dust deposition in the sediments of Qingua can be explained by several factors related to 1) the oceanography of Milne Inlet and 2) sampling limitations (see section 4.4 below).

Milne Inlet, and the specific Qingua area (Assomption Harbour), is a very dynamic system connected to the Eclipse Sound. Information from Inuit Qaujimajatuqangit (IQ) reports that the Milne Inlet system is driven by an outward water current driven by low tide and dominant winds that flow from the end of Milne Inlet towards Eclipse Sound. Current can convey dust-fall out of Qingua.

Here is a transcription of a mapping interview held with Jaykolaissie Kiliktee, an Elder from Pond Inlet :“*In this area [Qingua], the western wind blows in that direction and the current always moves [East] toward Baffin Bay. When the tide is going down, [the current] it will always move in this direction [East]*”. Based on this observation, potential routes of sediments transport have been discussed (**Figure 19**). In addition, the sea ice cycle - melt/formation and drift - can be a determinant for iron dust transport out of Qingua, and could explain the apparent low deposition of dust-fall. Dust deposition on the sea ice in Qingua, a phenomenon well documented by local land users and compiled in Coupel et L'Hérault (2024), occurs from October (freeze-up) to July when the ice breaks up; nearly 9 months of the year. During the summer melting, the sea ice can drift in large blocks outward from Qingua and carry significant quantities of dust encapsulated in the ice, to remote locations.

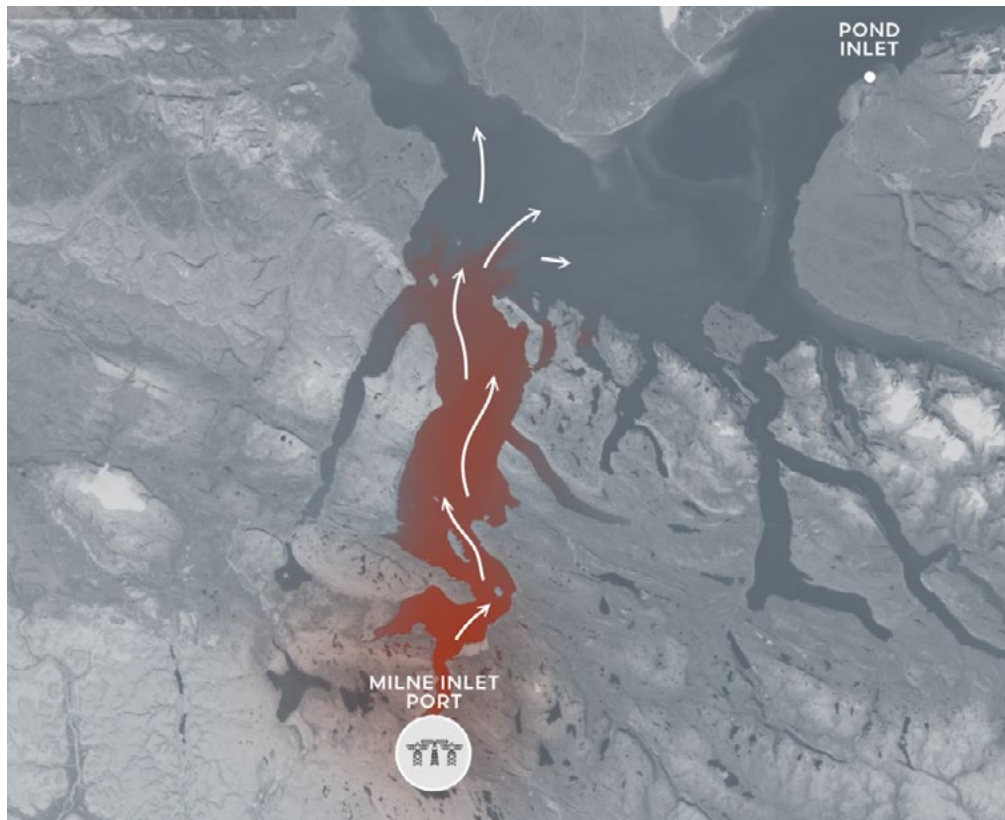


Figure 19 - Map of Milne Inlet showing the potential routes of dust dissemination through oceanic currents driven by tidal forcing and winds. This map is based on an interview conducted with an Elder from Pond Inlet. The red coloration illustrates the dust plume that expands northward from the Milne port through Milne Inlet and Eclipse Sound. White arrows represent the direction of the main currents identified by the interviewee.

Unexpectedly, the highest trace metals concentrations in sediments were found in our control area at Tremblay Sound (Kangiġuarjuk) (**Figure 8**). The source of elevated trace metals levels in Tremblay Sound remains unknown, but could be related to naturally-occurring metal-rich geology. Bulk mineralogy analyses revealed higher levels of chlorite-biotite compared to the other areas. Biotite can adsorb iron or other metals such as arsenic under several forms depending on pH (Seddique et al., 2008).

Other explanations are possible, yet not evidence-based. For example, during winter, several land users have reported the presence of red dust on sea ice as far as Tremblay Sound, but it is very unlikely that this limited amount contributes to trace metal deposition in the sediments. Qurluqtuuq lake, a recipient of fugitive iron dust located across Qingua, is also connected to Tremblay Sound. But the potential transfer of trace metals from this water body to Tremblay Sound is unknown. According to Inuit Qaujimagatuqangit, the marine currents driven by low tide can be a significant force conveying both the iron dust released near the Milne port in the seawater and the dust entrapped in the sea ice during the summer melt. There is yet no evidence on how far and where the drifting dust might ultimately be deposited.

4.3 Marine Biota

4.3.1 Phytoplankton

Phytoplankton abundance (Chl-a) was significantly lower in the Phillips Creek plume area compared to the Tremblay Sound area. Although this result can be attributable to various abiotic and biotic factors, the physical-chemical conditions of the sea water observed among the two areas, for the same water depth, were relatively similar (see Appendix 2). It is nonetheless too early, and not evidence-based, to attribute the observed variation in the primary production to the influence of mining activities and the release of dust/contaminants.

4.3.2 Zooplankton

4.3.2.1 DIVERSITY

Zooplankton communities were assessed through two complementary methods: visual classification and DNA barcoding (**Figures 13**). Both methods allowed the identification of the same major taxonomic orders but their relative abundances differ markedly. This was likely caused by the nature of the method; visual classification characterizes individual organisms, and barcoding characterizes DNA fragments. Barcoding provides a greater accuracy in species identification and is limited by the gaps in reference genetic databases (the genetic profile of many Arctic species haven't been characterized yet).

Alpha diversity indexes (**Figure 15a**) calculated at Phillips Creek revealed a reduced species richness (the total number of species) but a moderate species evenness (the abundance of each species). This result could suggest the absence of certain taxa, potentially sensitive to trace metal contamination, with a remaining balanced assemblage. In contrast, the Milne Port area showed higher species richness but lower evenness, indicating the dominance of the assemblage by a few species. Tremblay Sound area showed intermediate levels of species richness and evenness, potentially explained by a stable environment. Evenness is an important indicator to consider when assessing a community, as it tends to decrease when the environment is disturbed (Santos et al., 2025) and is associated with ecosystem and community resilience (Fung et al., 2015; Santos et al., 2025). The community dissimilarity index (beta diversity) supported these patterns, revealing distinct communities.

Abundance tables (**Figure 14**) showed a relatively high proportion of unidentified taxa in the three areas studied, especially at Tremblay Sound. This was due to the poor representation of Arctic species in reference genetic databases. These unidentified sequences most likely encompass several species found in the environment as nauplii larvae; hard to classify morphologically and hence underrepresented in barcode libraries. Interestingly, a visual count of nauplii larvae represented ~30% of all specimens counted, which corresponds to the proportion of unassigned barcodes in the Phillips Creek plume and Milne Port areas (**Figure 13**).

4.3.2.2 TRACE METALS

The relatively high concentrations of trace metals observed in zooplankton can potentially be the result of bioaccumulation in the trophic chain. Zooplankton can absorb trace metals through grazing on the phytoplankton and/or through direct ingestion/exposure to ambient dissolved trace metals present in the seawater. Several

species also migrate up and down the water column and can reach the depth of the sea floor. The elevated concentrations of iron, nickel and manganese observed in the zooplankton sampled at the mouth of Phillips Creek (PO) are potentially explained by their exposure to significant concentrations of trace metals present in the area (**Figure 5**, see Table 2 for the composition of the dust-fall).

In contrast, trace metal levels in zooplankton were below detection levels for most metal species in Tremblay Sound (control) and Milne Port. The ore stockpiles, the dust source, are located close to Phillips Creek and this river conveys to the sea, waters draining a large watershed encompassing the project area (the Tote Road). Trace metal concentrations in the seawater can be high enough, and bioavailable, to be ingested by living biota such as phytoplankton and zooplankton. However, direct measurement of trace metal concentrations in seawater, and in the phytoplankton, need to be assessed to determine cause-effect mechanisms.

Trace metal pollution can affect and shape the structure of the zooplankton community found in this area (**Figures 15**). For example, the literature reports that nauplii larvae can be particularly sensitive to trace metal contamination; they are often used as biological indicators in marine ecosystems (Kokkali et al., 2011). The presence of the order Eunicida in Phillips Creek's plume area (> 25% of the genetic assemblage, **Figure 14**), a group of polychaetes known for their tolerance to trace metals (Zhou et al., 2003), may also be indicative of pollution in this area.

Elijah Panipakoocho, an Elder from Pond Inlet interviewed in the context of the mining effects on the marine environment, shared his concerns about the risk that some copepods will come to disappear in Qingua, with potential upscaling effects on the marine food chain:

"[In Qingua] the red copepods are the food source of the fish, you can tell by the red color of their feces. Fish can get really fat by eating them. [In Qingua], I believe that the copepods will be gone, since they are really small and more and more ships are coming in."

The quote of the Elder likely refers to the copepod species of the calanoid Order observed in the area (**Figure 13**).

The presence of trace metals in zooplankton seems to be very localized at the mouth of Phillips creek, because trace metal concentrations in the zooplankton collected 2km away (P2) were lower. Arsenic levels in zooplankton sampled in Milne port were elevated, so were concentrations found in marine sediments in the same area (above the Interim Sediment Quality Guidelines, see **Figure 8**). Interestingly, we detected no trace of arsenic in the zooplankton sampled in Tremblay Sound, despite its high levels in the sediments of the area. This suggests that arsenic (and perhaps other trace metals) found in Tremblay Sound sediments are not bioavailable (i.e. directly assimilable) by organisms. In this context, Tremblay Sound potentially remains a good control site for comparing measures relating to marine biota. Environmental factors other than metal concentrations may explain site variation in the abundance of copepods.

4.4 Limits of the study

Our study met some limitations primarily related to the small sample size, sample biomass and certain methodological restrictions.

The mineral and geochemical analyses were limited due to the type of instrument used for sediment grab sampling. The ponar grab collects a 'random' sample of a random depth according to the density of the

sediments. The end result is the collection of a mix of sediment layers that each represent a record of diverse geological times unspecific to the very recent anthropogenic period characterized by mining exploitation. To minimize this bias, we sampled the upper 2cm of sediments, an arbitrary and exploratory target, using syringes. The use of a core sampler, unavailable at the time of the 2024 field work, can easily offset this bias and provide an ordered and accurate collection of sediment layers.

A better characterization of sediments size (granulometry) and mineralogical and geochemical analyses on the finer fraction of the sediment (see Appendix 1) would yield results that target the fine nature of the dust-fall.

The seasonal variation in phytoplankton abundance has not been addressed in this preliminary study. Incident sunlight, freshwater input, and nutrients availability are driving factors of the primary production that can greatly vary with seasons. We recommend further investigation.

Instruments used to sample zooplankton did not succeed in collecting amphipods. These are known to be elusive, with the capacity to escape the towed net. This limitation altered the representation of this taxa in the results obtained from the visual classification. The abundance of amphipods was nonetheless accounted for in the DNA barcoding testing. We recommend the use of a tow net with a wider circumference, and to slightly increasing the speed of the tow, to increase the capture rate of amphipods.

A wider net would also help overcome another bias of the study; the limited amount of zooplankton material collected for the trace metals analyses. Trace metals levels were measured on sludge samples of zooplankton and the presence of residual seawater in the mixture can represent a bias. Further study should aim at collecting a bigger sample (using a wider net), rinsed from sea water using distilled water, and dessicated to determine tissue concentrations in mg/kg.

Finally, our study design was challenged with the finding of relatively high concentrations of trace metal species in the marine sediments at our control site. Trace metal concentrations in Tremblay Sound sediments did not apparently upscale in the zooplankton (see Figure 16), but additional work on benthic species is needed to fully understand whether or not bioaccumulation might be at play. By extension, this information is needed to confirm or inform the quality of Tremblay Sound as a control site. We suggest studying the possibility of alternative locations to set up control stations, under the guidance of Inuit Qaujimagatuqangit.

4.5 Recommendations

We recommend the following to support further community-based monitoring:

4.5.1. Control area

In order to shed light on the cause and the potential biotic consequences of the trace metal concentrations observed in the sediments of Tremblay Sound, we suggest further investigating trace metals in the seawater, phytoplankton, and benthic species in the area. We also recommend working with local land users and Elders to identify and study alternative locations that can be used as control stations.

Our goal is to ensure that natural background levels of trace metals in seafloor sediments are well understood in the system, and that the control station is exempt from potential sources of contamination. For example, it may be relevant to identify an alternative site characterized by a mineralogical assemblage that is similar to the one observed in the Milne Inlet Port area (i.e. dominated by quartz and dolomites).

4.5.2 Milne Port area

As determined in previous studies (Coupel et L'Hérault, 2024; RWDI 2017), the extent of dust release and deposition in the environment is decreasing with distance from the Milne port. Dust deposition on the seafloor is possibly detectable in the vicinity of the ship loading area, a location we could not survey, the result of respecting a safe distance from the ships. We recommend collecting marine sediment samples along a gradient of stations in front of Milne Port, to measure the geochemical composition of the seafloor sediments, to confirm whether dust deposition occurs and, if so, to determine the extent of the deposition. This approach is similar to, and would yield comparative results to BIM's Marine Environmental Effects Monitoring Program (MEEMP).

To assess the impact of the Phillips Creek outflow on Milne Inlet biota – potentially enriched in metals due to the proximity of the watershed to the Tote Road and to the ore stockpiles – we recommend the collection of samples from the outflow of a reference creek (e.g. Kangiq&uarjuk river), not influenced by nearby infrastructure.

Dust source sample:

We recommend further analyses on the geochemical composition of the dust-fall near the Milne port to increase the sample size and the repeatability of the results. We also recommend analysing the size of particles contained in the dust-fall to get a sense of what size range can be used in the finer fraction of the seafloor sediments for the purpose of drawing appropriate comparisons (see Appendix 1). It would also help to resolve the question of whether dust-fall tends to sink or float/remain suspended in the water column.

4.5.3. Sediment sampling

We recommend the use of box cores or gravity cores to collect marine sediments. This would allow a more accurate delineation of the surface sediment layer that corresponds to the recent anthropogenic period and help to establish a natural/pre-industrial geochemical baseline of the area looking at the subsurface layers. Particle size analysis (granulometry) was performed on Phillips Creek sediments (Appendix 1) and revealed no correspondence in the geochemical composition of the finer fraction of the sediments versus the dust-fall. We recommend to further test for particle size with sediment samples from Milne Port area and the control stations. We also recommend the quantification of Total Organic Carbon (TOC) in the sediments as humic substances, at a certain pH, can form complexes with metals, increasing metal solubility in the water column.

4.5.4. Trace metals in zooplankton, benthic organisms, and demersal fish

To further investigate cause-effect mechanisms in trace metal concentrations observed in zooplankton samples, we recommend testing trace metal concentrations in the seawater and the phytoplankton at the Milne port stations, Phillips Creek's plume, and Tremblay Sound. For the zooplankton, we recommend using a wider tow net to increase the capture rate of larger zooplankton like the amphipods. Pursuing the study of the copepod community is also critical. They represent the bulk diet of several fish species and seal. Investigating the fate of the species referred to as the 'red copepods' by local Elder Elijah Panipakoocho, is important.

Similarly, investigating trace metals levels in benthic organisms such as crustaceans, clams and other shellfish, polychaetas and demersal fish is critical to address the uptake of contaminants throughout the food chain. For example, shellfish filter the seawater continuously, and can accumulate trace metals and other contaminants in their tissues. Their position in the trophic chain and their low dispersal capacity makes them good long-term bioindicators of local pollution (Moisan and Pelletier, 2014).

We recommend the conduct of fieldwork during different seasons (early summer , summer, late summer) to determine seasonal variation in the abundance of phytoplankton, and abundance and diversity of zooplankton.

4.5.5. Indicators of species diversity

The use of genetic tools such as barcoding, is promising to address species diversity and abundance in the marine environment. It will improve with time, given the advancement of Arctic genetic research. We recommend the use of barcoding in the context of this study because pollution is known to affect species assemblage. Beyond zooplankton and fish/marine mammals' taxa, we recommend the use of barcoding to explore species diversity in benthic species. This can be done by the sampling and filtration of seawater near the seafloor, or the collection of grab samples.

4.5.6. Seawater and sea ice in Milne Inlet

Because iron dust deposition in the marine sediment was not observed within the limits of our study, we recommend tracking the pathway of dust deposition by addressing the geochemical composition of the sea ice and sea water in Milne Inlet Port area (Qingua) and at control stations. Seawater monitoring should include the quantification of Total Organic Carbon (TOC) and dissolved trace metals concentrations. The monitoring of sea ice dynamic, either by remote sensing (Landsat imagery) or ground observations (e.g. trail camera monitoring), is recommended to assess the fate of the sea ice during the summer.

4.5.7. Inuit Qaujimagatuqangit (IQ)

We recommend incorporating the observations and knowledge of local land users and Elders to explore further hypotheses associated with dust contamination near the project area. For example, Inuit Qaujimagatuqangit can help to advance our understanding of the oceanographic features of Milne Inlet, including the sea ice cycle, local winds and oceanic currents, and hence help address potential mechanisms of dust-fall transport. IQ can also help to investigate potential control stations and to gain knowledge on different biota, including benthos and fish. IQ can also help to point out locations where the conveyed dust could potentially settle and accumulate beyond Qingua.

Conclusions



Despite its limits and its exploratory nature, our comparative study shed light on several observations and phenomena and met several research objectives. The most significant result is that our source ore sample showed mineralogical and geochemical signatures that were distinct from all marine sediment samples tested. This suggests that dust deposition is limited, even in the vicinity of the Milne port. Future work needs to target the transport of dust through the seawater and sea ice.

Visual evidence of disturbance of the sea floor near the Milne port, lower phytoplankton and zooplankton species abundance in Phillips Creek's plume, taken together with detectable levels of trace metals in zooplankton sampled in the Phillips Creek plume and Milne Port stations, provides evidence of contrasts between impacted versus control areas. These are potentially related to mining activities involving dust-fall deposition in the marine environment. But cause-effect relations cannot yet be confirmed. We recommend further study on the effects of dust in the area with the involvement of local staff from the Inuit Stewardship Program and further use of Inuit Qaujimagatuqangit.

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Appendix 1

GRAIN SIZE ANALYSIS (METHODS & RESULTS)

A total of 13 elements (Mg, Al, Si, K, Ca, Ti, Mn, Fe, V, Cr, Zn, Sr, Zr) were analyzed by energy dispersive X-ray fluorescence (ED-XRF) spectrometry using a PANalytical Epsilon 3-XL and following the procedure used by Gamboa et al. (2017). Briefly, prior to ED-XRF analysis, sediment samples were first wet-sieved through a 63- μm and 11- μm Nitex[®] mesh using distilled water and then oven-dried (<60°C) for 48h, crushed and homogenized with an agate mortar. The <63 μm and <11 μm fractions includes fine-grained sediments, main clay + silt (<63 μm) and clay + fine silt (<11 μm), which allow not only to avoid spatial biases in elemental concentrations linked to coarse-grained size variations, but also to capture the regional geochemical signature of the environment.

Next, 2 g of sediment sample were weighed before and after incineration in a muffle furnace at 950°C for 4 hours to determine loss on ignition (LOI). Subsequently, approximately 0.6 g of the ignited sample was mixed with ~6 g of lithium borate flux (CLAISSE, pure, 49.75% Li₂B₄O₇, 49.75% LiBO₂, 0.5% LiBr). The mixtures were melted in Pt-Au crucibles (95% Pt, 5% Au) with a CLAISSE M4 Fluxer automated fusion furnace. Acquired XRF spectra were processed with the Malvern PANalytical Omnia standardless software package calibration. Procedural blanks (n=2) were prepared with a silicon oxide powder (99.999% SiO₂; American Elements; SI-OX-05M-P.325M).

The SiO₂ blanks are less than detection limit (DL) for of major and trace element determined here, except for Al (~0.32%). This Al contamination is probably derived from the ceramic crucibles used for LOI determinations. Thus, Al concentrations in the sediment samples were corrected by subtracting the mean Al values of procedural blanks.

The accuracy of the overall method including the LOI determination and glass disks preparation was assessed by analyzing the CCRMP standard TILL-2 and TILL-3. The results obtained for these reference materials are in good agreement with reference values from the GeoREM database (<http://georem.mpch-mainz.gwdg.de/>). Except for V in the TILL-2 and TILL-3, the recovery values (accuracy) for all the measured elements were between 82 and 138 %. ED-XRF reproducibility, based on replicate analysis of the TILL-3 (n=2), was <8% relative standard deviation (RSD, 1 σ) for major elements, 1% for Cr, 7-9% for Sr and Zr, and <2% for the other elements.

Table 1. Grain size distribution results for sediment samples collected from Assumption Harbour.

Sample-ID	2024-PI-MI-P2	2024-PI-MI-P2R	2024-PI-MI-P0.5	2024-PI-MI-P0.5R
D50 (µm)	25	20	48	52
D90 (µm)	230	227	225	244
Sorting (µm)	5	5	4	4
Sorting	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted
Textural group	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud
% V COARSE SAND	0	0	0	0
% COARSE SAND	0.3	0.5	0.6	1.2
% MEDIUM SAND	8.4	8.2	7.7	8.4
% FINE SAND	9.5	7.7	13.8	14.4
% V FINE SAND	8.7	7.0	20.2	20.6
% V COARSE SILT	15.9	14.2	20.3	19.6
% COARSE SILT	20.7	20.3	15.2	14.8
% MEDIUM SILT	15.6	16.9	9.5	9.2
% FINE SILT	9.8	11.6	6.3	5.8
% V FINE SILT	6.4	7.8	4.1	3.7
% CLAY	4.7	5.7	2.5	2.2
Clay (%)	5	6	3	2
Silt (%)	68	71	55	53
Sand (%)	27	23	42	45

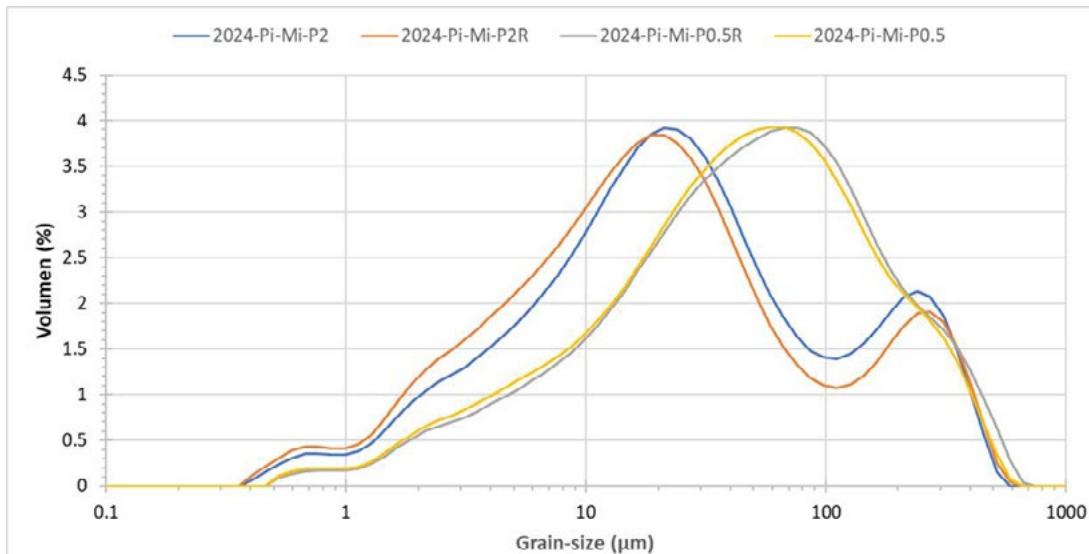


Figure 1- Size distribution of the sandy mud samples collected from Assumption Harbour.

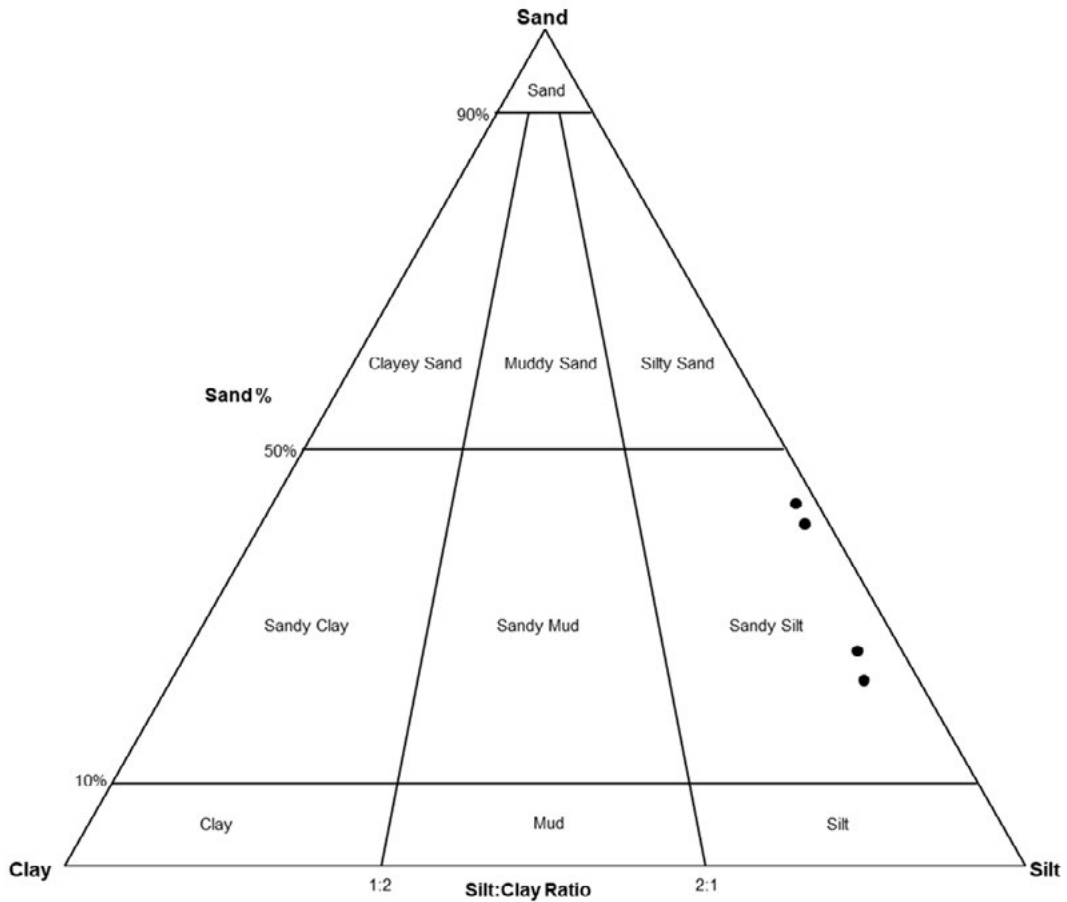


Figure 2- Ternary diagram clay-sand-silt showing sediment classification of the sediments.

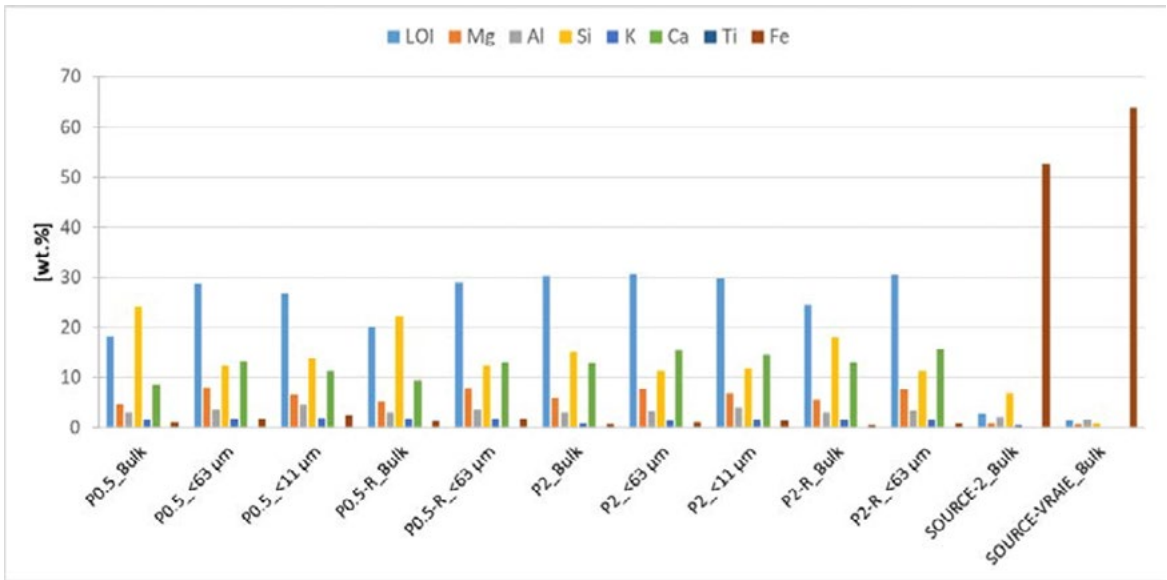


Figure 3- Bar plot of the distribution of major elements (wt.%) within the sediment samples from the stations P0.5 and P2.

Appendix 2

PHYSICO-CHEMICAL PARAMETERS OF THE SEA WATER AT EACH STATION

	P0		P0,5		P1		P1,5		P2	
Coordinate North	71.88802		71.89239		71.89667		71.89561		71.89810	
Coordinate West	-80.9415		-80.93439		-80.93298		-80.91897		-80.90730	
Depth	1m	5m	1m	5m	1m	5m	1m	5m	1m	5m
Temperature (C)	2.7	2.4	0.9	0.8	1.1	0.9	1	0.9	1.2	1
DO%	104.6	102.3	104.6	105.2	114	105	104.6	106.5	104	103.7
SPC	25475	25614	25846	25891	25842	25892	25812	25831	25718	25907
pH	8.02	8.02	8	8.02	8.07	8.06	8.06	8.06	8.04	8.04

	M0C		M0D		M1C		M1D		M3C		M3D	
Coordinate North	71.89052		71.89052		71.90033		71.90071		71.91107		71.91149	
Coordinate West	-80.88671		-80.88671		-80.84894		-80.84965		-80.81498		-80.81612	
Depth	1m	5m	1m	5m	1m	5m	1m	5m	1m	5m	1m	5m
Temperature (C)	2.7	2.7	2.7	2.7	2.9	2	2.7	2.2	2.3	1.9	2.4	1.9
DO%	101	98.6	101.7	99.9	102.5	105	99.5	100.8	100	104.8	97.9	101
SPC	24864	25309	25001	25002	25544	25775	23983	25027	23852	25184	23986	25409
pH	8.01	8.01	8.02	8.02	8.05	8.07	8.02	8.02	8.04	8.03	8.02	8.02

	T0C		T0D		T1C		T1D		T3C		T3D	
Coordinate North	72.27178		72.27201		72.28178		72.28186		72.29353		72.29254	
Coordinate West	-81.28372		-81.27941		-81.25103		-81.24890		-81.21414		-81.20870	
Depth	m	5m	1m	5m	1m	5m	1m	5m	1m	5m	1m	5m
Temperature (C)	2.8	2.6	2.8	2.3	3	1.8	2.9	1.8	2.8	1.8	2.8	1.6
DO%	9.5	100.6	99.3	101	104.1	107.1	118.3	103.7	99.9	102.7	102.4	104.8
SPC	4136	26353	24181	26417	24283	26275	25369	26305	26223	26282	26333	26226
pH	8	7.99	8	8.01	8	8	8.01	8	8.02	8.01	8.01	8.01

Appendix 3

ZOOPLANKTON CLASSIFICATION SHEET



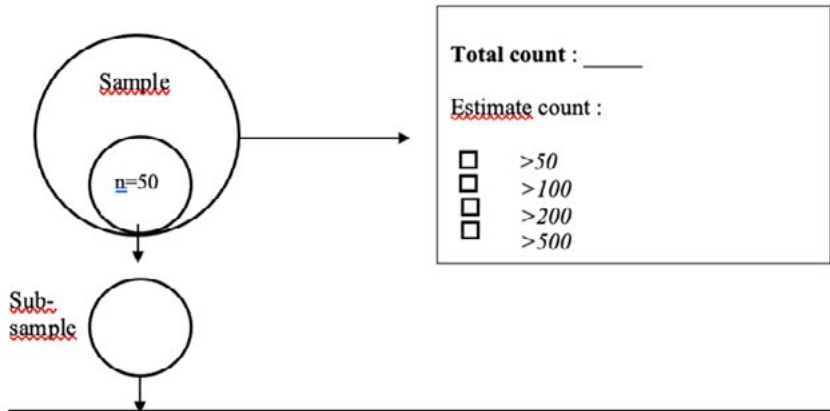
ZOOPLANKTON CLASSIFICATION

ANALYSIS DONE BY: _____
 LABEL ID# _____
(Year-Community-Station-Depth-Date)
 DATE: _____

1. GENERAL DESCRIPTION OF THE SAMPLE

Quality of the sample (check):

- Good quality (Full body recognizable- easy to see the structures)
- Fair quality (can see some structures)
- Bad quality (can see shapes only, broken parts)



3. ANALYSE- Identification

Class	Order	Family	Estimate Size (mm)	Nb
Subsample count				<input style="width: 40px; height: 20px;" type="text"/>

Appendix 4

Raw Lab results

TRACE METALS IN SEDIMENTS



CERTIFICATE OF ANALYSIS

Work Order	: WT2427755		
Amendment	: 2		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave	Address	: 60 Northland Road, Unit 1
	Quebec Quebec Canada G1L 2W1		Waterloo ON Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Date Analysis Commenced	: 29-Sep-2024
C-O-C number	: ----	Issue Date	: 25-Oct-2024 11:15
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 11		
No. of samples analysed	: 11		

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>
Greg Pokocky	Manager - Inorganics	Metals, Waterloo, Ontario



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/kg	milligrams per kilogram

<: 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

Amendment (30/09/2024): This report has been amended as a result of changes to the contacts for the distribution of the report. All analysis results are as per the previous report.

Amendment (09/10/2024): This report has been amended following minor LIMS report formatting corrections. All analysis results are as per the previous report.



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					2024-PI-MI-P0	2024-PI-MI-P0.5	2024-PI-MI-P1	2024-PI-MI-P1.5	2024-PI-MI-P2
Client sample ID									
Client sampling date / time					07-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-001	WT2427755-002	WT2427755-003	WT2427755-004	WT2427755-005
					Result	Result	Result	Result	Result
Metals									
Aluminum	7429-90-5	E440/WT	50	mg/kg	5730	6120	3070	7160	7810
Antimony	7440-36-0	E440/WT	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	7440-38-2	E440/WT	0.10	mg/kg	2.51	6.10	2.69	6.27	6.20
Barium	7440-39-3	E440/WT	0.50	mg/kg	16.6	17.1	10.1	18.8	20.3
Beryllium	7440-41-7	E440/WT	0.10	mg/kg	0.35	0.39	0.20	0.40	0.44
Bismuth	7440-69-9	E440/WT	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	7440-42-8	E440/WT	5.0	mg/kg	43.2	44.8	24.1	58.7	65.0
Cadmium	7440-43-9	E440/WT	0.020	mg/kg	0.027	0.059	0.032	0.052	0.114
Calcium	7440-70-2	E440/WT	50	mg/kg	100000	80700	50100	105000	131000
Chromium	7440-47-3	E440/WT	0.50	mg/kg	20.4	20.3	11.8	20.1	22.8
Cobalt	7440-48-4	E440/WT	0.10	mg/kg	4.02	3.64	2.28	3.64	3.78
Copper	7440-50-8	E440/WT	0.50	mg/kg	8.08	7.72	3.35	8.00	8.01
Iron	7439-89-6	E440/WT	50	mg/kg	13500	16400	13400	15900	13400
Lead	7439-92-1	E440/WT	0.50	mg/kg	4.46	5.02	2.58	5.66	6.26
Lithium	7439-93-2	E440/WT	2.0	mg/kg	33.2	30.5	14.2	34.9	37.7
Magnesium	7439-95-4	E440/WT	20	mg/kg	56500	45300	23500	49000	53100
Manganese	7439-96-5	E440/WT	1.0	mg/kg	169	140	101	153	150
Mercury	7439-97-6	E510/WT	0.0050	mg/kg	0.0080	0.0101	<0.0050	0.0178	0.0157
Molybdenum	7439-98-7	E440/WT	0.10	mg/kg	0.54	0.63	0.36	0.53	0.43
Nickel	7440-02-0	E440/WT	0.50	mg/kg	11.2	11.2	6.55	11.3	12.1
Phosphorus	7723-14-0	E440/WT	50	mg/kg	402	548	342	503	563



Analytical Results

Sub-Matrix: Sediment
(Matrix: Soil/Solid)

					Client sample ID				
					2024-PI-MI-P0	2024-PI-MI-P0.5	2024-PI-MI-P1	2024-PI-MI-P1.5	2024-PI-MI-P2
					Client sampling date / time				
					07-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00	10-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-001	WT2427755-002	WT2427755-003	WT2427755-004	WT2427755-005
					Result	Result	Result	Result	Result
Metals									
Potassium	7440-09-7	E440/WT	100	mg/kg	2740	2570	1480	3090	3450
Selenium	7782-49-2	E440/WT	0.20	mg/kg	<0.20	<0.20	<0.20	0.21	0.24
Silver	7440-22-4	E440/WT	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	7440-23-5	E440/WT	50	mg/kg	4000	4660	3180	5150	5960
Strontium	7440-24-6	E440/WT	0.50	mg/kg	55.5	52.9	60.7	84.5	145
Sulfur	7704-34-9	E440/WT	1000	mg/kg	1400	<1000	<1000	<1000	<1000
Thallium	7440-28-0	E440/WT	0.050	mg/kg	0.116	0.103	0.066	0.102	0.110
Tin	7440-31-5	E440/WT	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	7440-32-6	E440/WT	1.0	mg/kg	341	287	205	269	274
Tungsten	7440-33-7	E440/WT	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium	7440-61-1	E440/WT	0.050	mg/kg	0.865	0.843	0.464	0.844	0.803
Vanadium	7440-62-2	E440/WT	0.20	mg/kg	18.2	23.0	11.9	23.6	26.9
Zinc	7440-66-6	E440/WT	2.0	mg/kg	15.1	15.4	9.5	16.0	18.5
Zirconium	7440-67-7	E440/WT	1.0	mg/kg	7.8	6.8	3.7	7.2	6.2

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					Client sample ID				
					2024-PI-MI-M0C	2024-PI-MI-M1C	2024-PI-MI-M3C	2024-PI-MI-T0C	2024-PI-MI-T1C
					Client sampling date / time				
					11-Sep-2024 13:00	07-Sep-2024 13:00	11-Sep-2024 13:00	12-Sep-2024 13:00	13-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-006	WT2427755-007	WT2427755-008	WT2427755-009	WT2427755-010
					Result	Result	Result	Result	Result
Metals									
Aluminum	7429-90-5	E440/WT	50	mg/kg	4610	8860	3080	15700	15400
Antimony	7440-36-0	E440/WT	0.10	mg/kg	<0.10	<0.10	<0.10	0.18	0.18
Arsenic	7440-38-2	E440/WT	0.10	mg/kg	6.38	3.27	1.04	11.7	13.4
Barium	7440-39-3	E440/WT	0.50	mg/kg	13.5	19.0	6.32	79.6	77.6
Beryllium	7440-41-7	E440/WT	0.10	mg/kg	0.28	0.57	0.21	0.73	0.75
Bismuth	7440-69-9	E440/WT	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	7440-42-8	E440/WT	5.0	mg/kg	36.2	55.8	21.4	48.3	52.5
Cadmium	7440-43-9	E440/WT	0.020	mg/kg	0.040	0.071	0.029	0.107	0.111
Calcium	7440-70-2	E440/WT	50	mg/kg	48400	70900	21400	64000	75600
Chromium	7440-47-3	E440/WT	0.50	mg/kg	15.1	25.2	10.0	21.0	21.6
Cobalt	7440-48-4	E440/WT	0.10	mg/kg	2.64	4.49	1.71	9.56	8.41
Copper	7440-50-8	E440/WT	0.50	mg/kg	5.65	9.08	2.95	24.6	23.9
Iron	7439-89-6	E440/WT	50	mg/kg	12300	12900	5320	29200	26000
Lead	7439-92-1	E440/WT	0.50	mg/kg	4.51	7.36	2.50	14.2	14.7
Lithium	7439-93-2	E440/WT	2.0	mg/kg	19.6	39.0	12.6	35.7	33.8
Magnesium	7439-95-4	E440/WT	20	mg/kg	28000	37300	12900	26400	32100
Manganese	7439-96-5	E440/WT	1.0	mg/kg	101	137	56.6	279	304
Mercury	7439-97-6	E510/WT	0.0050	mg/kg	0.0094	0.0139	<0.0050	0.0137	0.0183
Molybdenum	7439-98-7	E440/WT	0.10	mg/kg	0.46	0.89	0.41	1.86	1.71
Nickel	7440-02-0	E440/WT	0.50	mg/kg	8.75	14.0	6.30	22.7	20.9
Phosphorus	7723-14-0	E440/WT	50	mg/kg	630	469	201	630	865



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					Client sample ID	2024-PI-MI-M0C	2024-PI-MI-M1C	2024-PI-MI-M3C	2024-PI-MI-T0C	2024-PI-MI-T1C
					Client sampling date / time	11-Sep-2024 13:00	07-Sep-2024 13:00	11-Sep-2024 13:00	12-Sep-2024 13:00	13-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-006	WT2427755-007	WT2427755-008	WT2427755-009	WT2427755-010	
					Result	Result	Result	Result	Result	
Metals										
Potassium	7440-09-7	E440/WT	100	mg/kg	2160	3650	1180	4000	4380	
Selenium	7782-49-2	E440/WT	0.20	mg/kg	0.27	0.24	<0.20	0.28	0.40	
Silver	7440-22-4	E440/WT	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	
Sodium	7440-23-5	E440/WT	50	mg/kg	3930	5570	2370	7280	12100	
Strontium	7440-24-6	E440/WT	0.50	mg/kg	42.8	52.2	17.8	82.0	129	
Sulfur	7704-34-9	E440/WT	1000	mg/kg	<1000	1100	<1000	1700	2200	
Thallium	7440-28-0	E440/WT	0.050	mg/kg	0.084	0.146	0.054	0.167	0.169	
Tin	7440-31-5	E440/WT	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	
Titanium	7440-32-6	E440/WT	1.0	mg/kg	227	293	154	81.6	82.6	
Tungsten	7440-33-7	E440/WT	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	
Uranium	7440-61-1	E440/WT	0.050	mg/kg	0.743	1.30	0.671	0.861	0.754	
Vanadium	7440-62-2	E440/WT	0.20	mg/kg	19.6	26.5	10.6	36.3	42.7	
Zinc	7440-66-6	E440/WT	2.0	mg/kg	14.6	20.2	9.0	56.9	52.3	
Zirconium	7440-67-7	E440/WT	1.0	mg/kg	4.3	11.4	3.8	4.2	2.6	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					Client sample ID	2024-PI-MI-T3C	----	----	----	----
					Client sampling date / time	13-Sep-2024 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-011	----	----	----	----	----
					Result	----	----	----	----	----
Metals										
Aluminum	7429-90-5	E440/WT	50	mg/kg	16600	----	----	----	----	----
Antimony	7440-36-0	E440/WT	0.10	mg/kg	0.19	----	----	----	----	----
Arsenic	7440-38-2	E440/WT	0.10	mg/kg	10.4	----	----	----	----	----
Barium	7440-39-3	E440/WT	0.50	mg/kg	74.9	----	----	----	----	----
Beryllium	7440-41-7	E440/WT	0.10	mg/kg	0.79	----	----	----	----	----
Bismuth	7440-69-9	E440/WT	0.20	mg/kg	<0.20	----	----	----	----	----
Boron	7440-42-8	E440/WT	5.0	mg/kg	40.2	----	----	----	----	----
Cadmium	7440-43-9	E440/WT	0.020	mg/kg	0.168	----	----	----	----	----
Calcium	7440-70-2	E440/WT	50	mg/kg	34200	----	----	----	----	----
Chromium	7440-47-3	E440/WT	0.50	mg/kg	21.8	----	----	----	----	----
Cobalt	7440-48-4	E440/WT	0.10	mg/kg	10.4	----	----	----	----	----
Copper	7440-50-8	E440/WT	0.50	mg/kg	27.6	----	----	----	----	----
Iron	7439-89-6	E440/WT	50	mg/kg	33500	----	----	----	----	----
Lead	7439-92-1	E440/WT	0.50	mg/kg	16.1	----	----	----	----	----
Lithium	7439-93-2	E440/WT	2.0	mg/kg	37.0	----	----	----	----	----
Magnesium	7439-95-4	E440/WT	20	mg/kg	15700	----	----	----	----	----
Manganese	7439-96-5	E440/WT	1.0	mg/kg	192	----	----	----	----	----
Mercury	7439-97-6	E510/WT	0.0050	mg/kg	0.0107	----	----	----	----	----
Molybdenum	7439-98-7	E440/WT	0.10	mg/kg	1.84	----	----	----	----	----
Nickel	7440-02-0	E440/WT	0.50	mg/kg	26.0	----	----	----	----	----
Phosphorus	7723-14-0	E440/WT	50	mg/kg	535	----	----	----	----	----



Analytical Results

Sub-Matrix: Sediment
(Matrix: Soil/Solid)

					Client sample ID	2024-PI-MI-T3C	----	----	----	----
					Client sampling date / time	13-Sep-2024 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427755-011	----	----	----	----	----
					Result	----	----	----	----	----
Metals										
Potassium	7440-09-7	E440/WT	100	mg/kg	3870	----	----	----	----	----
Selenium	7782-49-2	E440/WT	0.20	mg/kg	0.25	----	----	----	----	----
Silver	7440-22-4	E440/WT	0.10	mg/kg	<0.10	----	----	----	----	----
Sodium	7440-23-5	E440/WT	50	mg/kg	6210	----	----	----	----	----
Strontium	7440-24-6	E440/WT	0.50	mg/kg	75.8	----	----	----	----	----
Sulfur	7704-34-9	E440/WT	1000	mg/kg	1800	----	----	----	----	----
Thallium	7440-28-0	E440/WT	0.050	mg/kg	0.146	----	----	----	----	----
Tin	7440-31-5	E440/WT	2.0	mg/kg	<2.0	----	----	----	----	----
Titanium	7440-32-6	E440/WT	1.0	mg/kg	67.3	----	----	----	----	----
Tungsten	7440-33-7	E440/WT	0.50	mg/kg	<0.50	----	----	----	----	----
Uranium	7440-61-1	E440/WT	0.050	mg/kg	0.770	----	----	----	----	----
Vanadium	7440-62-2	E440/WT	0.20	mg/kg	38.4	----	----	----	----	----
Zinc	7440-66-6	E440/WT	2.0	mg/kg	68.7	----	----	----	----	----
Zirconium	7440-67-7	E440/WT	1.0	mg/kg	5.8	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: WT2427755	Page	: 1 of 7
Amendment	: 2		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec QC Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Issue Date	: 25-Oct-2024 11:15
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 11		
No. of samples analysed	: 11		

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.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) 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: **Soil/Solid**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-T1C	E510	13-Sep-2024	28-Sep-2024	28 days	15 days	✔	30-Sep-2024	28 days	17 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-T3C	E510	13-Sep-2024	28-Sep-2024	28 days	15 days	✔	30-Sep-2024	28 days	17 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-T0C	E510	12-Sep-2024	28-Sep-2024	28 days	16 days	✔	30-Sep-2024	28 days	18 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-M0C	E510	11-Sep-2024	28-Sep-2024	28 days	17 days	✔	30-Sep-2024	28 days	19 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-M3C	E510	11-Sep-2024	28-Sep-2024	28 days	17 days	✔	30-Sep-2024	28 days	19 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-P0.5	E510	10-Sep-2024	28-Sep-2024	28 days	18 days	✔	30-Sep-2024	28 days	20 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-P1	E510	10-Sep-2024	28-Sep-2024	28 days	18 days	✔	30-Sep-2024	28 days	20 days	✔



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-P1.5	E510	10-Sep-2024	28-Sep-2024	28 days	18 days	✔	30-Sep-2024	28 days	20 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-P2	E510	10-Sep-2024	28-Sep-2024	28 days	18 days	✔	30-Sep-2024	28 days	20 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-M1C	E510	07-Sep-2024	28-Sep-2024	28 days	21 days	✔	30-Sep-2024	28 days	23 days	✔
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag 2024-PI-MI-P0	E510	07-Sep-2024	28-Sep-2024	28 days	21 days	✔	30-Sep-2024	28 days	23 days	✔
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag 2024-PI-MI-T1C	E440	13-Sep-2024	28-Sep-2024	180 days	15 days	✔	30-Sep-2024	180 days	17 days	✔
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag 2024-PI-MI-T3C	E440	13-Sep-2024	28-Sep-2024	180 days	15 days	✔	30-Sep-2024	180 days	17 days	✔
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag 2024-PI-MI-T0C	E440	12-Sep-2024	28-Sep-2024	180 days	16 days	✔	30-Sep-2024	180 days	18 days	✔
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag 2024-PI-MI-M0C	E440	11-Sep-2024	28-Sep-2024	180 days	17 days	✔	30-Sep-2024	180 days	19 days	✔
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag 2024-PI-MI-M3C	E440	11-Sep-2024	28-Sep-2024	180 days	17 days	✔	30-Sep-2024	180 days	19 days	✔



Matrix: **Soil/Solid**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-P0.5	E440	10-Sep-2024	28-Sep-2024	180 days	18 days	✔	30-Sep-2024	180 days	20 days	✔	
Metals : Metals in Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-P1	E440	10-Sep-2024	28-Sep-2024	180 days	18 days	✔	30-Sep-2024	180 days	20 days	✔	
Metals : Metals in Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-P1.5	E440	10-Sep-2024	28-Sep-2024	180 days	18 days	✔	30-Sep-2024	180 days	20 days	✔	
Metals : Metals in Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-P2	E440	10-Sep-2024	28-Sep-2024	180 days	18 days	✔	30-Sep-2024	180 days	20 days	✔	
Metals : Metals in Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-M1C	E440	07-Sep-2024	28-Sep-2024	180 days	21 days	✔	30-Sep-2024	180 days	23 days	✔	
Metals : Metals in Soil/Solid by CRC ICPMS											
LDPE bag 2024-PI-MI-P0	E440	07-Sep-2024	28-Sep-2024	180 days	21 days	✔	30-Sep-2024	180 days	23 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: **Soil/Solid**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	1669436	1	11	9.0	5.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1669437	1	11	9.0	5.0	✔
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	1669436	2	11	18.1	10.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1669437	2	11	18.1	10.0	✔
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	1669436	1	11	9.0	5.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1669437	1	11	9.0	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>
Metals in Soil/Solid by CRC ICPMS	E440 ALS Environmental - Waterloo	Soil/Solid	EPA 6020B (mod)	<p>This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl.</p> <p>Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines.</p> <p>Analysis is by Collision/Reaction Cell ICPMS.</p>
Mercury in Soil/Solid by CVAAS	E510 ALS Environmental - Waterloo	Soil/Solid	EPA 200.2/1631 Appendix (mod)	<p>Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl, followed by CVAAS analysis.</p>
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Digestion for Metals and Mercury	EP440 ALS Environmental - Waterloo	Soil/Solid	EPA 200.2 (mod)	<p>Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl. This method is intended to liberate metals that may be environmentally available.</p>

QUALITY CONTROL REPORT

Work Order	: WT2427755	Page	: 1 of 10
Amendment	: 2		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec QC Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Date Analysis Commenced	: 28-Sep-2024
C-O-C number	: ----	Issue Date	: 25-Oct-2024 11:17
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 11		
No. of samples analysed	: 11		

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>
Greg Pokocky	Manager - Inorganics	Waterloo Metals, Waterloo, Ontario



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: Soil/Solid

					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: 1669436)											
WT2427755-001	2024-PI-MI-P0	Mercury	7439-97-6	E510	0.0050	mg/kg	0.0080	0.0088	0.0008	Diff <2x LOR	----
Metals (QC Lot: 1669437)											
WT2427755-001	2024-PI-MI-P0	Aluminum	7429-90-5	E440	50	mg/kg	5730	5520	3.63%	40%	----
		Antimony	7440-36-0	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440	0.10	mg/kg	2.51	2.42	3.69%	30%	----
		Barium	7440-39-3	E440	0.50	mg/kg	16.6	16.9	1.80%	40%	----
		Beryllium	7440-41-7	E440	0.10	mg/kg	0.35	0.35	0.0006	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	5.0	mg/kg	43.2	43.6	1.01%	30%	----
		Cadmium	7440-43-9	E440	0.020	mg/kg	0.027	0.026	0.001	Diff <2x LOR	----
		Calcium	7440-70-2	E440	50	mg/kg	100000	102000	2.13%	30%	----
		Chromium	7440-47-3	E440	0.50	mg/kg	20.4	20.3	0.238%	30%	----
		Cobalt	7440-48-4	E440	0.10	mg/kg	4.02	3.85	4.21%	30%	----
		Copper	7440-50-8	E440	0.50	mg/kg	8.08	7.64	5.65%	30%	----
		Iron	7439-89-6	E440	50	mg/kg	13500	13200	2.38%	30%	----
		Lead	7439-92-1	E440	0.50	mg/kg	4.46	4.42	0.715%	40%	----
		Lithium	7439-93-2	E440	2.0	mg/kg	33.2	33.1	0.277%	30%	----
		Magnesium	7439-95-4	E440	20	mg/kg	56500	56100	0.726%	30%	----
		Manganese	7439-96-5	E440	1.0	mg/kg	169	165	2.49%	30%	----
		Molybdenum	7439-98-7	E440	0.10	mg/kg	0.54	0.66	20.4%	40%	----
		Nickel	7440-02-0	E440	0.50	mg/kg	11.2	11.6	3.54%	30%	----
		Phosphorus	7723-14-0	E440	50	mg/kg	402	418	3.98%	30%	----
		Potassium	7440-09-7	E440	100	mg/kg	2740	2610	4.76%	40%	----
		Selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Sodium	7440-23-5	E440	50	mg/kg	4000	3780	5.58%	40%	----
		Strontium	7440-24-6	E440	0.50	mg/kg	55.5	55.9	0.783%	40%	----
		Sulfur	7704-34-9	E440	1000	mg/kg	1400	1500	80	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.050	mg/kg	0.116	0.116	0.00005	Diff <2x LOR	----
		Tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----



Sub-Matrix: Soil/Solid					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: 1669437) - continued											
WT2427755-001	2024-PI-MI-P0	Titanium	7440-32-6	E440	1.0	mg/kg	341	330	3.32%	40%	---
		Tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	---
		Uranium	7440-61-1	E440	0.050	mg/kg	0.865	0.890	2.87%	30%	---
		Vanadium	7440-62-2	E440	0.20	mg/kg	18.2	17.9	2.04%	30%	---
		Zinc	7440-66-6	E440	2.0	mg/kg	15.1	15.1	0.178%	30%	---
		Zirconium	7440-67-7	E440	1.0	mg/kg	7.8	7.4	4.96%	30%	---



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: Soil/Solid

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1669436)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	---
Metals (QCLot: 1669437)						
Aluminum	7429-90-5	E440	50	mg/kg	<50	---
Antimony	7440-36-0	E440	0.1	mg/kg	<0.10	---
Arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	---
Barium	7440-39-3	E440	0.5	mg/kg	<0.50	---
Beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	---
Bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	---
Boron	7440-42-8	E440	5	mg/kg	<5.0	---
Cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	---
Calcium	7440-70-2	E440	50	mg/kg	<50	---
Chromium	7440-47-3	E440	0.5	mg/kg	<0.50	---
Cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	---
Copper	7440-50-8	E440	0.5	mg/kg	<0.50	---
Iron	7439-89-6	E440	50	mg/kg	<50	---
Lead	7439-92-1	E440	0.5	mg/kg	<0.50	---
Lithium	7439-93-2	E440	2	mg/kg	<2.0	---
Magnesium	7439-95-4	E440	20	mg/kg	<20	---
Manganese	7439-96-5	E440	1	mg/kg	<1.0	---
Molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	---
Nickel	7440-02-0	E440	0.5	mg/kg	<0.50	---
Phosphorus	7723-14-0	E440	50	mg/kg	<50	---
Potassium	7440-09-7	E440	100	mg/kg	<100	---
Selenium	7782-49-2	E440	0.2	mg/kg	<0.20	---
Silver	7440-22-4	E440	0.1	mg/kg	<0.10	---
Sodium	7440-23-5	E440	50	mg/kg	<50	---
Strontium	7440-24-6	E440	0.5	mg/kg	<0.50	---
Sulfur	7704-34-9	E440	1000	mg/kg	<1000	---
Thallium	7440-28-0	E440	0.05	mg/kg	<0.050	---
Tin	7440-31-5	E440	2	mg/kg	<2.0	---
Titanium	7440-32-6	E440	1	mg/kg	<1.0	---
Uranium	7440-61-1	E440	0.05	mg/kg	<0.050	---



Sub-Matrix: **Soil/Solid**

<i>Analyte</i>	<i>CAS Number</i>	<i>Method</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>Qualifier</i>
Metals (QCLot: 1669437) - continued						
Vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	---
Zinc	7440-66-6	E440	2	mg/kg	<2.0	---
Zirconium	7440-67-7	E440	1	mg/kg	<1.0	---



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: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1669436)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	98.5	80.0	120	----
Metals (QCLot: 1669437)									
Aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	94.3	80.0	120	----
Antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	116	80.0	120	----
Arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	103	80.0	120	----
Barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	97.6	80.0	120	----
Beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	110	80.0	120	----
Bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	109	80.0	120	----
Boron	7440-42-8	E440	5	mg/kg	100 mg/kg	110	80.0	120	----
Cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	97.5	80.0	120	----
Calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	110	80.0	120	----
Chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	98.8	80.0	120	----
Cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	97.0	80.0	120	----
Copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	96.8	80.0	120	----
Iron	7439-89-6	E440	50	mg/kg	100 mg/kg	95.5	80.0	120	----
Lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	111	80.0	120	----
Lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	108	80.0	120	----
Magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	103	80.0	120	----
Manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	97.5	80.0	120	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	114	80.0	120	----
Nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	96.4	80.0	120	----
Phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	103	80.0	120	----
Potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	99.2	80.0	120	----
Selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	99.7	80.0	120	----
Silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	116	80.0	120	----
Sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	95.2	80.0	120	----
Strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	115	80.0	120	----
Sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	98.5	80.0	120	----
Thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	110	80.0	120	----
Tin	7440-31-5	E440	2	mg/kg	50 mg/kg	99.2	80.0	120	----
Titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	97.5	80.0	120	----
Uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	107	80.0	120	----
Vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	99.1	80.0	120	----



Sub-Matrix: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1669437) - continued									
Zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	94.0	80.0	120	----
Zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	108	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:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Metals (QCLot: 1669436)									
QC-1669436-003	RM	Mercury	7439-97-6	E510	0.068 mg/kg	96.2	70.0	130	----
Metals (QCLot: 1669437)									
QC-1669437-003	RM	Aluminum	7429-90-5	E440	22500 mg/kg	101	70.0	130	----
QC-1669437-003	RM	Antimony	7440-36-0	E440	24.8 mg/kg	88.2	70.0	130	----
QC-1669437-003	RM	Arsenic	7440-38-2	E440	21.2 mg/kg	97.9	70.0	130	----
QC-1669437-003	RM	Barium	7440-39-3	E440	788 mg/kg	99.2	70.0	130	----
QC-1669437-003	RM	Beryllium	7440-41-7	E440	1.82 mg/kg	100	70.0	130	----
QC-1669437-003	RM	Bismuth	7440-69-9	E440	1.78 mg/kg	83.2	70.0	130	----
QC-1669437-003	RM	Cadmium	7440-43-9	E440	2.15 mg/kg	99.1	70.0	130	----
QC-1669437-003	RM	Calcium	7440-70-2	E440	4900 mg/kg	98.2	70.0	130	----
QC-1669437-003	RM	Chromium	7440-47-3	E440	56.9 mg/kg	99.1	70.0	130	----
QC-1669437-003	RM	Cobalt	7440-48-4	E440	32 mg/kg	97.7	70.0	130	----
QC-1669437-003	RM	Copper	7440-50-8	E440	969 mg/kg	105	70.0	130	----
QC-1669437-003	RM	Iron	7439-89-6	E440	32700 mg/kg	102	70.0	130	----
QC-1669437-003	RM	Lead	7439-92-1	E440	919 mg/kg	92.9	70.0	130	----
QC-1669437-003	RM	Lithium	7439-93-2	E440	47.3 mg/kg	101	70.0	130	----
QC-1669437-003	RM	Magnesium	7439-95-4	E440	7780 mg/kg	103	70.0	130	----
QC-1669437-003	RM	Manganese	7439-96-5	E440	8640 mg/kg	101	70.0	130	----
QC-1669437-003	RM	Molybdenum	7439-98-7	E440	25.1 mg/kg	96.7	70.0	130	----
QC-1669437-003	RM	Nickel	7440-02-0	E440	1000 mg/kg	103	70.0	130	----
QC-1669437-003	RM	Phosphorus	7723-14-0	E440	660 mg/kg	95.9	70.0	130	----
QC-1669437-003	RM	Potassium	7440-09-7	E440	10800 mg/kg	100	70.0	130	----
QC-1669437-003	RM	Selenium	7782-49-2	E440	1.04 mg/kg	105	60.0	140	----
QC-1669437-003	RM	Silver	7440-22-4	E440	8.98 mg/kg	92.1	70.0	130	----
QC-1669437-003	RM	Sodium	7440-23-5	E440	1770 mg/kg	106	70.0	130	----
QC-1669437-003	RM	Strontium	7440-24-6	E440	41 mg/kg	94.7	70.0	130	----
QC-1669437-003	RM	Sulfur	7704-34-9	E440	3940 mg/kg	103	50.0	150	----
QC-1669437-003	RM	Thallium	7440-28-0	E440	0.907 mg/kg	92.4	70.0	130	----
QC-1669437-003	RM	Tin	7440-31-5	E440	3.79 mg/kg	99.7	40.0	160	----
QC-1669437-003	RM	Titanium	7440-32-6	E440	2790 mg/kg	103	70.0	130	----
QC-1669437-003	RM	Tungsten	7440-33-7	E440	6.99 mg/kg	104	70.0	130	----
QC-1669437-003	RM	Uranium	7440-61-1	E440	3.97 mg/kg	90.3	70.0	130	----
QC-1669437-003	RM	Vanadium	7440-62-2	E440	66.2 mg/kg	98.3	70.0	130	----



Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Metals (QCLot: 1669437) - continued									
QC-1669437-003	RM	Zinc	7440-66-6	E440	828 mg/kg	95.7	70.0	130	----
QC-1669437-003	RM	Zirconium	7440-67-7	E440	6.91 mg/kg	110	70.0	130	----



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COC Number: 20 -

Page

Chain of Custody (COC) / Analytical Request Form

Contact and company name below will appear on the final report

Report To
 Company: ArcticConneXion
 Contact: Gwenaelle Minot-Kohl
 Phone: 581-989-5477
 Company address below will appear on the final report

Street: 422 3e Ave
 City/Province: Quebec, QC
 Postal Code: G1L 1Y8
 Invoice To: Same as Report To YES NO
 Copy of Invoice with Report: YES NO

Company:
 Contact:
 Project Information
 ALS Account # / Quote #: 2023 Price List
 Job #:
 PO / AFE:
 LSD:
 ALS Lab Work Order # (ALS use only): 1070427755 FH

Sample Identification and/or Coordinates
 (This description will appear on the report)

Reports / Recipients

Select Report Format: PDF EXCEL EDD (DIGITAL)
 Merge QC/QCI Reports with COA YES NO N/A
 Compare Results to Criteria on Report - provide details below if box checked
 Select Distribution: EMAIL MAIL FAX
 Email 1 or Fax: pierre@arcticconneXion.ca
 Email 2: ver@arcticconneXion.ca
 Email 3: vincent@arcticconneXion.ca
 Invoice Recipients
 Select Invoice Distribution: EMAIL MAIL FAX
 Email 1 or Fax: info@arcticconneXion.ca
 Email 2:
 Oil and Gas Required Fields (client use)
 AFE/Cost Center:
 Major/Minor Code:
 Requisitioner:
 Location:
 ALS Contact: Emily Smith
 Sampler:
 Date (dd-mm-yy)
 Time (hh:mm)
 Sample Type

ALS Sample # (ALS use only)	Date	Time	Sample Type
2024-PL-MI-P0	7-Sep-24	13:00	Sediment
2024-PL-MI-P0.5	10-Sep-24	13:00	Sediment
2024-PL-MI-P1	10-Sep-24	13:00	Sediment
2024-PL-MI-P1.5	10-Sep-24	13:00	Sediment
2024-PL-MI-P2	10-Sep-24	13:00	Sediment
2024-PL-MI-M0C	11-Sep-24	13:00	Sediment
2024-PL-MI-M1C	7-Sep-24	13:00	Sediment
2024-PL-MI-M3C	11-Sep-24	13:00	Sediment
2024-PL-MI-T0C	12-Sep-24	13:00	Sediment
2024-PL-MI-T1C	13-Sep-24	13:00	Sediment
2024-PL-MI-T3C	13-Sep-24	13:00	Sediment

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Drinking Water (DW) Samples¹ (client use)
 Are samples taken from a Regulated DW System?
 YES NO
 Are samples for human consumption/use?
 YES NO

SAMPLE RECEIPT DETAILS (ALS use only)
 Cooling Method: NONE ICE ICE PACKS FROZEN COOLING INITIATED
 Submission Comments identified on Sample Receipt Notification: YES NO
 Cooler Custody Seals Intact: YES N/A Sample Custody Seals Intact: YES N/A
 INITIAL COOLER TEMPERATURES °C:
 FINAL COOLER TEMPERATURES °C:
 Time: 4:5
 Received by:
 Date: 12/2
 Time: 9:08

Turnaround Time (TAT) Requested

Routine (R) if received by 3pm M-F - no surcharges apply
 4 day (P4) if received by 3pm M-F - 20% rush surcharge min/m
 3 day (P3) if received by 3pm M-F - 25% rush surcharge min/m
 2 day (P2) if received by 3pm M-F - 50% rush surcharge min/m
 1 day (E) if received by 3pm M-F - 100% rush surcharge min/m
 Same day (EZ) if received by 10am M-S - 200% rush surcharge
 fees may apply to rush requests on weekends, statutory holidays
 routine tests
 Date and Time Required for all E&P TATs:
 For all tests with rush TATs requested, please
 Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below
 Analysis R
 Telephone: + 1 519 886 8910

NUMBER OF CONTAINERS	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRE	SUSPECTED HAZARD (see notes)
Total Metals (ICPMS)			
Total Mercury (CVAAS)			
TSS			
TDS			
Dissolved Metals (ICPMS)			
Dissolved Mercury			
Hardness			
pH			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
 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.
 If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.
 WHITE - LABORATORY COPY
 YELLOW - CLIENT COPY
 INITIAL SHIPMENT RECEPTION (ALS use only)
 Received by: hana R.
 Date: 18/09/24
 Time: 10:30
 FINAL SHIPMENT RECEPTION (ALS use only)
 Received by:
 Date: 19 Sep 24
 Time: 9:08
 801 - 8888 3344



Environmental Division
 Waterloo
 Work Order Reference
WT2427755

TRACE METALS IN DUST- FALL AND SOURCE



CERTIFICATE OF ANALYSIS

Work Order	: WT2500521		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave	Address	: 60 Northland Road, Unit 1
	: Quebec Quebec Canada G1L 2W1		: Waterloo ON Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 10-Jan-2025 09:00
PO	: ----	Date Analysis Commenced	: 14-Jan-2025
C-O-C number	: ----	Issue Date	: 22-Jan-2025 09:58
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 5		
No. of samples analysed	: 5		

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>
Greg Pokocky	Manager - Inorganics	Metals, Waterloo, Ontario
Nik Perkió	Senior Analyst	Metals, Waterloo, Ontario



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/kg	milligrams per kilogram
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	2024-PI-MI-P0	2024-PI-MI-M1D	----	----	----
Client sampling date / time					08-Jan-2025 13:00	08-Jan-2025 13:00	----	----	----	
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2500521-001	WT2500521-003	----	----	----	
					Result	Result	----	----	----	
Total Metals										
Aluminum, total	7429-90-5	E440B/WT	2.0	mg/L	97.5	6.1	----	----	----	
Antimony, total	7440-36-0	E440B/WT	0.020	mg/L	<0.020	<0.020	----	----	----	
Arsenic, total	7440-38-2	E440B/WT	0.020	mg/L	0.024	<0.020	----	----	----	
Barium, total	7440-39-3	E440B/WT	0.040	mg/L	0.491	0.063	----	----	----	
Beryllium, total	7440-41-7	E440B/WT	0.020	mg/L	<0.020	<0.020	----	----	----	
Bismuth, total	7440-69-9	E440B/WT	0.010	mg/L	<0.010	<0.010	----	----	----	
Boron, total	7440-42-8	E440B/WT	2.0	mg/L	<2.0	<2.0	----	----	----	
Cadmium, total	7440-43-9	E440B/WT	0.0020	mg/L	0.0037	<0.0020	----	----	----	
Calcium, total	7440-70-2	E440B/WT	100	mg/L	<100	<100	----	----	----	
Chromium, total	7440-47-3	E440B/WT	0.10	mg/L	0.41	<0.10	----	----	----	
Cobalt, total	7440-48-4	E440B/WT	0.10	mg/L	<0.10	<0.10	----	----	----	
Copper, total	7440-50-8	E440B/WT	0.20	mg/L	<0.20	<0.20	----	----	----	
Iron, total	7439-89-6	E440B/WT	10	mg/L	232	<10	----	----	----	
Lead, total	7439-92-1	E440B/WT	0.020	mg/L	0.072	<0.020	----	----	----	
Lithium, total	7439-93-2	E440B/WT	0.20	mg/L	<0.20	<0.20	----	----	----	
Magnesium, total	7439-95-4	E440B/WT	10	mg/L	133	47	----	----	----	
Manganese, total	7439-96-5	E440B/WT	0.10	mg/L	2.99	0.14	----	----	----	
Mercury, total	7439-97-6	E508B/WT	0.00050	mg/L	<0.00050	<0.00050	----	----	----	
Molybdenum, total	7439-98-7	E440B/WT	0.010	mg/L	<0.010	<0.010	----	----	----	
Nickel, total	7440-02-0	E440B/WT	0.10	mg/L	0.26	<0.10	----	----	----	
Phosphorus, total	7723-14-0	E440B/WT	10	mg/L	<10	<10	----	----	----	



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID	2024-PI-MI-P0	2024-PI-MI-M1D	----	----	----
					Client sampling date / time	08-Jan-2025 13:00	08-Jan-2025 13:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2500521-001	WT2500521-003	----	----	----	
					Result	Result	----	----	----	
Total Metals										
Potassium, total	7440-09-7	E440B/WT	10	mg/L	59	16	----	----	----	
Selenium, total	7782-49-2	E440B/WT	0.010	mg/L	<0.010	<0.010	----	----	----	
Silver, total	7440-22-4	E440B/WT	0.010	mg/L	<0.010	<0.010	----	----	----	
Sodium, total	7440-23-5	E440B/WT	10	mg/L	119	343	----	----	----	
Strontium, total	7440-24-6	E440B/WT	0.0200	mg/L	1.32	0.528	----	----	----	
Sulfur, total	7704-34-9	E440B/WT	100	mg/L	<100	<100	----	----	----	
Thallium, total	7440-28-0	E440B/WT	0.0020	mg/L	0.0045	<0.0020	----	----	----	
Tin, total	7440-31-5	E440B/WT	0.020	mg/L	<0.020	<0.020	----	----	----	
Titanium, total	7440-32-6	E440B/WT	0.060	mg/L	14.4	0.222	----	----	----	
Tungsten, total	7440-33-7	E440B/WT	0.18	mg/L	<0.18	<0.18	----	----	----	
Uranium, total	7440-61-1	E440B/WT	0.0020	mg/L	0.0139	0.0032	----	----	----	
Vanadium, total	7440-62-2	E440B/WT	0.10	mg/L	0.33	<0.10	----	----	----	
Zinc, total	7440-66-6	E440B/WT	0.60	mg/L	1.07	0.63	----	----	----	
Zirconium, total	7440-67-7	E440B/WT	0.060	mg/L	0.173	<0.060	----	----	----	

Please refer to the General Comments section for an explanation of any result qualifiers detected.



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					Client sample ID	2024-PI-MI-SOURCE	----	----	----	----
					Client sampling date / time	08-Jan-2025 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2500521-005	----	----	----	----	
						Result	----	----	----	----
Metals										
Aluminum	7429-90-5	E440/WT	50	mg/kg	6500	----	----	----	----	
Antimony	7440-36-0	E440/WT	0.10	mg/kg	0.14	----	----	----	----	
Arsenic	7440-38-2	E440/WT	0.10	mg/kg	5.09	----	----	----	----	
Barium	7440-39-3	E440/WT	0.50	mg/kg	5.60	----	----	----	----	
Beryllium	7440-41-7	E440/WT	0.10	mg/kg	0.36	----	----	----	----	
Bismuth	7440-69-9	E440/WT	0.20	mg/kg	<0.20	----	----	----	----	
Boron	7440-42-8	E440/WT	5.0	mg/kg	5.8	----	----	----	----	
Cadmium	7440-43-9	E440/WT	0.020	mg/kg	<0.020	----	----	----	----	
Calcium	7440-70-2	E440/WT	50	mg/kg	677	----	----	----	----	
Chromium	7440-47-3	E440/WT	0.50	mg/kg	25.0	----	----	----	----	
Cobalt	7440-48-4	E440/WT	0.10	mg/kg	12.5	----	----	----	----	
Copper	7440-50-8	E440/WT	0.50	mg/kg	7.06	----	----	----	----	
Iron	7439-89-6	E440/WT	50	mg/kg	204000	----	----	----	----	
Lead	7439-92-1	E440/WT	0.50	mg/kg	1.52	----	----	----	----	
Lithium	7439-93-2	E440/WT	2.0	mg/kg	9.6	----	----	----	----	
Magnesium	7439-95-4	E440/WT	20	mg/kg	6260	----	----	----	----	
Manganese	7439-96-5	E440/WT	1.0	mg/kg	531	----	----	----	----	
Mercury	7439-97-6	E510/WT	0.0050	mg/kg	<0.0050	----	----	----	----	
Molybdenum	7439-98-7	E440/WT	0.10	mg/kg	2.62	----	----	----	----	
Nickel	7440-02-0	E440/WT	0.50	mg/kg	30.9	----	----	----	----	
Phosphorus	7723-14-0	E440/WT	50	mg/kg	385	----	----	----	----	



Analytical Results

Sub-Matrix: Sediment
 (Matrix: Soil/Solid)

					Client sample ID	2024-PI-MI-SOURCE	----	----	----	----
					Client sampling date / time	08-Jan-2025 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2500521-005	----	----	----	----	----
						Result	----	----	----	----
Metals										
Potassium	7440-09-7	E440/WT	100	mg/kg	<100	----	----	----	----	----
Selenium	7782-49-2	E440/WT	0.20	mg/kg	<0.20	----	----	----	----	----
Silver	7440-22-4	E440/WT	0.10	mg/kg	<0.10	----	----	----	----	----
Sodium	7440-23-5	E440/WT	50	mg/kg	<50	----	----	----	----	----
Strontium	7440-24-6	E440/WT	0.50	mg/kg	3.07	----	----	----	----	----
Sulfur	7704-34-9	E440/WT	1000	mg/kg	<1000	----	----	----	----	----
Thallium	7440-28-0	E440/WT	0.050	mg/kg	<0.050	----	----	----	----	----
Tin	7440-31-5	E440/WT	2.0	mg/kg	<2.0	----	----	----	----	----
Titanium	7440-32-6	E440/WT	1.0	mg/kg	88.4	----	----	----	----	----
Tungsten	7440-33-7	E440/WT	0.50	mg/kg	<0.50	----	----	----	----	----
Uranium	7440-61-1	E440/WT	0.050	mg/kg	0.740	----	----	----	----	----
Vanadium	7440-62-2	E440/WT	0.20	mg/kg	9.30	----	----	----	----	----
Zinc	7440-66-6	E440/WT	2.0	mg/kg	10.4	----	----	----	----	----
Zirconium	7440-67-7	E440/WT	1.0	mg/kg	2.2	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.



QUALITY CONTROL INTERPRETIVE REPORT

<p>Work Order : WT2500521</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : ----</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 5</p> <p>No. of samples analysed : 3</p>	<p>Page : 1 of 6</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 10-Jan-2025 09:00</p> <p>Issue Date : 22-Jan-2025 09:56</p>
---	---

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.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) 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: **Soil/Solid**

Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method 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 Soil/Solid by CVAAS										
Compliant container 2024-PI-MI-SOURCE	E510	08-Jan-2025	14-Jan-2025	28 days	6 days	✓	14-Jan-2025	28 days	6 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Compliant container 2024-PI-MI-SOURCE	E440	08-Jan-2025	14-Jan-2025	180 days	6 days	✓	14-Jan-2025	180 days	6 days	✓

Matrix: **Water**

Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method 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	
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE - unpreserved 2024-PI-MI-M1D	E440B	08-Jan-2025	17-Jan-2025	5 hrs	220 hrs	* EHTR-FM	20-Jan-2025	5 hrs	285 hrs	* EHTR-FM
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE - unpreserved 2024-PI-MI-P0	E440B	08-Jan-2025	17-Jan-2025	5 hrs	220 hrs	* EHTR-FM	20-Jan-2025	5 hrs	285 hrs	* EHTR-FM
Total Metals : Total Mercury in Liquid Sludge by CVAAS										
Non ALS HDPE - unpreserved 2024-PI-MI-M1D	E508B	08-Jan-2025	17-Jan-2025	0 hrs	220 hrs	* UCP	20-Jan-2025	0 hrs	286 hrs	* UCP
Total Metals : Total Mercury in Liquid Sludge by CVAAS										
Non ALS HDPE - unpreserved 2024-PI-MI-P0	E508B	08-Jan-2025	17-Jan-2025	0 hrs	220 hrs	* UCP	20-Jan-2025	0 hrs	286 hrs	* UCP



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).

UCP: Unsuitable Container and/or Preservative used (invalidates standard hold time). Maximum hold time of zero applied. Test results may be biased low / unreliable, and may not meet regulatory requirements.



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: **Soil/Solid**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	1838308	1	2	50.0	5.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1838307	1	2	50.0	5.0	✔
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	1838308	2	2	100.0	10.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1838307	2	2	100.0	10.0	✔
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	1838308	1	2	50.0	5.0	✔
Metals in Soil/Solid by CRC ICPMS	E440	1838307	1	2	50.0	5.0	✔

Matrix: **Water**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1843528	1	3	33.3	5.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1843529	1	2	50.0	5.0	✔
Laboratory Control Samples (LCS)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1843528	2	3	66.6	10.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1843529	2	2	100.0	10.0	✔
Method Blanks (MB)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1843528	1	3	33.3	5.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1843529	1	2	50.0	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
Metals in Soil/Solid by CRC ICPMS	E440 ALS Environmental - Waterloo	Soil/Solid	EPA 6020B (mod)	<p>This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl.</p> <p>Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines.</p> <p>Analysis is by Collision/Reaction Cell ICPMS.</p>
Mercury in Soil/Solid by CVAAS	E510 ALS Environmental - Waterloo	Soil/Solid	EPA 200.2/1631 Appendix (mod)	<p>Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl, followed by CVAAS analysis.</p>
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B ALS Environmental - Waterloo	Water	6020B (mod)	<p>Sludge samples are digested with nitric and hydrochloric acids, followed by analysis by Collision/Reaction Cell ICPMS.</p> <p>Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.</p>
Total Mercury in Liquid Sludge by CVAAS	E508B ALS Environmental - Waterloo	Water	EPA 200.2 (mod)/1631E (mod)	<p>Sludge samples are preserved with HCl and/or BrCl, digested with HNO₃ and HCl at 95C, followed by CVAAS analysis.</p>

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 ALS Environmental - Waterloo	Soil/Solid	EPA 200.2 (mod)	<p>Samples are dried, then sieved through a 2 mm sieve, and digested with HNO₃ and HCl. This method is intended to liberate metals that may be environmentally available.</p>
Digestion for Metals and Mercury in Liquid Sludge	EP440B ALS Environmental - Waterloo	Water	EPA 200.2	<p>Liquid Sludge samples are digested with nitric and hydrochloric acids.</p>



QUALITY CONTROL REPORT

Work Order	: WT2500521	Page	: 1 of 14
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec QC Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 10-Jan-2025 09:00
PO	: ----	Date Analysis Commenced	: 14-Jan-2025
C-O-C number	: ----	Issue Date	: 22-Jan-2025 09:58
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 5		
No. of samples analysed	: 3		

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>
Greg Pokocky	Manager - Inorganics	Waterloo Metals, Waterloo, Ontario
Nik Perkio	Senior Analyst	Waterloo Metals, Waterloo, Ontario

Page : 2 of 14
Work Order : WT2500521
Client : ArctiConnexion
Project : ----



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: Soil/Solid

					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: 1838307)											
HA2500082-001	Anonymous	Aluminum	7429-90-5	E440	50	mg/kg	871	836	4.17%	40%	---
		Antimony	7440-36-0	E440	0.10	mg/kg	0.72	0.70	3.74%	30%	---
		Arsenic	7440-38-2	E440	0.10	mg/kg	22.2	21.5	3.44%	30%	---
		Barium	7440-39-3	E440	0.50	mg/kg	33.6	32.4	3.69%	40%	---
		Beryllium	7440-41-7	E440	0.10	mg/kg	0.49	0.49	0.001	Diff <2x LOR	---
		Bismuth	7440-69-9	E440	0.20	mg/kg	1.26	1.24	0.02	Diff <2x LOR	---
		Boron	7440-42-8	E440	5.0	mg/kg	13.4	13.4	0.01	Diff <2x LOR	---
		Cadmium	7440-43-9	E440	0.020	mg/kg	0.056	0.059	0.003	Diff <2x LOR	---
		Calcium	7440-70-2	E440	50	mg/kg	60700	59300	2.30%	30%	---
		Chromium	7440-47-3	E440	0.50	mg/kg	9.45	8.98	5.04%	30%	---
		Cobalt	7440-48-4	E440	0.10	mg/kg	21.6	20.7	4.09%	30%	---
		Copper	7440-50-8	E440	0.50	mg/kg	15.7	14.9	5.34%	30%	---
		Iron	7439-89-6	E440	50	mg/kg	15300	14900	3.17%	30%	---
		Lead	7439-92-1	E440	0.50	mg/kg	11.8	11.4	3.00%	40%	---
		Lithium	7439-93-2	E440	2.0	mg/kg	4.1	4.1	0.0002	Diff <2x LOR	---
		Magnesium	7439-95-4	E440	20	mg/kg	351000	340000	3.04%	30%	---
		Manganese	7439-96-5	E440	1.0	mg/kg	1120	1090	2.90%	30%	---
		Molybdenum	7439-98-7	E440	0.10	mg/kg	5.25	5.11	2.72%	40%	---
		Nickel	7440-02-0	E440	0.50	mg/kg	107	103	3.43%	30%	---
		Phosphorus	7723-14-0	E440	50	mg/kg	222	218	4	Diff <2x LOR	---
		Potassium	7440-09-7	E440	100	mg/kg	2500	2370	5.50%	40%	---
		Selenium	7782-49-2	E440	0.20	mg/kg	0.58	0.53	0.05	Diff <2x LOR	---
		Silver	7440-22-4	E440	0.10	mg/kg	0.26	0.28	0.01	Diff <2x LOR	---
		Sodium	7440-23-5	E440	50	mg/kg	485	462	4.95%	40%	---
		Strontium	7440-24-6	E440	0.50	mg/kg	55.4	54.8	1.26%	40%	---
		Sulfur	7704-34-9	E440	1000	mg/kg	15500	15300	1.71%	30%	---
		Thallium	7440-28-0	E440	0.050	mg/kg	0.152	0.150	0.002	Diff <2x LOR	---
		Tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	---
		Titanium	7440-32-6	E440	1.0	mg/kg	20.5	19.0	7.98%	40%	---
		Tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	---



Sub-Matrix: Soil/Solid					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: 1838307) - continued											
HA2500082-001	Anonymous	Uranium	7440-61-1	E440	0.050	mg/kg	0.817	0.734	10.6%	30%	---
		Vanadium	7440-62-2	E440	0.20	mg/kg	419	396	5.54%	30%	---
		Zinc	7440-66-6	E440	2.0	mg/kg	13.1	12.2	0.9	Diff <2x LOR	---
		Zirconium	7440-67-7	E440	1.0	mg/kg	1.2	1.2	0.02	Diff <2x LOR	---
Metals (QC Lot: 1838308)											
HA2500082-001	Anonymous	Mercury	7439-97-6	E510	0.0050	mg/kg	0.171	0.158	7.89%	40%	---
Sub-Matrix: Water					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
Total Metals (QC Lot: 1843528)											
WT2500521-001	2024-PI-MI-P0	Aluminum, total	7429-90-5	E440B	2.0	mg/L	97.5	100	2.97%	40%	---
		Antimony, total	7440-36-0	E440B	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	---
		Arsenic, total	7440-38-2	E440B	0.020	mg/L	0.024	0.022	0.002	Diff <2x LOR	---
		Barium, total	7440-39-3	E440B	0.040	mg/L	0.491	0.505	2.68%	40%	---
		Beryllium, total	7440-41-7	E440B	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	---
		Bismuth, total	7440-69-9	E440B	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	---
		Boron, total	7440-42-8	E440B	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	---
		Cadmium, total	7440-43-9	E440B	0.0020	mg/L	0.0037	0.0043	0.0006	Diff <2x LOR	---
		Calcium, total	7440-70-2	E440B	100	mg/L	<100	<100	0	Diff <2x LOR	---
		Chromium, total	7440-47-3	E440B	0.10	mg/L	0.41	0.44	0.03	Diff <2x LOR	---
		Cobalt, total	7440-48-4	E440B	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	---
		Copper, total	7440-50-8	E440B	0.20	mg/L	<0.20	0.20	0.002	Diff <2x LOR	---
		Iron, total	7439-89-6	E440B	10	mg/L	232	234	0.902%	40%	---
		Lead, total	7439-92-1	E440B	0.020	mg/L	0.072	0.071	0.001	Diff <2x LOR	---
		Lithium, total	7439-93-2	E440B	0.20	mg/L	<0.20	<0.20	0	Diff <2x LOR	---
		Magnesium, total	7439-95-4	E440B	10	mg/L	133	138	3.31%	40%	---
		Manganese, total	7439-96-5	E440B	0.10	mg/L	2.99	3.04	1.74%	40%	---
		Molybdenum, total	7439-98-7	E440B	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	---
		Nickel, total	7440-02-0	E440B	0.10	mg/L	0.26	0.26	0.003	Diff <2x LOR	---
		Phosphorus, total	7723-14-0	E440B	10	mg/L	<10	<10	0	Diff <2x LOR	---
Potassium, total	7440-09-7	E440B	10	mg/L	59	61	3.20%	40%	---		
Selenium, total	7782-49-2	E440B	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	---		
Silver, total	7440-22-4	E440B	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	---		
Sodium, total	7440-23-5	E440B	10	mg/L	119	122	2.64%	40%	---		



Sub-Matrix: Water					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
Total Metals (QC Lot: 1843528) - continued											
WT2500521-001	2024-PI-MI-P0	Strontium, total	7440-24-6	E440B	0.0400	mg/L	1.32	1.34	2.06%	40%	---
		Sulfur, total	7704-34-9	E440B	100	mg/L	<100	<100	0	Diff <2x LOR	---
		Thallium, total	7440-28-0	E440B	0.0020	mg/L	0.0045	0.0046	0.0002	Diff <2x LOR	---
		Tin, total	7440-31-5	E440B	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	---
		Titanium, total	7440-32-6	E440B	0.060	mg/L	14.4	15.0	3.95%	40%	---
		Tungsten, total	7440-33-7	E440B	0.18	mg/L	<0.18	<0.18	0	Diff <2x LOR	---
		Uranium, total	7440-61-1	E440B	0.0020	mg/L	0.0139	0.0138	0.867%	40%	---
		Vanadium, total	7440-62-2	E440B	0.10	mg/L	0.33	0.34	0.01	Diff <2x LOR	---
		Zinc, total	7440-66-6	E440B	0.60	mg/L	1.07	1.11	0.03	Diff <2x LOR	---
		Zirconium, total	7440-67-7	E440B	0.060	mg/L	0.173	0.159	0.014	Diff <2x LOR	---
Total Metals (QC Lot: 1843529)											
WT2500521-001	2024-PI-MI-P0	Mercury, total	7439-97-6	E508B	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	---



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: Soil/Solid

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1838307)						
Aluminum	7429-90-5	E440	50	mg/kg	<50	---
Antimony	7440-36-0	E440	0.1	mg/kg	<0.10	---
Arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	---
Barium	7440-39-3	E440	0.5	mg/kg	<0.50	---
Beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	---
Bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	---
Boron	7440-42-8	E440	5	mg/kg	<5.0	---
Cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	---
Calcium	7440-70-2	E440	50	mg/kg	<50	---
Chromium	7440-47-3	E440	0.5	mg/kg	<0.50	---
Cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	---
Copper	7440-50-8	E440	0.5	mg/kg	<0.50	---
Iron	7439-89-6	E440	50	mg/kg	<50	---
Lead	7439-92-1	E440	0.5	mg/kg	<0.50	---
Lithium	7439-93-2	E440	2	mg/kg	<2.0	---
Magnesium	7439-95-4	E440	20	mg/kg	<20	---
Manganese	7439-96-5	E440	1	mg/kg	<1.0	---
Molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	---
Nickel	7440-02-0	E440	0.5	mg/kg	<0.50	---
Phosphorus	7723-14-0	E440	50	mg/kg	<50	---
Potassium	7440-09-7	E440	100	mg/kg	<100	---
Selenium	7782-49-2	E440	0.2	mg/kg	<0.20	---
Silver	7440-22-4	E440	0.1	mg/kg	<0.10	---
Sodium	7440-23-5	E440	50	mg/kg	<50	---
Strontium	7440-24-6	E440	0.5	mg/kg	<0.50	---
Sulfur	7704-34-9	E440	1000	mg/kg	<1000	---
Thallium	7440-28-0	E440	0.05	mg/kg	<0.050	---
Tin	7440-31-5	E440	2	mg/kg	<2.0	---
Titanium	7440-32-6	E440	1	mg/kg	<1.0	---
Uranium	7440-61-1	E440	0.05	mg/kg	<0.050	---
Vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	---
Zinc	7440-66-6	E440	2	mg/kg	<2.0	---



Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1838307) - continued						
Zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 1838308)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 1843528)						
Aluminum, total	7429-90-5	E440B	2	mg/L	<3.0	----
Antimony, total	7440-36-0	E440B	0.02	mg/L	<0.100	----
Arsenic, total	7440-38-2	E440B	0.02	mg/L	<0.100	----
Barium, total	7440-39-3	E440B	0.04	mg/L	<0.100	----
Beryllium, total	7440-41-7	E440B	0.02	mg/L	<0.020	----
Bismuth, total	7440-69-9	E440B	0.01	mg/L	<0.050	----
Boron, total	7440-42-8	E440B	2	mg/L	<10.0	----
Cadmium, total	7440-43-9	E440B	0.002	mg/L	<0.0050	----
Calcium, total	7440-70-2	E440B	100	mg/L	<100	----
Chromium, total	7440-47-3	E440B	0.1	mg/L	<0.50	----
Cobalt, total	7440-48-4	E440B	0.1	mg/L	<0.10	----
Copper, total	7440-50-8	E440B	0.2	mg/L	<0.50	----
Iron, total	7439-89-6	E440B	10	mg/L	<10	----
Lead, total	7439-92-1	E440B	0.02	mg/L	<0.050	----
Lithium, total	7439-93-2	E440B	0.2	mg/L	<1.00	----
Magnesium, total	7439-95-4	E440B	10	mg/L	<10	----
Manganese, total	7439-96-5	E440B	0.1	mg/L	<0.10	----
Molybdenum, total	7439-98-7	E440B	0.01	mg/L	<0.050	----
Nickel, total	7440-02-0	E440B	0.1	mg/L	0.56	----
Phosphorus, total	7723-14-0	E440B	10	mg/L	<50	----
Potassium, total	7440-09-7	E440B	10	mg/L	<50	----
Selenium, total	7782-49-2	E440B	0.01	mg/L	<0.050	----
Silver, total	7440-22-4	E440B	0.01	mg/L	<0.010	----
Sodium, total	7440-23-5	E440B	10	mg/L	<50	----
Strontium, total	7440-24-6	E440B	0.02	mg/L	<0.200	----
Sulfur, total	7704-34-9	E440B	100	mg/L	<500	----
Thallium, total	7440-28-0	E440B	0.002	mg/L	<0.0100	----
Tin, total	7440-31-5	E440B	0.02	mg/L	<0.100	----



Sub-Matrix: **Water**

<i>Analyte</i>	<i>CAS Number</i>	<i>Method</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>Qualifier</i>
Total Metals (QCLot: 1843528) - continued						
Titanium, total	7440-32-6	E440B	0.06	mg/L	<0.300	---
Uranium, total	7440-61-1	E440B	0.002	mg/L	<0.0100	---
Vanadium, total	7440-62-2	E440B	0.1	mg/L	<0.50	---
Zinc, total	7440-66-6	E440B	0.6	mg/L	<3.00	---
Zirconium, total	7440-67-7	E440B	0.06	mg/L	<0.200	---
Total Metals (QCLot: 1843529)						
Mercury, total	7439-97-6	E508B	0.0005	mg/L	<0.00250	---



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: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1838307)									
Aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	94.7	80.0	120	----
Antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	94.6	80.0	120	----
Arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
Barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
Beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	92.0	80.0	120	----
Bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	93.4	80.0	120	----
Boron	7440-42-8	E440	5	mg/kg	100 mg/kg	94.0	80.0	120	----
Cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	103	80.0	120	----
Calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	94.2	80.0	120	----
Chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	99.2	80.0	120	----
Cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	97.1	80.0	120	----
Copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	97.0	80.0	120	----
Iron	7439-89-6	E440	50	mg/kg	100 mg/kg	97.9	80.0	120	----
Lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	99.6	80.0	120	----
Lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	90.8	80.0	120	----
Magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	104	80.0	120	----
Manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	98.5	80.0	120	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	99.9	80.0	120	----
Nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	97.2	80.0	120	----
Phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	102	80.0	120	----
Potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	101	80.0	120	----
Selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	102	80.0	120	----
Silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	88.6	80.0	120	----
Sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
Strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
Sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	98.2	80.0	120	----
Thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	98.9	80.0	120	----
Tin	7440-31-5	E440	2	mg/kg	50 mg/kg	100	80.0	120	----
Titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	98.7	80.0	120	----
Uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	98.5	80.0	120	----
Vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	101	80.0	120	----
Zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	96.6	80.0	120	----
Zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	92.8	80.0	120	----



Sub-Matrix: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1838308)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	104	80.0	120	---

Sub-Matrix: Water

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1843528)									
Aluminum, total	7429-90-5	E440B	2	mg/L	200 mg/L	104	80.0	120	---
Antimony, total	7440-36-0	E440B	0.02	mg/L	100 mg/L	102	80.0	120	---
Arsenic, total	7440-38-2	E440B	0.02	mg/L	100 mg/L	113	80.0	120	---
Barium, total	7440-39-3	E440B	0.04	mg/L	25 mg/L	110	80.0	120	---
Beryllium, total	7440-41-7	E440B	0.02	mg/L	10 mg/L	99.6	80.0	120	---
Bismuth, total	7440-69-9	E440B	0.01	mg/L	100 mg/L	98.8	80.0	120	---
Boron, total	7440-42-8	E440B	2	mg/L	100 mg/L	95.2	80.0	120	---
Cadmium, total	7440-43-9	E440B	0.002	mg/L	10 mg/L	99.2	80.0	120	---
Calcium, total	7440-70-2	E440B	100	mg/L	5000 mg/L	104	80.0	120	---
Chromium, total	7440-47-3	E440B	0.1	mg/L	25 mg/L	106	80.0	120	---
Cobalt, total	7440-48-4	E440B	0.1	mg/L	25 mg/L	105	80.0	120	---
Copper, total	7440-50-8	E440B	0.2	mg/L	25 mg/L	102	80.0	120	---
Iron, total	7439-89-6	E440B	10	mg/L	100 mg/L	98.9	80.0	120	---
Lead, total	7439-92-1	E440B	0.02	mg/L	50 mg/L	106	80.0	120	---
Lithium, total	7439-93-2	E440B	0.2	mg/L	25 mg/L	105	80.0	120	---
Magnesium, total	7439-95-4	E440B	10	mg/L	5000 mg/L	116	80.0	120	---
Manganese, total	7439-96-5	E440B	0.1	mg/L	25 mg/L	107	80.0	120	---
Molybdenum, total	7439-98-7	E440B	0.01	mg/L	25 mg/L	106	80.0	120	---
Nickel, total	7440-02-0	E440B	0.1	mg/L	50 mg/L	104	80.0	120	---
Phosphorus, total	7723-14-0	E440B	10	mg/L	1000 mg/L	114	80.0	120	---
Potassium, total	7440-09-7	E440B	10	mg/L	5000 mg/L	116	80.0	120	---
Selenium, total	7782-49-2	E440B	0.01	mg/L	100 mg/L	102	80.0	120	---
Silver, total	7440-22-4	E440B	0.01	mg/L	10 mg/L	94.6	80.0	120	---
Sodium, total	7440-23-5	E440B	10	mg/L	5000 mg/L	103	80.0	120	---
Strontium, total	7440-24-6	E440B	0.02	mg/L	25 mg/L	111	80.0	120	---
Sulfur, total	7704-34-9	E440B	100	mg/L	5000 mg/L	105	80.0	120	---
Thallium, total	7440-28-0	E440B	0.002	mg/L	100 mg/L	102	80.0	120	---
Tin, total	7440-31-5	E440B	0.02	mg/L	50 mg/L	103	80.0	120	---
Titanium, total	7440-32-6	E440B	0.06	mg/L	25 mg/L	105	80.0	120	---
Uranium, total	7440-61-1	E440B	0.002	mg/L	0.5 mg/L	99.9	80.0	120	---



Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1843528) - continued									
Vanadium, total	7440-62-2	E440B	0.1	mg/L	50 mg/L	108	80.0	120	----
Zinc, total	7440-66-6	E440B	0.6	mg/L	50 mg/L	103	80.0	120	----
Zirconium, total	7440-67-7	E440B	0.06	mg/L	10 mg/L	103	80.0	120	----
Total Metals (QCLot: 1843529)									
Mercury, total	7439-97-6	E508B	0.0005	mg/L	0.1 mg/L	100	70.0	130	----



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:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Metals (QCLot: 1838307)									
QC-1838307-003	RM	Aluminum	7429-90-5	E440	22500 mg/kg	102	70.0	130	----
QC-1838307-003	RM	Antimony	7440-36-0	E440	24.8 mg/kg	82.8	70.0	130	----
QC-1838307-003	RM	Arsenic	7440-38-2	E440	21.2 mg/kg	98.1	70.0	130	----
QC-1838307-003	RM	Barium	7440-39-3	E440	788 mg/kg	108	70.0	130	----
QC-1838307-003	RM	Beryllium	7440-41-7	E440	1.82 mg/kg	99.8	70.0	130	----
QC-1838307-003	RM	Bismuth	7440-69-9	E440	1.78 mg/kg	90.5	70.0	130	----
QC-1838307-003	RM	Cadmium	7440-43-9	E440	2.15 mg/kg	103	70.0	130	----
QC-1838307-003	RM	Calcium	7440-70-2	E440	4900 mg/kg	97.0	70.0	130	----
QC-1838307-003	RM	Chromium	7440-47-3	E440	56.9 mg/kg	99.6	70.0	130	----
QC-1838307-003	RM	Cobalt	7440-48-4	E440	32 mg/kg	98.6	70.0	130	----
QC-1838307-003	RM	Copper	7440-50-8	E440	969 mg/kg	103	70.0	130	----
QC-1838307-003	RM	Iron	7439-89-6	E440	32700 mg/kg	102	70.0	130	----
QC-1838307-003	RM	Lead	7439-92-1	E440	919 mg/kg	93.6	70.0	130	----
QC-1838307-003	RM	Lithium	7439-93-2	E440	47.3 mg/kg	99.9	70.0	130	----
QC-1838307-003	RM	Magnesium	7439-95-4	E440	7780 mg/kg	104	70.0	130	----
QC-1838307-003	RM	Manganese	7439-96-5	E440	8640 mg/kg	108	70.0	130	----
QC-1838307-003	RM	Molybdenum	7439-98-7	E440	25.1 mg/kg	96.8	70.0	130	----
QC-1838307-003	RM	Nickel	7440-02-0	E440	1000 mg/kg	105	70.0	130	----
QC-1838307-003	RM	Phosphorus	7723-14-0	E440	660 mg/kg	99.2	70.0	130	----
QC-1838307-003	RM	Potassium	7440-09-7	E440	10800 mg/kg	102	70.0	130	----
QC-1838307-003	RM	Selenium	7782-49-2	E440	1.04 mg/kg	106	60.0	140	----
QC-1838307-003	RM	Silver	7440-22-4	E440	8.98 mg/kg	89.8	70.0	130	----
QC-1838307-003	RM	Sodium	7440-23-5	E440	1770 mg/kg	108	70.0	130	----
QC-1838307-003	RM	Strontium	7440-24-6	E440	41 mg/kg	101	70.0	130	----
QC-1838307-003	RM	Sulfur	7704-34-9	E440	3940 mg/kg	105	50.0	150	----
QC-1838307-003	RM	Thallium	7440-28-0	E440	0.907 mg/kg	93.0	70.0	130	----
QC-1838307-003	RM	Tin	7440-31-5	E440	3.79 mg/kg	93.2	40.0	160	----
QC-1838307-003	RM	Titanium	7440-32-6	E440	2790 mg/kg	103	70.0	130	----
QC-1838307-003	RM	Tungsten	7440-33-7	E440	6.99 mg/kg	99.4	70.0	130	----
QC-1838307-003	RM	Uranium	7440-61-1	E440	3.97 mg/kg	95.8	70.0	130	----
QC-1838307-003	RM	Vanadium	7440-62-2	E440	66.2 mg/kg	98.8	70.0	130	----
QC-1838307-003	RM	Zinc	7440-66-6	E440	828 mg/kg	97.0	70.0	130	----
QC-1838307-003	RM	Zirconium	7440-67-7	E440	6.91 mg/kg	103	70.0	130	----



Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Metals (QCLot: 1838308)									
QC-1838308-003	RM	Mercury	7439-97-6	E510	0.068 mg/kg	106	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Total Metals (QCLot: 1843528)									
QC-1843528-003	RM	Aluminum, total	7429-90-5	E440B	22500 mg/L	105	70.0	130	----
QC-1843528-003	RM	Antimony, total	7440-36-0	E440B	24.8 mg/L	98.5	70.0	130	----
QC-1843528-003	RM	Arsenic, total	7440-38-2	E440B	21.2 mg/L	100	70.0	130	----
QC-1843528-003	RM	Barium, total	7440-39-3	E440B	788 mg/L	108	70.0	130	----
QC-1843528-003	RM	Beryllium, total	7440-41-7	E440B	1.82 mg/L	94.8	70.0	130	----
QC-1843528-003	RM	Bismuth, total	7440-69-9	E440B	1.78 mg/L	88.6	70.0	130	----
QC-1843528-003	RM	Cadmium, total	7440-43-9	E440B	2.15 mg/L	96.2	70.0	130	----
QC-1843528-003	RM	Calcium, total	7440-70-2	E440B	4900 mg/L	97.7	70.0	130	----
QC-1843528-003	RM	Chromium, total	7440-47-3	E440B	56.9 mg/L	100	70.0	130	----
QC-1843528-003	RM	Cobalt, total	7440-48-4	E440B	32 mg/L	99.0	70.0	130	----
QC-1843528-003	RM	Copper, total	7440-50-8	E440B	969 mg/L	106	70.0	130	----
QC-1843528-003	RM	Iron, total	7439-89-6	E440B	32700 mg/L	105	70.0	130	----
QC-1843528-003	RM	Lead, total	7439-92-1	E440B	919 mg/L	98.4	70.0	130	----
QC-1843528-003	RM	Lithium, total	7439-93-2	E440B	47.3 mg/L	102	70.0	130	----
QC-1843528-003	RM	Magnesium, total	7439-95-4	E440B	7780 mg/L	107	70.0	130	----
QC-1843528-003	RM	Manganese, total	7439-96-5	E440B	8640 mg/L	111	70.0	130	----
QC-1843528-003	RM	Molybdenum, total	7439-98-7	E440B	25.1 mg/L	99.4	70.0	130	----
QC-1843528-003	RM	Nickel, total	7440-02-0	E440B	1000 mg/L	106	70.0	130	----
QC-1843528-003	RM	Phosphorus, total	7723-14-0	E440B	660 mg/L	99.0	70.0	130	----
QC-1843528-003	RM	Potassium, total	7440-09-7	E440B	10800 mg/L	104	70.0	130	----
QC-1843528-003	RM	Selenium, total	7782-49-2	E440B	1.04 mg/L	102	60.0	140	----
QC-1843528-003	RM	Silver, total	7440-22-4	E440B	8.98 mg/L	93.2	70.0	130	----
QC-1843528-003	RM	Sodium, total	7440-23-5	E440B	1770 mg/L	91.7	70.0	130	----
QC-1843528-003	RM	Strontium, total	7440-24-6	E440B	41 mg/L	104	70.0	130	----
QC-1843528-003	RM	Sulfur, total	7704-34-9	E440B	3940 mg/L	108	50.0	150	----
QC-1843528-003	RM	Thallium, total	7440-28-0	E440B	0.907 mg/L	96.9	70.0	130	----
QC-1843528-003	RM	Tin, total	7440-31-5	E440B	3.79 mg/L	98.3	40.0	160	----
QC-1843528-003	RM	Titanium, total	7440-32-6	E440B	2790 mg/L	105	70.0	130	----
QC-1843528-003	RM	Tungsten, total	7440-33-7	E440B	6.99 mg/L	102	70.0	130	----
QC-1843528-003	RM	Uranium, total	7440-61-1	E440B	3.97 mg/L	87.7	70.0	130	----
QC-1843528-003	RM	Vanadium, total	7440-62-2	E440B	66.2 mg/L	101	70.0	130	----

Page : 14 of 14
 Work Order : WT2500521
 Client : ArctiConnexion
 Project : ----



Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Total Metals (QCLot: 1843528) - continued									
QC-1843528-003	RM	Zinc, total	7440-66-6	E440B	828 mg/L	96.9	70.0	130	----
QC-1843528-003	RM	Zirconium, total	7440-67-7	E440B	6.91 mg/L	109	70.0	130	----
Total Metals (QCLot: 1843529)									
QC-1843529-003	RM	Mercury, total	7439-97-6	E508B	0.068 mg/L	104	70.0	130	----

MM 576, 58C 902



www.alslab.com

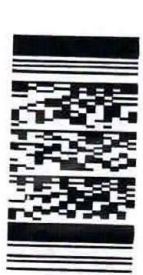
Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 20 -

Page

Environmental Division
Waterloo
Work Order Reference
WT2500521



Telephone: +1 519 866 6970

Contact and company name below will appear on the final report

Company: ArctiConnexion
Company address below will appear on the final report
Street: 422 3e Ave
City/Province: Quebec, QC
Postal Code: G1L 1Y8
Phone: 581-989-5477

Select Report Format: PDF BCL EDD (DIGITAL)
Merge QC/QCI Reports with COA YES NO N/A
Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: EMAIL MAIL FAX
Email 1 or Fax: pierre@arcticonnexion.ca
Email 2: pierre@arcticonnexion.ca
Email 3: vincent@arcticonnexion.ca

Select Invoice Distribution: EMAIL MAIL FAX
Email 1 or Fax: info@arcticonnexion.ca
Email 2:
Oil and Gas Required Fields (client use)
AFECost Center: PO#
Material Code: Routing Code:
Requisitioner: Location:
ALS Contact: Emily Smith Sampler:

Reports / Recipients
Invoice Recipients

Turnaround Time (TAT) Requested
Routine [R] if received by 3pm M-F - no surcharges apply
1 day [P1] if received by 3pm M-F - 20% rush surcharge minimum
2 day [P2] if received by 3pm M-F - 25% rush surcharge minimum
3 day [P3] if received by 3pm M-F - 50% rush surcharge minimum
4 day [P4] if received by 3pm M-F - 100% rush surcharge minimum
1 day [E] if received by 10am M-S - 20% rush surcharge. As Same day [E2] if received by 10am M-S - 20% rush surcharge. As may apply to rush requests on weekends, statutory holidays and non business days.
Date and Time Required for all EAP TATs:
For all tests with rush TATs requested, please indicate filtered (F), Preserved (P) or Filtered

ANALYSIS

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	Total Metals (ICPMS)	Total Mercury (CVAAS)	TSS	TDS	Dissolved Metals (ICPMS)	Dissolved Mercury	Hardness	pH
2024-PI-MM-P0		8-Jan-25	13:00	Zooplankton	R	R						
2024-PI-MM-P2		8-Jan-25	13:00	Zooplankton	R	R						
2024-PI-MM-M1D		8-Jan-25	13:00	Zooplankton	R	R						
2024-PI-MM-T0D		8-Jan-25	13:00	Zooplankton	R	R						
2024-PI-MM-Source		8-Jan-25	13:00	Sediment	R	R						

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Drinking Water (DW) Samples¹ (client use)
Are samples taken from a Regulated DW System? YES NO
Are samples for human consumption use? YES NO

Released by: _____ Date: _____
Time: _____

SHIPMENT RELEASE (client use)

Received by: Tammy Chorkand Date: Jan 10th 125 Time: 9:00
WHITE - LABORATORY COPY YELLOW - CLIENT COPY

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by: MM Date: Jan 11 Time: 11:50

FINAL SHIPMENT RECEPTION (ALS use only)

Shipping Method: NONE ICE ICE PACKS FROZEN COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: YES NO
Cooler Custody Seals Intact: YES N/A Sample Custody Seals Intact: YES N/A
INITIAL COOLER TEMPERATURES °C: 5.3 FINAL COOLER TEMPERATURES °C: 6.3

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
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. Heavy water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



CERTIFICATE OF ANALYSIS

Work Order	: WT2523964	Laboratory	: ALS Environmental - Waterloo
Amendment	: 2	Account Manager	: Emily Smith
Client	: ArctiConnexion	Address	: 60 Northland Road, Unit 1
Contact	: Gwenaelle Minot-Kohl		: Waterloo ON Canada N2V 2B8
Address	: 422 3e Ave	E-mail	: Emily.Smith@ALSGlobal.com
	: Quebec Quebec Canada G1L 2W1	Telephone	: +1 519 886 6910
Telephone	: 581 922 1925	Date Samples Received	: 27-Aug-2025 11:30
Project	: ----	Date Analysis Commenced	: 05-Sep-2025
PO	: ----	Issue Date	: 07-Oct-2025 10:54
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 3		
No. of samples analysed	: 3		

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>
Ilmaz Badbezanchi	Supervisor - Metals Prep	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Administration, Burnaby, British Columbia
Wayne Smith	Client Services Specialist	Metals, Waterloo, Ontario



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>
cm ²	square centimetres
µg/cm ²	micrograms per square centimetre
µg/sample	micrograms 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

WT2523964 #1,2,3: E510 Hg was performed without LCS. This was a shared digestion with E440 metals, and the metals LCS passed, indicating there were no issues with the digestion. Hg data not expected to be impacted.

Amendment (06/10/2025): This report has been amended as a result of changes to the contacts for the distribution of the report. All analysis results are as per the previous report.

Amendment (07/10/2025): This report has been amended as a result of changes to the contacts for the distribution of the report. All analysis results are as per the previous report.

Qualifiers

<i>Qualifier</i>	<i>Description</i>
RRR	Refer to report comments for issues regarding this analysis.



Analytical Results

Sub-Matrix: Swab (Matrix: Wipe)					Client sample ID	2024-PI-MI-DF1 ----	2024-PI-MI-DF2 ----	2024-PI-MI-DF3 ----	----	----
Client sampling date / time					25-Aug-2025 00:00	25-Aug-2025 00:00	25-Aug-2025 00:00	----	----	
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2523964-001	WT2523964-002	WT2523964-003	----	----	
					Result	Result	Result	----	----	
Field Tests										
Area sampled, field	----	EF001/VA	0.010	cm²	100	100	100	----	----	
Metals										
Aluminum	7429-90-5	EC440/VA	0.20	µg/cm²	0.64	0.48	0.86	----	----	
Aluminum	7429-90-5	E440/VA	20	µg/sampl e	64	48	86	----	----	
Antimony	7440-36-0	EC440/VA	0.20	µg/cm²	<0.20	<0.20	<0.20	----	----	
Antimony	7440-36-0	E440/VA	20	µg/sampl e	<20	<20	<20	----	----	
Arsenic	7440-38-2	EC440/VA	0.20	µg/cm²	<0.20	<0.20	<0.20	----	----	
Arsenic	7440-38-2	E440/VA	20	µg/sampl e	<20	<20	<20	----	----	
Barium	7440-39-3	EC440/VA	0.010	µg/cm²	<0.010	<0.010	<0.010	----	----	
Barium	7440-39-3	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Beryllium	7440-41-7	EC440/VA	0.0050	µg/cm²	<0.0050	<0.0050	<0.0050	----	----	
Beryllium	7440-41-7	E440/VA	0.50	µg/sampl e	<0.50	<0.50	<0.50	----	----	
Bismuth	7440-69-9	EC440/VA	0.20	µg/cm²	<0.20	<0.20	<0.20	----	----	
Bismuth	7440-69-9	E440/VA	20	µg/sampl e	<20	<20	<20	----	----	
Cadmium	7440-43-9	EC440/VA	0.010	µg/cm²	<0.010	<0.010	<0.010	----	----	
Cadmium	7440-43-9	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Calcium	7440-70-2	EC440/VA	2.0	µg/cm²	<2.0	<2.0	3.2	----	----	
Calcium	7440-70-2	E440/VA	200	µg/sampl e	<200	<200	320	----	----	
Chromium	7440-47-3	EC440/VA	0.020	µg/cm²	<0.020	<0.020	<0.020	----	----	
Chromium	7440-47-3	E440/VA	2.0	µg/sampl e	<2.0	<2.0	<2.0	----	----	



Analytical Results

Sub-Matrix: Swab
 (Matrix: Wipe)

					Client sample ID	2024-PI-MI-DF1	2024-PI-MI-DF2	2024-PI-MI-DF3	----	----
					Client sampling date / time	25-Aug-2025 00:00	25-Aug-2025 00:00	25-Aug-2025 00:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2523964-001	WT2523964-002	WT2523964-003	----	----	
					Result	Result	Result	----	----	
Metals										
Cobalt	7440-48-4	EC440/VA	0.010	µg/cm ²	<0.010	<0.010	<0.010	----	----	
Cobalt	7440-48-4	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Copper	7440-50-8	EC440/VA	0.010	µg/cm ²	<0.010	<0.010	<0.010	----	----	
Copper	7440-50-8	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Iron	7439-89-6	EC440/VA	0.030	µg/cm ²	6.99	7.17	15.3	----	----	
Iron	7439-89-6	E440/VA	3.0	µg/sampl e	699	717	1530	----	----	
Lead	7439-92-1	EC440/VA	0.0040	µg/cm ²	<0.0040	<0.0040	<0.0040	----	----	
Lead	7439-92-1	E440/VA	0.40	µg/sampl e	<0.40	<0.40	<0.40	----	----	
Lithium	7439-93-2	EC440/VA	0.010	µg/cm ²	<0.010	<0.010	<0.010	----	----	
Lithium	7439-93-2	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Magnesium	7439-95-4	EC440/VA	1.0	µg/cm ²	1.3	1.2	1.9	----	----	
Magnesium	7439-95-4	E440/VA	100	µg/sampl e	130	120	190	----	----	
Manganese	7439-96-5	EC440/VA	0.0050	µg/cm ²	0.0370	0.0312	0.0571	----	----	
Manganese	7439-96-5	E440/VA	0.50	µg/sampl e	3.70	3.12	5.71	----	----	
Mercury	7439-97-6	EC510/WT	0.010	µg/cm ²	<0.010	<0.010	<0.010	----	----	
Mercury	7439-97-6	E510/VA	0.010	µg/sampl e	<0.010 ^{RRR}	<0.010 ^{RRR}	<0.010 ^{RRR}	----	----	
Molybdenum	7439-98-7	EC440/VA	0.030	µg/cm ²	<0.030	<0.030	<0.030	----	----	
Molybdenum	7439-98-7	E440/VA	3.0	µg/sampl e	<3.0	<3.0	<3.0	----	----	
Nickel	7440-02-0	EC440/VA	0.050	µg/cm ²	<0.050	<0.050	<0.050	----	----	
Nickel	7440-02-0	E440/VA	5.0	µg/sampl e	<5.0	<5.0	<5.0	----	----	



Analytical Results

Sub-Matrix: Swab
 (Matrix: Wipe)

					Client sample ID	2024-PI-MI-DF1	2024-PI-MI-DF2	2024-PI-MI-DF3	----	----
					Client sampling date / time	25-Aug-2025 00:00	25-Aug-2025 00:00	25-Aug-2025 00:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2523964-001	WT2523964-002	WT2523964-003	----	----	
					Result	Result	Result	----	----	
Metals										
Phosphorus	7723-14-0	EC440/VA	0.30	µg/cm ²	<0.30	<0.30	<0.30	----	----	
Phosphorus	7723-14-0	E440/VA	30	µg/sampl e	<30	<30	<30	----	----	
Potassium	7440-09-7	EC440/VA	2.0	µg/cm ²	<2.0	<2.0	<2.0	----	----	
Potassium	7440-09-7	E440/VA	200	µg/sampl e	<200	<200	<200	----	----	
Selenium	7782-49-2	EC440/VA	0.20	µg/cm ²	<0.20	<0.20	<0.20	----	----	
Selenium	7782-49-2	E440/VA	20	µg/sampl e	<20	<20	<20	----	----	
Silver	7440-22-4	EC440/VA	0.010	µg/cm ²	<0.010	<0.010	<0.010	----	----	
Silver	7440-22-4	E440/VA	1.0	µg/sampl e	<1.0	<1.0	<1.0	----	----	
Sodium	7440-23-5	EC440/VA	4.0	µg/cm ²	<4.0	<4.0	<4.0	----	----	
Sodium	7440-23-5	E440/VA	400	µg/sampl e	<400	<400	<400	----	----	
Strontium	7440-24-6	EC440/VA	0.0050	µg/cm ²	0.0066	<0.0050	0.0060	----	----	
Strontium	7440-24-6	E440/VA	0.50	µg/sampl e	0.66	<0.50	0.60	----	----	
Thallium	7440-28-0	EC440/VA	0.20	µg/cm ²	<0.20	<0.20	<0.20	----	----	
Thallium	7440-28-0	E440/VA	20	µg/sampl e	<20	<20	<20	----	----	
Tin	7440-31-5	EC440/VA	0.030	µg/cm ²	<0.030	<0.030	<0.030	----	----	
Tin	7440-31-5	E440/VA	3.0	µg/sampl e	<3.0	<3.0	<3.0	----	----	
Titanium	7440-32-6	EC440/VA	0.010	µg/cm ²	0.011	<0.010	0.014	----	----	
Titanium	7440-32-6	E440/VA	1.0	µg/sampl e	1.1	<1.0	1.4	----	----	
Vanadium	7440-62-2	EC440/VA	0.030	µg/cm ²	<0.030	<0.030	<0.030	----	----	
Vanadium	7440-62-2	E440/VA	3.0	µg/sampl e	<3.0	<3.0	<3.0	----	----	



Analytical Results

Sub-Matrix: Swab
(Matrix: Wipe)

					Client sample ID	2024-PI-MI-DF1	2024-PI-MI-DF2	2024-PI-MI-DF3	----	----
					Client sampling date / time	25-Aug-2025 00:00	25-Aug-2025 00:00	25-Aug-2025 00:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2523964-001	WT2523964-002	WT2523964-003	----	----	
					Result	Result	Result	----	----	
Metals										
Zinc	7440-66-6	EC440/VA	0.0050	µg/cm ²	0.0086	0.0088	0.0082	----	----	
Zinc	7440-66-6	E440/VA	0.50	µg/sample	0.86	0.88	0.82	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.



QUALITY CONTROL INTERPRETIVE REPORT

<p>Work Order : WT2523964</p> <p>Amendment : 2</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : ----</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 3</p> <p>No. of samples analysed : 3</p>	<p>Page : 1 of 6</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 27-Aug-2025 11:30</p> <p>Issue Date : 07-Oct-2025 10:54</p>
--	---

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.
- No Laboratory Control Sample (LCS) 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: **Wipe** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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	
Field Tests : Field measurements										
Sterile wipe 2024-PI-MI-DF1	EF001	25-Aug-2025	----	----	----		12-Sep-2025	----	----	
Field Tests : Field measurements										
Sterile wipe 2024-PI-MI-DF2	EF001	25-Aug-2025	----	----	----		12-Sep-2025	----	----	
Field Tests : Field measurements										
Sterile wipe 2024-PI-MI-DF3	EF001	25-Aug-2025	----	----	----		12-Sep-2025	----	----	
Metals : Mercury by CVAAS (ug/sample)										
Sterile wipe 2024-PI-MI-DF1	E510	25-Aug-2025	11-Sep-2025	180 days	18 days	✔	11-Sep-2025	180 days	0 days	✔
Metals : Mercury by CVAAS (ug/sample)										
Sterile wipe 2024-PI-MI-DF2	E510	25-Aug-2025	11-Sep-2025	180 days	18 days	✔	11-Sep-2025	180 days	0 days	✔
Metals : Mercury by CVAAS (ug/sample)										
Sterile wipe 2024-PI-MI-DF3	E510	25-Aug-2025	11-Sep-2025	180 days	18 days	✔	11-Sep-2025	180 days	0 days	✔
Metals : Metals in Wipe by CRC ICPMS (ug/sample)										
Sterile wipe 2024-PI-MI-DF1	E440	25-Aug-2025	05-Sep-2025	180 days	12 days	✔	06-Sep-2025	180 days	12 days	✔



Matrix: **Wipe** Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method 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 Wipe by CRC ICPMS (ug/sample)										
Sterile wipe 2024-PI-MI-DF2	E440	25-Aug-2025	05-Sep-2025	180 days	12 days	✓	06-Sep-2025	180 days	12 days	✓
Metals : Metals in Wipe by CRC ICPMS (ug/sample)										
Sterile wipe 2024-PI-MI-DF3	E440	25-Aug-2025	05-Sep-2025	180 days	12 days	✓	06-Sep-2025	180 days	12 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: **Wipe** Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Control Samples (LCS)							
Metals in Wipe by CRC ICPMS (ug/sample)	E440	2202937	1	3	33.3	5.0	✔
Mercury by CVAAS (ug/sample)	E510	2212486	0	3	0.0	5.0	✖
Method Blanks (MB)							
Metals in Wipe by CRC ICPMS (ug/sample)	E440	2202937	1	3	33.3	5.0	✔
Mercury by CVAAS (ug/sample)	E510	2212486	1	3	33.3	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>
Metals in Wipe by CRC ICPMS (ug/sample)	E440 ALS Environmental - Vancouver	Wipe	NIOSH 7303 (mod)/EPA 6020B (mod)	Samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Mercury by CVAAS (ug/sample)	E510 ALS Environmental - Vancouver	Wipe	EPA 200.2/1631 Appendix (mod)	Wipe is digested with HNO ₃ and HCl, followed by CVAAS analysis.
Metals in Wipe by CRC ICPMS (ug/cm ²)	EC440 ALS Environmental - Vancouver	Wipe	unit conversion	Converts ug/sample data to ug/cm ² based on size of area wiped (as provided by client). LORs in ug/cm ² are based on an area wiped equal to 10 cm x 10 cm.
Mercury in wipe by CVAAS (ug/cm ²)	EC510 ALS Environmental - Waterloo	Wipe	unit conversion	Converts ug/sample data to ug/cm ² based on size of area wiped (as provided by client).
Field measurements	EF001 ALS Environmental - Vancouver	Wipe		Field measurement of sampling area (cm ²) provided by client and recorded on ALS report may affect the validity of results.
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Metals and Mercury Wipe Digestion	EP440 ALS Environmental - Vancouver	Wipe	US EPA 3050B / 6020	Samples are digested with nitric and hydrochloric acid.

QUALITY CONTROL REPORT

Work Order	: WT2523964	Page	: 1 of 5
Amendment	: 2		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec QC Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 27-Aug-2025 11:30
PO	: ----	Date Analysis Commenced	: 05-Sep-2025
C-O-C number	: ----	Issue Date	: 07-Oct-2025 10:53
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 3		
No. of samples analysed	: 3		

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:

- 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>
Ilnaz Badbezanchi	Supervisor - Metals Prep	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Administration, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Wayne Smith	Client Services Specialist	Waterloo Metals, Waterloo, Ontario



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.



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: Wipe

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 2202937)						
Aluminum	7429-90-5	E440	20	µg/sample	<20	----
Antimony	7440-36-0	E440	20	µg/sample	<20	----
Arsenic	7440-38-2	E440	20	µg/sample	<20	----
Barium	7440-39-3	E440	1	µg/sample	<1.0	----
Beryllium	7440-41-7	E440	0.5	µg/sample	<0.50	----
Bismuth	7440-69-9	E440	20	µg/sample	<20	----
Cadmium	7440-43-9	E440	1	µg/sample	<1.0	----
Calcium	7440-70-2	E440	200	µg/sample	<200	----
Chromium	7440-47-3	E440	2	µg/sample	<2.0	----
Cobalt	7440-48-4	E440	1	µg/sample	<1.0	----
Copper	7440-50-8	E440	1	µg/sample	<1.0	----
Iron	7439-89-6	E440	3	µg/sample	<3.0	----
Lead	7439-92-1	E440	0.4	µg/sample	<0.40	----
Lithium	7439-93-2	E440	1	µg/sample	<1.0	----
Magnesium	7439-95-4	E440	100	µg/sample	<100	----
Manganese	7439-96-5	E440	0.5	µg/sample	<0.50	----
Molybdenum	7439-98-7	E440	3	µg/sample	<3.0	----
Nickel	7440-02-0	E440	5	µg/sample	<5.0	----
Phosphorus	7723-14-0	E440	30	µg/sample	<30	----
Potassium	7440-09-7	E440	200	µg/sample	<200	----
Selenium	7782-49-2	E440	20	µg/sample	<20	----
Silver	7440-22-4	E440	1	µg/sample	<1.0	----
Sodium	7440-23-5	E440	400	µg/sample	<400	----
Strontium	7440-24-6	E440	0.5	µg/sample	<0.50	----
Thallium	7440-28-0	E440	20	µg/sample	<20	----
Tin	7440-31-5	E440	3	µg/sample	<3.0	----
Titanium	7440-32-6	E440	1	µg/sample	<1.0	----
Vanadium	7440-62-2	E440	3	µg/sample	<3.0	----
Zinc	7440-66-6	E440	0.5	µg/sample	<0.50	----
Metals (QCLot: 2212486)						
Mercury	7439-97-6	E510	0.01	µg/sample	<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: Wipe

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 2202937)									
Aluminum	7429-90-5	E440	20	µg/sample	500 µg/sample	95.8	80.0	120	---
Antimony	7440-36-0	E440	20	µg/sample	250 µg/sample	97.4	80.0	120	---
Arsenic	7440-38-2	E440	20	µg/sample	250 µg/sample	100	80.0	120	---
Barium	7440-39-3	E440	1	µg/sample	62.5 µg/sample	101	80.0	120	---
Beryllium	7440-41-7	E440	0.5	µg/sample	25 µg/sample	96.1	80.0	120	---
Bismuth	7440-69-9	E440	20	µg/sample	250 µg/sample	92.8	80.0	120	---
Cadmium	7440-43-9	E440	1	µg/sample	25 µg/sample	97.9	80.0	120	---
Calcium	7440-70-2	E440	200	µg/sample	12500 µg/sample	95.4	80.0	120	---
Chromium	7440-47-3	E440	2	µg/sample	62.5 µg/sample	99.7	80.0	120	---
Cobalt	7440-48-4	E440	1	µg/sample	62.5 µg/sample	98.4	80.0	120	---
Copper	7440-50-8	E440	1	µg/sample	62.5 µg/sample	96.7	80.0	120	---
Iron	7439-89-6	E440	3	µg/sample	250 µg/sample	101	80.0	120	---
Lead	7439-92-1	E440	0.4	µg/sample	125 µg/sample	92.8	80.0	120	---
Lithium	7439-93-2	E440	1	µg/sample	62.5 µg/sample	98.7	80.0	120	---
Magnesium	7439-95-4	E440	100	µg/sample	12500 µg/sample	99.5	80.0	120	---
Manganese	7439-96-5	E440	0.5	µg/sample	62.5 µg/sample	98.5	80.0	120	---
Molybdenum	7439-98-7	E440	3	µg/sample	62.5 µg/sample	101	80.0	120	---
Nickel	7440-02-0	E440	5	µg/sample	125 µg/sample	100	80.0	120	---
Phosphorus	7723-14-0	E440	30	µg/sample	2500 µg/sample	98.4	80.0	120	---
Potassium	7440-09-7	E440	200	µg/sample	12500 µg/sample	94.8	80.0	120	---
Selenium	7782-49-2	E440	20	µg/sample	250 µg/sample	97.0	80.0	120	---
Silver	7440-22-4	E440	1	µg/sample	25 µg/sample	89.8	80.0	120	---
Sodium	7440-23-5	E440	400	µg/sample	12500 µg/sample	99.5	80.0	120	---
Strontium	7440-24-6	E440	0.5	µg/sample	62.5 µg/sample	99.2	80.0	120	---
Thallium	7440-28-0	E440	20	µg/sample	250 µg/sample	93.7	80.0	120	---
Tin	7440-31-5	E440	3	µg/sample	125 µg/sample	99.3	80.0	120	---
Titanium	7440-32-6	E440	1	µg/sample	62.5 µg/sample	96.9	80.0	120	---
Vanadium	7440-62-2	E440	3	µg/sample	125 µg/sample	101	80.0	120	---
Zinc	7440-66-6	E440	0.5	µg/sample	125 µg/sample	94.2	80.0	120	---





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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 2

Environmental Division
Waterloo
Work Order Reference
WT25523964

Report To: Contact and company name below will appear on the final report

Company: ArctiConneXion

Contact: Gwenaelle Minoi-Kohl

Phone: Company address below will appear on the final report

Street:

City/Province:

Postal Code:

Invoice To: Same as Report To YES NO

Copy of Invoice with Report YES NO

Company:

Project Information: 2025 Price List

ALS Account # / Quote #:

Job #:

PO / A/E:

LSD:

ALS Lab Work Order # (ALS use only) 1576523964

Sample Identification and/or Coordinates (This description will appear on the report)

ALS Sample # (ALS use only)

2024-PLM-DF1

2024-PLM-DF2

2024-PLM-DF3

Reports / Recipients

Select Report Format:

PDF EXCEL EOD (DIGITAL)

Merge QC/QCI Reports with COA YES NO N/A

Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: EMAIL MAIL FAX

Email 1 or Fax: gwenaelle@arcticonnexion.ca

Email 2:

Email 3:

Select Invoice Distribution: EMAIL MAIL FAX

Email 1 or Fax: info@arcticonnexion.ca

Email 2:

Oil and Gas Required Fields (client use)

A/E/Cost Center:

Major/Minor Code:

Requisitioner:

Location:

ALS Contact:

Emily Smith

Date (dd-mm-yy):

25-Aug-25

25-Aug-25

25-Aug-25

Turnaround Time (TAT) Requested

4 day [P4] if received by 3pm M-F - no surcharges apply

3 day [P3] if received by 3pm M-F - 20% rush surcharge minimum

2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

1 day [P1] if received by 3pm M-F - 100% rush surcharge minimum

Same day [E] if received by 10am M-S - 200% rush surcharge. Add may apply to rush requests on weekends, statutory holidays and non.

Date and Time Required for all EAP TATs

For all tests with rush TATs requested, please contact your A/E to confirm availability.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered/and Preserved (FP) below

Metals

Mercury

Swab Area (cm²)

SAMPLES ON HOLD

EXTENDED STORAGE REQUIRED

SUSPECTED HAZARD (see notes)

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Drinking Water (DW) Samples (client use)

Are samples taken from a Regulated DW System? YES NO

Are samples for human consumption/ use? YES NO

SHIPMENT RELEASE (client use)

Date:

Time:

Received by: G. SMITH

Date: 24-Aug-2025

Time: 11:30

Received by: G.M.F.

Date: 28/AUG/2025

Time: 8:45

INITIAL SHIPMENT RECEPTION (ALS use only)

FINAL SHIPMENT RECEPTION (ALS use only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: NONE ICE ICE BAGS FROZEN COOLING INITIATED

Submission Comments identified on Sample Receipt/Notification: YES NO

Cooler Custody Seals Intact: YES N/A Sample Custody Seals Intact: YES N/A

INITIAL COOLER TEMPERATURES °C: 20.4 FINAL COOLER TEMPERATURES °C: 13.8

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
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.

TRACE METALS IN ZOOPLANKTON



CERTIFICATE OF ANALYSIS

Work Order	: WT2427728		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec Quebec Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: Zooplankton	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Date Analysis Commenced	: 24-Sep-2024
C-O-C number	: ----	Issue Date	: 09-Oct-2024 11:36
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
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 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>
Greg Pokocky	Manager - Inorganics	Metals, Waterloo, Ontario



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.

Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLIS	Detection Limit Adjusted due to insufficient sample.



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID				
					2024-PI-MI-P0	2024-PI-MI-P2	2024-PI-MI-M0D	2024-PI-MI-M1D	2024-PI-MI-M3D
					Client sampling date / time				
					07-Sep-2024 13:00	10-Sep-2024 13:00	11-Sep-2024 13:00	11-Sep-2024 13:00	11-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427728-001	WT2427728-005	WT2427728-006	WT2427728-007	WT2427728-008
					Result	Result	Result	Result	Result
Total Metals									
Aluminum, total	7429-90-5	E440B/WT	2.0	mg/L	300	8.9	6.4	6.7	2.2
Antimony, total	7440-36-0	E440B/WT	0.020	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Arsenic, total	7440-38-2	E440B/WT	0.020	mg/L	0.089	0.063	0.021	0.121	<0.020
Barium, total	7440-39-3	E440B/WT	0.040	mg/L	1.47	0.304	0.092	0.056	<0.040
Beryllium, total	7440-41-7	E440B/WT	0.020	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Bismuth, total	7440-69-9	E440B/WT	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Boron, total	7440-42-8	E440B/WT	2.0	mg/L	3.6	4.0	3.5	2.7	3.1
Cadmium, total	7440-43-9	E440B/WT	0.0020	mg/L	0.0125	0.0456	0.0055	0.0511	0.0041
Calcium, total	7440-70-2	E440B/WT	100	mg/L	550	470	350	610	300
Chromium, total	7440-47-3	E440B/WT	0.10	mg/L	1.25	<0.10	<0.10	<0.10	<0.10
Cobalt, total	7440-48-4	E440B/WT	0.10	mg/L	0.29	<0.10	<0.10	<0.10	<0.10
Copper, total	7440-50-8	E440B/WT	0.20	mg/L	0.34	0.20	<0.20	<0.20	<0.20
Iron, total	7439-89-6	E440B/WT	10	mg/L	700	13	<10	<10	<10
Lead, total	7439-92-1	E440B/WT	0.020	mg/L	0.112	0.028	<0.020	<0.020	<0.020
Lithium, total	7439-93-2	E440B/WT	0.20	mg/L	0.82	<0.20	<0.20	<0.20	<0.20
Magnesium, total	7439-95-4	E440B/WT	10	mg/L	1350	1190	1150	1060	957
Manganese, total	7439-96-5	E440B/WT	0.10	mg/L	9.34	0.65	0.37	0.22	<0.10
Mercury, total	7439-97-6	E508B/WT	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Molybdenum, total	7439-98-7	E440B/WT	0.010	mg/L	0.016	0.012	<0.010	0.010	<0.010
Nickel, total	7440-02-0	E440B/WT	0.10	mg/L	0.83	<0.10	<0.10	<0.10	<0.10
Phosphorus, total	7723-14-0	E440B/WT	10	mg/L	46	52	34	182	<10



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID				
					2024-PI-MI-P0	2024-PI-MI-P2	2024-PI-MI-M0D	2024-PI-MI-M1D	2024-PI-MI-M3D
					Client sampling date / time				
					07-Sep-2024 13:00	10-Sep-2024 13:00	11-Sep-2024 13:00	11-Sep-2024 13:00	11-Sep-2024 13:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427728-001	WT2427728-005	WT2427728-006	WT2427728-007	WT2427728-008
					Result	Result	Result	Result	Result
Total Metals									
Potassium, total	7440-09-7	E440B/WT	10	mg/L	545	421	396	498	276
Selenium, total	7782-49-2	E440B/WT	0.010	mg/L	0.026	0.038	0.012	0.049	<0.010
Silver, total	7440-22-4	E440B/WT	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium, total	7440-23-5	E440B/WT	10	mg/L	6700	8960	8690	7910	7240
Strontium, total	7440-24-6	E440B/WT	0.0200	mg/L	20.0	154	12.9	11.0	6.36
Sulfur, total	7704-34-9	E440B/WT	100	mg/L	630	880	750	740	680
Thallium, total	7440-28-0	E440B/WT	0.0020	mg/L	0.0132	<0.0020	<0.0020	<0.0020	<0.0020
Tin, total	7440-31-5	E440B/WT	0.020	mg/L	0.022	0.076	<0.020	<0.020	<0.020
Titanium, total	7440-32-6	E440B/WT	0.060	mg/L	47.6	0.467	0.266	0.259	0.066
Tungsten, total	7440-33-7	E440B/WT	0.18	mg/L	<0.18	<0.18	<0.18	<0.18	<0.18
Uranium, total	7440-61-1	E440B/WT	0.0020	mg/L	0.0247	0.0047	0.0032	0.0041	0.0031
Vanadium, total	7440-62-2	E440B/WT	0.10	mg/L	1.03	<0.10	<0.10	<0.10	<0.10
Zinc, total	7440-66-6	E440B/WT	0.60	mg/L	3.33	2.27	0.84	1.75	<0.60
Zirconium, total	7440-67-7	E440B/WT	0.060	mg/L	0.143	<0.060	<0.060	<0.060	<0.060

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID	2024-PI-MI-T0D	2024-PI-MI-T1D	2024-PI-MI-T3D	----	----
					Client sampling date / time	12-Sep-2024 13:00	13-Sep-2024 13:00	13-Sep-2024 13:00	----	----
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427728-009	WT2427728-010	WT2427728-011	----	----	
					Result	Result	Result	----	----	
Total Metals										
Aluminum, total	7429-90-5	E440B/WT	2.0	mg/L	26.6	4.7	2.2	----	----	
Antimony, total	7440-36-0	E440B/WT	0.020	mg/L	<0.200 DLHC	<0.025 DLHC	<0.020	----	----	
Arsenic, total	7440-38-2	E440B/WT	0.020	mg/L	<0.200 DLHC	<0.025 DLHC	<0.020	----	----	
Barium, total	7440-39-3	E440B/WT	0.040	mg/L	0.218	0.057	<0.040	----	----	
Beryllium, total	7440-41-7	E440B/WT	0.020	mg/L	<0.040 DLHC	<0.020	<0.020	----	----	
Bismuth, total	7440-69-9	E440B/WT	0.010	mg/L	<0.100 DLHC	<0.012 DLHC	<0.010	----	----	
Boron, total	7440-42-8	E440B/WT	2.0	mg/L	<20.0 DLHC	4.7	2.8	----	----	
Cadmium, total	7440-43-9	E440B/WT	0.0020	mg/L	0.0196	<0.0020	<0.0020	----	----	
Calcium, total	7440-70-2	E440B/WT	100	mg/L	240	430	250	----	----	
Chromium, total	7440-47-3	E440B/WT	0.10	mg/L	<1.00 DLHC	<0.12 DLHC	<0.10	----	----	
Cobalt, total	7440-48-4	E440B/WT	0.10	mg/L	<0.20 DLHC	<0.10	<0.10	----	----	
Copper, total	7440-50-8	E440B/WT	0.20	mg/L	<1.00 DLHC	<0.20	<0.20	----	----	
Iron, total	7439-89-6	E440B/WT	10	mg/L	<20 DLHC	<10	<10	----	----	
Lead, total	7439-92-1	E440B/WT	0.020	mg/L	<0.100 DLHC	<0.020	<0.020	----	----	
Lithium, total	7439-93-2	E440B/WT	0.20	mg/L	<2.00 DLHC	<0.25 DLHC	<0.20	----	----	
Magnesium, total	7439-95-4	E440B/WT	10	mg/L	526	1450	831	----	----	
Manganese, total	7439-96-5	E440B/WT	0.10	mg/L	1.21	<0.10	<0.10	----	----	
Mercury, total	7439-97-6	E508B/WT	0.00050	mg/L	<0.00500 DLIS	<0.00062 DLIS	<0.00050	----	----	
Molybdenum, total	7439-98-7	E440B/WT	0.010	mg/L	<0.100 DLHC	<0.012 DLHC	<0.010	----	----	
Nickel, total	7440-02-0	E440B/WT	0.10	mg/L	<1.00 DLHC	<0.12 DLHC	<0.10	----	----	
Phosphorus, total	7723-14-0	E440B/WT	10	mg/L	<100 DLHC	14	12	----	----	



Analytical Results

Sub-Matrix: Water
 (Matrix: Water)

					Client sample ID	2024-PI-MI-T0D	2024-PI-MI-T1D	2024-PI-MI-T3D	----	----
					Client sampling date / time	12-Sep-2024 13:00	13-Sep-2024 13:00	13-Sep-2024 13:00	----	----
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2427728-009	WT2427728-010	WT2427728-011	----	----	
					Result	Result	Result	----	----	
Total Metals										
Potassium, total	7440-09-7	E440B/WT	10	mg/L	181	432	252	----	----	
Selenium, total	7782-49-2	E440B/WT	0.010	mg/L	<0.100 DLHC	<0.012 DLHC	<0.010	----	----	
Silver, total	7440-22-4	E440B/WT	0.010	mg/L	<0.020 DLHC	<0.010	<0.010	----	----	
Sodium, total	7440-23-5	E440B/WT	10	mg/L	4150	10800	6380	----	----	
Strontium, total	7440-24-6	E440B/WT	0.0200	mg/L	3.01	8.84	4.51	----	----	
Sulfur, total	7704-34-9	E440B/WT	100	mg/L	<1000 DLHC	1040	580	----	----	
Thallium, total	7440-28-0	E440B/WT	0.0020	mg/L	0.147	<0.0025 DLHC	<0.0020	----	----	
Tin, total	7440-31-5	E440B/WT	0.020	mg/L	<0.200 DLHC	<0.025 DLHC	<0.020	----	----	
Titanium, total	7440-32-6	E440B/WT	0.060	mg/L	<0.600 DLHC	0.086	<0.060	----	----	
Tungsten, total	7440-33-7	E440B/WT	0.18	mg/L	<0.20 DLHC	<0.18	<0.18	----	----	
Uranium, total	7440-61-1	E440B/WT	0.0020	mg/L	<0.0200 DLHC	0.0049	0.0036	----	----	
Vanadium, total	7440-62-2	E440B/WT	0.10	mg/L	<1.00 DLHC	<0.12 DLHC	<0.10	----	----	
Zinc, total	7440-66-6	E440B/WT	0.60	mg/L	<6.00 DLHC	<0.75 DLHC	<0.60	----	----	
Zirconium, total	7440-67-7	E440B/WT	0.060	mg/L	<0.400 DLHC	<0.060	<0.060	----	----	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



QUALITY CONTROL INTERPRETIVE REPORT

<p>Work Order : WT2427728</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : Zooplankton</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 8</p> <p>No. of samples analysed : 8</p>	<p>Page : 1 of 7</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 18-Sep-2024 10:30</p> <p>Issue Date : 09-Oct-2024 11:36</p>
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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.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) 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 : Analytical Method 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	
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T1D	E440B	13-Sep-2024	24-Sep-2024	30 days	11 days	✔	24-Sep-2024	30 days	11 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T3D	E440B	13-Sep-2024	24-Sep-2024	30 days	11 days	✔	24-Sep-2024	30 days	11 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T0D	E440B	12-Sep-2024	24-Sep-2024	30 days	12 days	✔	24-Sep-2024	30 days	12 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M0D	E440B	11-Sep-2024	24-Sep-2024	30 days	13 days	✔	24-Sep-2024	30 days	13 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M1D	E440B	11-Sep-2024	24-Sep-2024	30 days	13 days	✔	24-Sep-2024	30 days	13 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M3D	E440B	11-Sep-2024	24-Sep-2024	30 days	13 days	✔	24-Sep-2024	30 days	13 days	✔
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)										
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-P2	E440B	10-Sep-2024	24-Sep-2024	30 days	14 days	✔	24-Sep-2024	30 days	14 days	✔



Matrix: **Water** Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method 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		
Total Metals : Metals in Liquid Sludge by CRC ICPMS (mg/L)											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-P0	E440B	07-Sep-2024	24-Sep-2024	30 days	17 days	✓	24-Sep-2024	30 days	17 days	✓	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T1D	E508B	13-Sep-2024	24-Sep-2024	0 hrs	265 hrs	* UCP	25-Sep-2024	0 hrs	282 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T3D	E508B	13-Sep-2024	24-Sep-2024	0 hrs	265 hrs	* UCP	25-Sep-2024	0 hrs	282 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-T0D	E508B	12-Sep-2024	24-Sep-2024	0 hrs	289 hrs	* UCP	25-Sep-2024	0 hrs	306 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M0D	E508B	11-Sep-2024	24-Sep-2024	0 hrs	313 hrs	* UCP	25-Sep-2024	0 hrs	330 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M1D	E508B	11-Sep-2024	24-Sep-2024	0 hrs	313 hrs	* UCP	25-Sep-2024	0 hrs	330 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-M3D	E508B	11-Sep-2024	24-Sep-2024	0 hrs	313 hrs	* UCP	25-Sep-2024	0 hrs	330 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-P2	E508B	10-Sep-2024	24-Sep-2024	0 hrs	337 hrs	* UCP	25-Sep-2024	0 hrs	354 hrs	* UCP	
Total Metals : Total Mercury in Liquid Sludge by CVAAS											
Non ALS HDPE Container - Lab Preserved 2024-PI-MI-P0	E508B	07-Sep-2024	24-Sep-2024	0 hrs	409 hrs	* UCP	25-Sep-2024	0 hrs	426 hrs	* UCP	

[Legend & Qualifier Definitions](#)

Page : 5 of 7
Work Order : WT2427728
Client : ArctiConnexion
Project : Zooplankton



Rec. HT: ALS recommended hold time (see units).

UCP: Unsuitable Container and/or Preservative used (invalidates standard hold time). Maximum hold time of zero applied. Test results may be biased low / unreliable, and may not meet regulatory requirements.



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	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Duplicates (DUP)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1669737	1	15	6.6	5.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1669738	1	14	7.1	5.0	✔
Laboratory Control Samples (LCS)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1669737	2	15	13.3	10.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1669738	2	14	14.2	10.0	✔
Method Blanks (MB)							
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B	1669737	1	15	6.6	5.0	✔
Total Mercury in Liquid Sludge by CVAAS	E508B	1669738	1	14	7.1	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>
Metals in Liquid Sludge by CRC ICPMS (mg/L)	E440B ALS Environmental - Waterloo	Water	6020B (mod)	Sludge samples are digested with nitric and hydrochloric acids, followed by analysis by Collision/Reaction Cell ICPMS. Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.
Total Mercury in Liquid Sludge by CVAAS	E508B ALS Environmental - Waterloo	Water	EPA 200.2 (mod)/1631E (mod)	Sludge samples are preserved with HCl and/or BrCl, digested with HNO ₃ and HCl at 95C, followed by CVAAS analysis.
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Digestion for Metals and Mercury in Liquid Sludge	EP440B ALS Environmental - Waterloo	Water	EPA 200.2	Liquid Sludge samples are digested with nitric and hydrochloric acids.

QUALITY CONTROL REPORT

Work Order	: WT2427728	Page	: 1 of 10
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec QC Canada G1L 2W1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: Zooplankton	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Date Analysis Commenced	: 24-Sep-2024
C-O-C number	: ----	Issue Date	: 09-Oct-2024 11:36
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
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>
Greg Pokocky	Manager - Inorganics	Waterloo Metals, Waterloo, Ontario

Page : 2 of 10
Work Order : WT2427728
Client : ArctiConnexion
Project : Zooplankton



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: Water					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
Total Metals (QC Lot: 1669737)											
WT2427413-001	Anonymous	Aluminum, total	7429-90-5	E440B	2.0	mg/L	613	595	3.01%	40%	----
		Antimony, total	7440-36-0	E440B	0.020	mg/L	0.028	0.028	0.0004	Diff <2x LOR	----
		Arsenic, total	7440-38-2	E440B	0.020	mg/L	0.066	0.067	0.0009	Diff <2x LOR	----
		Barium, total	7440-39-3	E440B	0.040	mg/L	5.84	5.54	5.38%	40%	----
		Beryllium, total	7440-41-7	E440B	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		Bismuth, total	7440-69-9	E440B	0.010	mg/L	0.291	0.281	3.58%	40%	----
		Boron, total	7440-42-8	E440B	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
		Cadmium, total	7440-43-9	E440B	0.0020	mg/L	0.0106	0.0094	11.8%	40%	----
		Calcium, total	7440-70-2	E440B	100	mg/L	300	310	5	Diff <2x LOR	----
		Chromium, total	7440-47-3	E440B	0.10	mg/L	0.41	0.41	0.001	Diff <2x LOR	----
		Cobalt, total	7440-48-4	E440B	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
		Copper, total	7440-50-8	E440B	0.20	mg/L	5.91	5.71	3.40%	40%	----
		Iron, total	7439-89-6	E440B	10	mg/L	471	465	1.36%	40%	----
		Lead, total	7439-92-1	E440B	0.020	mg/L	0.207	0.265	24.9%	40%	----
		Lithium, total	7439-93-2	E440B	0.20	mg/L	<0.20	<0.20	0	Diff <2x LOR	----
		Magnesium, total	7439-95-4	E440B	10	mg/L	61	59	3.91%	40%	----
		Manganese, total	7439-96-5	E440B	0.10	mg/L	10.7	10.3	3.10%	40%	----
		Molybdenum, total	7439-98-7	E440B	0.010	mg/L	0.057	0.057	0.0352%	40%	----
		Nickel, total	7440-02-0	E440B	0.10	mg/L	0.37	0.34	0.04	Diff <2x LOR	----
		Phosphorus, total	7723-14-0	E440B	10	mg/L	325	320	1.45%	40%	----
		Potassium, total	7440-09-7	E440B	10	mg/L	47	45	2	Diff <2x LOR	----
		Selenium, total	7782-49-2	E440B	0.010	mg/L	0.034	0.037	0.004	Diff <2x LOR	----
		Silver, total	7440-22-4	E440B	0.010	mg/L	0.011	0.022	0.012	Diff <2x LOR	----
		Sodium, total	7440-23-5	E440B	10	mg/L	36	35	0.9	Diff <2x LOR	----
		Strontium, total	7440-24-6	E440B	0.0400	mg/L	0.806	0.779	3.47%	40%	----
		Sulfur, total	7704-34-9	E440B	100	mg/L	<100	<100	0	Diff <2x LOR	----
		Thallium, total	7440-28-0	E440B	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
		Tin, total	7440-31-5	E440B	0.020	mg/L	0.209	0.235	11.4%	40%	----
		Titanium, total	7440-32-6	E440B	0.060	mg/L	4.57	4.40	3.72%	40%	----
		Tungsten, total	7440-33-7	E440B	0.18	mg/L	<0.18	<0.18	0	Diff <2x LOR	----



Sub-Matrix: Water					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
Total Metals (QC Lot: 1669737) - continued											
WT2427413-001	Anonymous	Uranium, total	7440-61-1	E440B	0.0020	mg/L	0.0306	0.0303	0.854%	40%	----
		Vanadium, total	7440-62-2	E440B	0.10	mg/L	0.65	0.64	2.18%	40%	----
		Zinc, total	7440-66-6	E440B	0.60	mg/L	17.4	17.3	0.212%	40%	----
		Zirconium, total	7440-67-7	E440B	0.060	mg/L	0.152	0.172	0.020	Diff <2x LOR	----
Total Metals (QC Lot: 1669738)											
WT2427413-001	Anonymous	Mercury, total	7439-97-6	E508B	0.00050	mg/L	0.00467	0.00498	6.42%	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: Water

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 1669737)						
Aluminum, total	7429-90-5	E440B	2	mg/L	<3.0	---
Antimony, total	7440-36-0	E440B	0.02	mg/L	<0.100	---
Arsenic, total	7440-38-2	E440B	0.02	mg/L	<0.100	---
Barium, total	7440-39-3	E440B	0.04	mg/L	<0.100	---
Beryllium, total	7440-41-7	E440B	0.02	mg/L	<0.020	---
Bismuth, total	7440-69-9	E440B	0.01	mg/L	<0.050	---
Boron, total	7440-42-8	E440B	2	mg/L	<10.0	---
Cadmium, total	7440-43-9	E440B	0.002	mg/L	<0.0050	---
Calcium, total	7440-70-2	E440B	100	mg/L	<100	---
Chromium, total	7440-47-3	E440B	0.1	mg/L	<0.50	---
Cobalt, total	7440-48-4	E440B	0.1	mg/L	<0.10	---
Copper, total	7440-50-8	E440B	0.2	mg/L	<0.50	---
Iron, total	7439-89-6	E440B	10	mg/L	<10	---
Lead, total	7439-92-1	E440B	0.02	mg/L	<0.050	---
Lithium, total	7439-93-2	E440B	0.2	mg/L	<1.00	---
Magnesium, total	7439-95-4	E440B	10	mg/L	<10	---
Manganese, total	7439-96-5	E440B	0.1	mg/L	<0.10	---
Molybdenum, total	7439-98-7	E440B	0.01	mg/L	<0.050	---
Nickel, total	7440-02-0	E440B	0.1	mg/L	<0.50	---
Phosphorus, total	7723-14-0	E440B	10	mg/L	<50	---
Potassium, total	7440-09-7	E440B	10	mg/L	<50	---
Selenium, total	7782-49-2	E440B	0.01	mg/L	<0.050	---
Silver, total	7440-22-4	E440B	0.01	mg/L	<0.010	---
Sodium, total	7440-23-5	E440B	10	mg/L	<50	---
Strontium, total	7440-24-6	E440B	0.02	mg/L	<0.200	---
Sulfur, total	7704-34-9	E440B	100	mg/L	<500	---
Thallium, total	7440-28-0	E440B	0.002	mg/L	<0.0100	---
Tin, total	7440-31-5	E440B	0.02	mg/L	<0.100	---
Titanium, total	7440-32-6	E440B	0.06	mg/L	<0.300	---
Uranium, total	7440-61-1	E440B	0.002	mg/L	<0.0100	---
Vanadium, total	7440-62-2	E440B	0.1	mg/L	<0.50	---
Zinc, total	7440-66-6	E440B	0.6	mg/L	<3.00	---



Sub-Matrix: **Water**

<i>Analyte</i>	<i>CAS Number</i>	<i>Method</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>Qualifier</i>
Total Metals (QCLot: 1669737) - continued						
Zirconium, total	7440-67-7	E440B	0.06	mg/L	<0.200	----
Total Metals (QCLot: 1669738)						
Mercury, total	7439-97-6	E508B	0.0005	mg/L	<0.00250	----



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: Water

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1669737)									
Aluminum, total	7429-90-5	E440B	2	mg/L	200 mg/L	93.8	80.0	120	----
Antimony, total	7440-36-0	E440B	0.02	mg/L	100 mg/L	111	80.0	120	----
Arsenic, total	7440-38-2	E440B	0.02	mg/L	100 mg/L	110	80.0	120	----
Barium, total	7440-39-3	E440B	0.04	mg/L	25 mg/L	107	80.0	120	----
Beryllium, total	7440-41-7	E440B	0.02	mg/L	10 mg/L	90.8	80.0	120	----
Bismuth, total	7440-69-9	E440B	0.01	mg/L	100 mg/L	99.2	80.0	120	----
Boron, total	7440-42-8	E440B	2	mg/L	100 mg/L	92.6	80.0	120	----
Cadmium, total	7440-43-9	E440B	0.002	mg/L	10 mg/L	97.3	80.0	120	----
Calcium, total	7440-70-2	E440B	100	mg/L	5000 mg/L	96.6	80.0	120	----
Chromium, total	7440-47-3	E440B	0.1	mg/L	25 mg/L	101	80.0	120	----
Cobalt, total	7440-48-4	E440B	0.1	mg/L	25 mg/L	99.9	80.0	120	----
Copper, total	7440-50-8	E440B	0.2	mg/L	25 mg/L	100	80.0	120	----
Iron, total	7439-89-6	E440B	10	mg/L	100 mg/L	95.2	80.0	120	----
Lead, total	7439-92-1	E440B	0.02	mg/L	50 mg/L	101	80.0	120	----
Lithium, total	7439-93-2	E440B	0.2	mg/L	25 mg/L	85.2	80.0	120	----
Magnesium, total	7439-95-4	E440B	10	mg/L	5000 mg/L	107	80.0	120	----
Manganese, total	7439-96-5	E440B	0.1	mg/L	25 mg/L	100	80.0	120	----
Molybdenum, total	7439-98-7	E440B	0.01	mg/L	25 mg/L	102	80.0	120	----
Nickel, total	7440-02-0	E440B	0.1	mg/L	50 mg/L	99.2	80.0	120	----
Phosphorus, total	7723-14-0	E440B	10	mg/L	1000 mg/L	112	80.0	120	----
Potassium, total	7440-09-7	E440B	10	mg/L	5000 mg/L	104	80.0	120	----
Selenium, total	7782-49-2	E440B	0.01	mg/L	100 mg/L	102	80.0	120	----
Silver, total	7440-22-4	E440B	0.01	mg/L	10 mg/L	91.0	80.0	120	----
Sodium, total	7440-23-5	E440B	10	mg/L	5000 mg/L	98.3	80.0	120	----
Strontium, total	7440-24-6	E440B	0.02	mg/L	25 mg/L	100	80.0	120	----
Sulfur, total	7704-34-9	E440B	100	mg/L	5000 mg/L	98.4	80.0	120	----
Thallium, total	7440-28-0	E440B	0.002	mg/L	100 mg/L	98.8	80.0	120	----
Tin, total	7440-31-5	E440B	0.02	mg/L	50 mg/L	101	80.0	120	----
Titanium, total	7440-32-6	E440B	0.06	mg/L	25 mg/L	102	80.0	120	----
Uranium, total	7440-61-1	E440B	0.002	mg/L	0.5 mg/L	99.9	80.0	120	----
Vanadium, total	7440-62-2	E440B	0.1	mg/L	50 mg/L	103	80.0	120	----
Zinc, total	7440-66-6	E440B	0.6	mg/L	50 mg/L	97.4	80.0	120	----
Zirconium, total	7440-67-7	E440B	0.06	mg/L	10 mg/L	95.7	80.0	120	----



Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1669738)									
Mercury, total	7439-97-6	E508B	0.0005	mg/L	0.1 mg/L	99.5	70.0	130	----



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:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Total Metals (QCLot: 1669737)									
QC-1669737-003	RM	Aluminum, total	7429-90-5	E440B	22500 mg/L	107	70.0	130	----
QC-1669737-003	RM	Antimony, total	7440-36-0	E440B	24.8 mg/L	103	70.0	130	----
QC-1669737-003	RM	Arsenic, total	7440-38-2	E440B	21.2 mg/L	100	70.0	130	----
QC-1669737-003	RM	Barium, total	7440-39-3	E440B	788 mg/L	113	70.0	130	----
QC-1669737-003	RM	Beryllium, total	7440-41-7	E440B	1.82 mg/L	91.9	70.0	130	----
QC-1669737-003	RM	Bismuth, total	7440-69-9	E440B	1.78 mg/L	92.8	70.0	130	----
QC-1669737-003	RM	Cadmium, total	7440-43-9	E440B	2.15 mg/L	100	70.0	130	----
QC-1669737-003	RM	Calcium, total	7440-70-2	E440B	4900 mg/L	97.6	70.0	130	----
QC-1669737-003	RM	Chromium, total	7440-47-3	E440B	56.9 mg/L	101	70.0	130	----
QC-1669737-003	RM	Cobalt, total	7440-48-4	E440B	32 mg/L	100	70.0	130	----
QC-1669737-003	RM	Copper, total	7440-50-8	E440B	969 mg/L	110	70.0	130	----
QC-1669737-003	RM	Iron, total	7439-89-6	E440B	32700 mg/L	104	70.0	130	----
QC-1669737-003	RM	Lead, total	7439-92-1	E440B	919 mg/L	97.1	70.0	130	----
QC-1669737-003	RM	Lithium, total	7439-93-2	E440B	47.3 mg/L	86.6	70.0	130	----
QC-1669737-003	RM	Magnesium, total	7439-95-4	E440B	7780 mg/L	106	70.0	130	----
QC-1669737-003	RM	Manganese, total	7439-96-5	E440B	8640 mg/L	109	70.0	130	----
QC-1669737-003	RM	Molybdenum, total	7439-98-7	E440B	25.1 mg/L	98.8	70.0	130	----
QC-1669737-003	RM	Nickel, total	7440-02-0	E440B	1000 mg/L	96.5	70.0	130	----
QC-1669737-003	RM	Phosphorus, total	7723-14-0	E440B	660 mg/L	96.1	70.0	130	----
QC-1669737-003	RM	Potassium, total	7440-09-7	E440B	10800 mg/L	107	70.0	130	----
QC-1669737-003	RM	Selenium, total	7782-49-2	E440B	1.04 mg/L	93.6	60.0	140	----
QC-1669737-003	RM	Silver, total	7440-22-4	E440B	8.98 mg/L	93.9	70.0	130	----
QC-1669737-003	RM	Sodium, total	7440-23-5	E440B	1770 mg/L	109	70.0	130	----
QC-1669737-003	RM	Strontium, total	7440-24-6	E440B	41 mg/L	97.7	70.0	130	----
QC-1669737-003	RM	Sulfur, total	7704-34-9	E440B	3940 mg/L	96.6	50.0	150	----
QC-1669737-003	RM	Thallium, total	7440-28-0	E440B	0.907 mg/L	93.6	70.0	130	----
QC-1669737-003	RM	Tin, total	7440-31-5	E440B	3.79 mg/L	103	40.0	160	----
QC-1669737-003	RM	Titanium, total	7440-32-6	E440B	2790 mg/L	106	70.0	130	----
QC-1669737-003	RM	Tungsten, total	7440-33-7	E440B	6.99 mg/L	110	70.0	130	----
QC-1669737-003	RM	Uranium, total	7440-61-1	E440B	3.97 mg/L	87.2	70.0	130	----
QC-1669737-003	RM	Vanadium, total	7440-62-2	E440B	66.2 mg/L	100	70.0	130	----
QC-1669737-003	RM	Zinc, total	7440-66-6	E440B	828 mg/L	97.3	70.0	130	----
QC-1669737-003	RM	Zirconium, total	7440-67-7	E440B	6.91 mg/L	122	70.0	130	----

Page : 10 of 10
 Work Order : WT2427728
 Client : ArctiConnexion
 Project : Zooplankton



Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Total Metals (QCLot: 1669738)									
QC-1669738-003	RM	Mercury, total	7439-97-6	E508B	0.068 mg/L	94.5	70.0	130	----



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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 20 -

Page

Environmental Division
Waterloo
Work Order Reference
WT2427728

Report To: Contact and company name below will appear on the final report

Company: Arc/Comexion
 Contact: Gwenaelle Minnot-Kohl
 Phone: 581-989-5477
 Street: 422 3e Ave
 City/Province: Quebec, QC
 Postal Code: G1L 1Y8

Company address below will appear on the final report

Invoice To: Same as Report To
 Copy of Invoice with Report: YES NO

Company: YES NO

Project Information
 ALS Account #: Quote #: 2023 Price List
 Job #: PO / AFE: 08
 LSD: Location: Major/Minor Code: PO#: Routing Code:

Reports / Recipients
 Select Report Format: PDF EXCEL EDD (DIGITAL)
 Merge COC/OCI Reports with COA: YES NO N/A
 Compare Results to Criteria on Report - provide details below if box checked
 Select Distribution: EMAIL MAIL FAX
 Email 1 or Fax: pierre@arcdcomexion.ca
 Email 2: vero@arcdcomexion.ca
 Email 3: vince@arcdcomexion.ca

Invoice Recipients
 Select Invoice Distribution: EMAIL MAIL FAX
 Email 1 or Fax: info@arcdcomexion.ca
 Email 2: OFF and Gas Required Fields (client use)
 AFE/Cost Center: PO#:
 Requisitioner: Routing Code:
 Location:

Turnaround Time (TAT) Requested
 Routine [R] if received by 3pm M-F - no surcharges apply
 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
 Same day [E2] if received by 10am M-S - 200% rush surcharge. Addn fees may apply to rush requests on weekends, statutory holidays and no routine tests
 Date and Time Required for all EAP TATs: _____

Analysis Request
 For all tests with rush TATs requested, please contact your AM to confirm availability.
 Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	ALS Contact: Emily Smith	Date (dd-mm-yy)	Time (hh:mm)	Sampler:	Sample Type	NUMBER OF CONTAINERS	SAMPLES ON HOLD
1	2024-PI-MI-P0		7-Sep-24	13:00	Zooplankton		Total Metals (ICPMS) Total Mercury (CVAAS) TSS TDS Dissolved Metals (ICPMS) Dissolved Mercury Hardness pH	EXTENDED STORAGE REQUIRED
2	2024-PI-MI-P0.5		10-Sep-24	13:00	Zooplankton			
3	2024-PI-MI-P1		10-Sep-24	13:00	Zooplankton			
4	2024-PI-MI-P1.5		10-Sep-24	13:00	Zooplankton			
5	2024-PI-MI-P2		10-Sep-24	13:00	Zooplankton			
6	2024-PI-MI-M0D		11-Sep-24	13:00	Zooplankton			
7	2024-PI-MI-M1D		11-Sep-24	13:00	Zooplankton			
8	2024-PI-MI-M3D		11-Sep-24	13:00	Zooplankton			
9	2024-PI-MI-T0D		12-Sep-24	13:00	Zooplankton			
10	2024-PI-MI-T1D		13-Sep-24	13:00	Zooplankton			
11	2024-PI-MI-T3D		13-Sep-24	13:00	Zooplankton			

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Drinking Water (DW) Samples (client use)
 Are samples taken from a Regulated DW System? YES NO
 Are samples for human consumption/ use? YES NO

SHIPMENT RELEASE (client use)
 Released by: _____ Date: _____

INITIAL SHIPMENT RECEPTION (ALS use only)
 Received by: Lara R. Date: 18/09/24

WHITE - LABORATORY COPY
 YELLOW - CLIENT COPY

FINAL SHIPMENT RECEPTION (ALS use only)
 Received by: AP Date: 19 Sep 24

SAMPLE RECEIPT DETAILS (ALS use only)
 Cooling Method: NONE ICE ICE PACKS FROZEN COOLING INITIATED
 Submission Comments identified on Sample Receipt Notification: YES NO
 Cooler Custody Seals Intact: YES N/A
 Sample Custody Seals Intact: YES N/A
 INITIAL COOLER TEMPERATURES °C: 6.5
 FINAL COOLER TEMPERATURES °C: 12.2

Time: 10:30
 Date: 19 Sep 24
 Time: 9:10

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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.

08. Sept. 20th
 MM-108



CERTIFICATE OF ANALYSIS

Work Order	: WT2501197		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Vancouver
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave Quebec Quebec Canada G1L 2W1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 581 922 1925	Telephone	: +1 604 253 4188
Project	: Zooplankton	Date Samples Received	: 10-Jan-2025 09:00
PO	: ----	Date Analysis Commenced	: 28-Jan-2025
C-O-C number	: ----	Issue Date	: 19-Feb-2025 17:30
Sampler	: ----		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 1		
No. of samples analysed	: 1		

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



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/kg wwt	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	2024-PI-MI-P2	----	----	----	----
Client sampling date / time					08-Jan-2025 13:00	----	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2501197-002	----	----	----	----	----
					Result	----	----	----	----	----
Metals										
Aluminum	7429-90-5	E475A/VA	1.0	mg/kg wwt	109	----	----	----	----	----
Antimony	7440-36-0	E475A/VA	0.0040	mg/kg wwt	0.0157	----	----	----	----	----
Arsenic	7440-38-2	E475A/VA	0.010	mg/kg wwt	0.414	----	----	----	----	----
Barium	7440-39-3	E475A/VA	0.010	mg/kg wwt	2.14	----	----	----	----	----
Beryllium	7440-41-7	E475A/VA	0.0020	mg/kg wwt	<0.0020	----	----	----	----	----
Bismuth	7440-69-9	E475A/VA	0.0020	mg/kg wwt	<0.0020	----	----	----	----	----
Boron	7440-42-8	E475A/VA	0.20	mg/kg wwt	9.44	----	----	----	----	----
Cadmium	7440-43-9	E475A/VA	0.0020	mg/kg wwt	1.00	----	----	----	----	----
Calcium	7440-70-2	E475A/VA	4.0	mg/kg wwt	18400	----	----	----	----	----
Cesium	7440-46-2	E475A/VA	0.0010	mg/kg wwt	0.0045	----	----	----	----	----
Chromium	7440-47-3	E475A/VA	0.040	mg/kg wwt	0.669	----	----	----	----	----
Cobalt	7440-48-4	E475A/VA	0.0040	mg/kg wwt	0.0726	----	----	----	----	----
Copper	7440-50-8	E475A/VA	0.040	mg/kg wwt	1.00	----	----	----	----	----
Iron	7439-89-6	E475A/VA	1.0	mg/kg wwt	59.2	----	----	----	----	----
Lead	7439-92-1	E475A/VA	0.010	mg/kg wwt	0.078	----	----	----	----	----
Lithium	7439-93-2	E475A/VA	0.10	mg/kg wwt	0.23	----	----	----	----	----
Magnesium	7439-95-4	E475A/VA	0.40	mg/kg wwt	885	----	----	----	----	----
Manganese	7439-96-5	E475A/VA	0.010	mg/kg wwt	8.45	----	----	----	----	----
Mercury	7439-97-6	E512A/VA	0.0020	mg/kg wwt	0.0033	----	----	----	----	----



Analytical Results

Sub-Matrix: Tissue
 (Matrix: Biota)

					Client sample ID	2024-PI-MI-P2	----	----	----	----
					Client sampling date / time	08-Jan-2025 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2501197-002	----	----	----	----	----
						Result	----	----	----	----
Metals										
Molybdenum	7439-98-7	E475A/VA	0.0080	mg/kg wwt	0.0592	----	----	----	----	----
Nickel	7440-02-0	E475A/VA	0.040	mg/kg wwt	0.239	----	----	----	----	----
Phosphorus	7723-14-0	E475A/VA	4.0	mg/kg wwt	1110	----	----	----	----	----
Potassium	7440-09-7	E475A/VA	4.0	mg/kg wwt	207	----	----	----	----	----
Rubidium	7440-17-7	E475A/VA	0.010	mg/kg wwt	0.169	----	----	----	----	----
Selenium	7782-49-2	E475A/VA	0.020	mg/kg wwt	0.376	----	----	----	----	----
Sodium	7440-23-5	E475A/VA	4.0	mg/kg wwt	1650	----	----	----	----	----
Strontium	7440-24-6	E475A/VA	0.020	mg/kg wwt	720	----	----	----	----	----
Tellurium	13494-80-9	E475A/VA	0.0040	mg/kg wwt	0.0255	----	----	----	----	----
Thallium	7440-28-0	E475A/VA	0.00040	mg/kg wwt	0.00105	----	----	----	----	----
Tin	7440-31-5	E475A/VA	0.020	mg/kg wwt	0.044	----	----	----	----	----
Uranium	7440-61-1	E475A/VA	0.00040	mg/kg wwt	0.0433	----	----	----	----	----
Vanadium	7440-62-2	E475A/VA	0.020	mg/kg wwt	0.213	----	----	----	----	----
Zinc	7440-66-6	E475A/VA	0.20	mg/kg wwt	18.3	----	----	----	----	----
Zirconium	7440-67-7	E475A/VA	0.040	mg/kg wwt	0.094	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.



QUALITY CONTROL INTERPRETIVE REPORT

<p>Work Order : WT2501197</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : Zooplankton</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 1</p> <p>No. of samples analysed : 1</p>	<p>Page : 1 of 5</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 10-Jan-2025 09:00</p> <p>Issue Date : 19-Feb-2025 17:30</p>
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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.
- No Laboratory Control Sample (LCS) 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 : Analytical Method 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 (WET units, Biopsy)										
Non ALS HDPE - unpreserved 2024-PI-MI-P2	E512A	08-Jan-2025	28-Jan-2025	365 days	20 days	✔	05-Feb-2025	365 days	28 days	✔
Metals : Metals in Biota by CRC ICPMS (WET units, Biopsy)										
Non ALS HDPE - unpreserved 2024-PI-MI-P2	E475A	08-Jan-2025	28-Jan-2025	730 days	20 days	✔	29-Jan-2025	730 days	21 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	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
<i>Analytical Methods</i>							
Laboratory Control Samples (LCS)							
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A	1853223	2	1	200.0	10.0	✔
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	1853224	2	1	200.0	10.0	✔
Method Blanks (MB)							
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A	1853223	1	1	100.0	5.0	✔
Mercury in Biota by CVAAS (WET units, Biopsy)	E512A	1853224	1	1	100.0	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>
Metals in Biota by CRC ICPMS (WET units, Biopsy)	E475A ALS Environmental - Vancouver	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 (WET units, Biopsy)	E512A ALS Environmental - Vancouver	Biota	EPA 200.3/1631 Appendix (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 (Biopsy)	EP475 ALS Environmental - Vancouver	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

<p>Work Order : WT2501197</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : Zooplankton</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 1</p> <p>No. of samples analysed : 1</p>	<p>Page : 1 of 7</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 10-Jan-2025 09:00</p> <p>Date Analysis Commenced : 28-Jan-2025</p> <p>Issue Date : 19-Feb-2025 17:30</p>
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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:

- 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>
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia

Page : 2 of 7
Work Order : WT2501197
Client : ArctiConnexion
Project : Zooplankton



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.



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
Metals (QCLot: 1853223)						
Aluminum	7429-90-5	E475A	1	mg/kg wwt	<1.0	----
Antimony	7440-36-0	E475A	0.004	mg/kg wwt	<0.0040	----
Arsenic	7440-38-2	E475A	0.01	mg/kg wwt	<0.010	----
Barium	7440-39-3	E475A	0.01	mg/kg wwt	<0.010	----
Beryllium	7440-41-7	E475A	0.002	mg/kg wwt	<0.0020	----
Bismuth	7440-69-9	E475A	0.002	mg/kg wwt	<0.0020	----
Boron	7440-42-8	E475A	0.2	mg/kg wwt	<0.20	----
Cadmium	7440-43-9	E475A	0.002	mg/kg wwt	<0.0020	----
Calcium	7440-70-2	E475A	4	mg/kg wwt	<4.0	----
Cesium	7440-46-2	E475A	0.001	mg/kg wwt	<0.0010	----
Chromium	7440-47-3	E475A	0.04	mg/kg wwt	<0.040	----
Cobalt	7440-48-4	E475A	0.004	mg/kg wwt	<0.0040	----
Copper	7440-50-8	E475A	0.04	mg/kg wwt	<0.040	----
Iron	7439-89-6	E475A	1	mg/kg wwt	<1.0	----
Lead	7439-92-1	E475A	0.01	mg/kg wwt	<0.010	----
Lithium	7439-93-2	E475A	0.1	mg/kg wwt	<0.10	----
Magnesium	7439-95-4	E475A	0.4	mg/kg wwt	<0.40	----
Manganese	7439-96-5	E475A	0.01	mg/kg wwt	<0.010	----
Molybdenum	7439-98-7	E475A	0.008	mg/kg wwt	<0.0080	----
Nickel	7440-02-0	E475A	0.04	mg/kg wwt	<0.040	----
Phosphorus	7723-14-0	E475A	4	mg/kg wwt	<4.0	----
Potassium	7440-09-7	E475A	4	mg/kg wwt	<4.0	----
Rubidium	7440-17-7	E475A	0.01	mg/kg wwt	<0.010	----
Selenium	7782-49-2	E475A	0.02	mg/kg wwt	<0.020	----
Sodium	7440-23-5	E475A	4	mg/kg wwt	<4.0	----
Strontium	7440-24-6	E475A	0.02	mg/kg wwt	<0.020	----
Tellurium	13494-80-9	E475A	0.004	mg/kg wwt	<0.0040	----
Thallium	7440-28-0	E475A	0.0004	mg/kg wwt	<0.00040	----
Tin	7440-31-5	E475A	0.02	mg/kg wwt	<0.020	----
Uranium	7440-61-1	E475A	0.0004	mg/kg wwt	<0.00040	----
Vanadium	7440-62-2	E475A	0.02	mg/kg wwt	<0.020	----
Zinc	7440-66-6	E475A	0.2	mg/kg wwt	<0.20	----



Sub-Matrix: **Biota**

<i>Analyte</i>	<i>CAS Number</i>	<i>Method</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>Qualifier</i>
Metals (QCLot: 1853223) - continued						
Zirconium	7440-67-7	E475A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 1853224)						
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	<0.0020	----



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	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1853223)									
Aluminum	7429-90-5	E475A	1	mg/kg wwt	50 mg/kg wwt	93.9	80.0	120	----
Antimony	7440-36-0	E475A	0.004	mg/kg wwt	25 mg/kg wwt	97.5	80.0	120	----
Arsenic	7440-38-2	E475A	0.01	mg/kg wwt	25 mg/kg wwt	100	80.0	120	----
Barium	7440-39-3	E475A	0.01	mg/kg wwt	6.25 mg/kg wwt	95.0	80.0	120	----
Beryllium	7440-41-7	E475A	0.002	mg/kg wwt	2.5 mg/kg wwt	89.8	80.0	120	----
Bismuth	7440-69-9	E475A	0.002	mg/kg wwt	25 mg/kg wwt	94.0	80.0	120	----
Boron	7440-42-8	E475A	0.2	mg/kg wwt	25 mg/kg wwt	98.2	80.0	120	----
Cadmium	7440-43-9	E475A	0.002	mg/kg wwt	2.5 mg/kg wwt	91.1	80.0	120	----
Calcium	7440-70-2	E475A	4	mg/kg wwt	1250 mg/kg wwt	98.5	80.0	120	----
Cesium	7440-46-2	E475A	0.001	mg/kg wwt	1.25 mg/kg wwt	95.4	80.0	120	----
Chromium	7440-47-3	E475A	0.04	mg/kg wwt	6.25 mg/kg wwt	93.2	80.0	120	----
Cobalt	7440-48-4	E475A	0.004	mg/kg wwt	6.25 mg/kg wwt	91.2	80.0	120	----
Copper	7440-50-8	E475A	0.04	mg/kg wwt	6.25 mg/kg wwt	90.4	80.0	120	----
Iron	7439-89-6	E475A	1	mg/kg wwt	25 mg/kg wwt	95.1	80.0	120	----
Lead	7439-92-1	E475A	0.01	mg/kg wwt	12.5 mg/kg wwt	92.2	80.0	120	----
Lithium	7439-93-2	E475A	0.1	mg/kg wwt	6.25 mg/kg wwt	88.2	80.0	120	----
Magnesium	7439-95-4	E475A	0.4	mg/kg wwt	1250 mg/kg wwt	88.7	80.0	120	----
Manganese	7439-96-5	E475A	0.01	mg/kg wwt	6.25 mg/kg wwt	93.1	80.0	120	----
Molybdenum	7439-98-7	E475A	0.008	mg/kg wwt	6.25 mg/kg wwt	96.9	80.0	120	----
Nickel	7440-02-0	E475A	0.04	mg/kg wwt	12.5 mg/kg wwt	90.6	80.0	120	----
Phosphorus	7723-14-0	E475A	4	mg/kg wwt	250 mg/kg wwt	96.2	80.0	120	----
Potassium	7440-09-7	E475A	4	mg/kg wwt	1250 mg/kg wwt	89.0	80.0	120	----
Rubidium	7440-17-7	E475A	0.01	mg/kg wwt	2.5 mg/kg wwt	91.7	80.0	120	----
Selenium	7782-49-2	E475A	0.02	mg/kg wwt	25 mg/kg wwt	93.9	80.0	120	----
Sodium	7440-23-5	E475A	4	mg/kg wwt	1250 mg/kg wwt	91.9	80.0	120	----
Strontium	7440-24-6	E475A	0.02	mg/kg wwt	6.25 mg/kg wwt	95.5	80.0	120	----
Tellurium	13494-80-9	E475A	0.004	mg/kg wwt	2.5 mg/kg wwt	94.8	80.0	120	----
Thallium	7440-28-0	E475A	0.0004	mg/kg wwt	25 mg/kg wwt	95.4	80.0	120	----
Tin	7440-31-5	E475A	0.02	mg/kg wwt	12.5 mg/kg wwt	95.5	80.0	120	----
Uranium	7440-61-1	E475A	0.0004	mg/kg wwt	0.125 mg/kg wwt	93.2	80.0	120	----
Vanadium	7440-62-2	E475A	0.02	mg/kg wwt	12.5 mg/kg wwt	95.7	80.0	120	----
Zinc	7440-66-6	E475A	0.2	mg/kg wwt	12.5 mg/kg wwt	87.1	80.0	120	----
Zirconium	7440-67-7	E475A	0.04	mg/kg wwt	2.5 mg/kg wwt	99.8	80.0	120	----



Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1853224)									
Mercury	7439-97-6	E512A	0.002	mg/kg wwt	0.05 mg/kg wwt	88.2	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:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Metals (QCLot: 1853223)									
QC-1853223-003	RM	Aluminum	7429-90-5	E475A	147 mg/kg wwt	93.4	70.0	130	----
QC-1853223-003	RM	Arsenic	7440-38-2	E475A	14.5 mg/kg wwt	94.7	70.0	130	----
QC-1853223-003	RM	Barium	7440-39-3	E475A	0.352 mg/kg wwt	100	70.0	130	----
QC-1853223-003	RM	Boron	7440-42-8	E475A	3.47 mg/kg wwt	98.8	70.0	130	----
QC-1853223-003	RM	Cadmium	7440-43-9	E475A	0.153 mg/kg wwt	98.2	70.0	130	----
QC-1853223-003	RM	Calcium	7440-70-2	E475A	2010 mg/kg wwt	101	70.0	130	----
QC-1853223-003	RM	Cesium	7440-46-2	E475A	0.089 mg/kg wwt	92.2	70.0	130	----
QC-1853223-003	RM	Chromium	7440-47-3	E475A	0.453 mg/kg wwt	95.6	50.0	150	----
QC-1853223-003	RM	Cobalt	7440-48-4	E475A	0.057 mg/kg wwt	94.0	65.0	135	----
QC-1853223-003	RM	Copper	7440-50-8	E475A	3.3 mg/kg wwt	94.0	70.0	130	----
QC-1853223-003	RM	Iron	7439-89-6	E475A	102 mg/kg wwt	93.8	70.0	130	----
QC-1853223-003	RM	Lead	7439-92-1	E475A	0.058 mg/kg wwt	95.6	15.0	185	----
QC-1853223-003	RM	Magnesium	7439-95-4	E475A	899 mg/kg wwt	96.5	70.0	130	----
QC-1853223-003	RM	Manganese	7439-96-5	E475A	0.948 mg/kg wwt	94.2	70.0	130	----
QC-1853223-003	RM	Molybdenum	7439-98-7	E475A	0.134 mg/kg wwt	96.3	70.0	130	----
QC-1853223-003	RM	Nickel	7440-02-0	E475A	0.33 mg/kg wwt	110	40.0	160	----
QC-1853223-003	RM	Phosphorus	7723-14-0	E475A	6700 mg/kg wwt	94.6	70.0	130	----
QC-1853223-003	RM	Potassium	7440-09-7	E475A	11600 mg/kg wwt	100	70.0	130	----
QC-1853223-003	RM	Rubidium	7440-17-7	E475A	2.53 mg/kg wwt	93.8	70.0	130	----
QC-1853223-003	RM	Selenium	7782-49-2	E475A	2.48 mg/kg wwt	103	70.0	130	----
QC-1853223-003	RM	Sodium	7440-23-5	E475A	9620 mg/kg wwt	97.7	70.0	130	----
QC-1853223-003	RM	Strontium	7440-24-6	E475A	10.6 mg/kg wwt	90.9	70.0	130	----
QC-1853223-003	RM	Vanadium	7440-62-2	E475A	0.269 mg/kg wwt	92.4	70.0	130	----
QC-1853223-003	RM	Zinc	7440-66-6	E475A	28.7 mg/kg wwt	95.3	70.0	130	----
Metals (QCLot: 1853224)									
QC-1853224-003	RM	Mercury	7439-97-6	E512A	0.281 mg/kg wwt	96.5	70.0	130	----

CHLOROPHYLL-A



CERTIFICATE OF ANALYSIS

Work Order	: WT2428218		
Client	: ArctiConnexion	Laboratory	: ALS Environmental - Waterloo
Contact	: Gwenaelle Minot-Kohl	Account Manager	: Emily Smith
Address	: 422 3e Ave	Address	: 60 Northland Road, Unit 1
	: Quebec Quebec Canada G1L 2W1		: Waterloo ON Canada N2V 2B8
Telephone	: 581 922 1925	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 18-Sep-2024 10:30
PO	: ----	Date Analysis Commenced	: 03-Oct-2024
C-O-C number	: ----	Issue Date	: 25-Oct-2024 11:15
Sampler	: CLIENT		
Site	: ----		
Quote number	: 2024 Price List		
No. of samples received	: 32		
No. of samples analysed	: 32		

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>
ChrysDanielle Mabalot		Inorganics, Winnipeg, Manitoba
Oleksandr Busel		Administration, Winnipeg, Manitoba
Oleksandr Busel		Inorganics, Winnipeg, Manitoba



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>
L	litres
µg/sample	micrograms per sample
µg/L	micrograms 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.

Work Order : WT2428218
Client : ArctiConnexion
Project : ----





Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID				
					2024-PI-MI-P0-1m	2024-PI-MI-P0-5m	2024-PI-MI-P0.5-1m	2024-PI-MI-P0.5-5m	2024-PI-MI-P1-1m
Client sampling date / time					07-Sep-2024 00:00	07-Sep-2024 00:00	10-Sep-2024 00:00	10-Sep-2024 00:00	10-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-001	WT2428218-002	WT2428218-003	WT2428218-004	WT2428218-005
					Result	Result	Result	Result	Result
Field Tests									
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00
Plant Pigments									
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.528	0.492	0.246	0.244	0.278
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.528	0.492	0.246	0.244	0.278

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID				
					2024-PI-MI-P1-5m	2024-PI-MI-P1.5-1m	2024-PI-MI-P1.5-5m	2024-PI-MI-P2-1m	2024-PI-MI-P2-5m
Client sampling date / time					10-Sep-2024 00:00	10-Sep-2024 00:00	10-Sep-2024 00:00	10-Sep-2024 00:00	10-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-006	WT2428218-007	WT2428218-008	WT2428218-009	WT2428218-010
					Result	Result	Result	Result	Result
Field Tests									
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00
Plant Pigments									
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.236	0.203	0.290	0.174	0.180
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.236	0.203	0.290	0.174	0.180

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID	2024-PI-MI-M0C-1m	2024-PI-MI-M0C-5m	2024-PI-MI-M0D-1m	2024-PI-MI-M0D-5m	2024-PI-MI-M1C-1m
					Client sampling date / time	10-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-011	WT2428218-012	WT2428218-013	WT2428218-014	WT2428218-015	
					Result	Result	Result	Result	Result	
Field Tests										
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00	
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.392	0.407	0.407	0.436	0.519	
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.392	0.407	0.407	0.436	0.519	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID	2024-PI-MI-M1C-5m	2024-PI-MI-M1D-1m	2024-PI-MI-M1D-5m	2024-PI-MI-M3C-1m	2024-PI-MI-M3C-5m
					Client sampling date / time	07-Sep-2024 00:00	07-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-016	WT2428218-017	WT2428218-018	WT2428218-019	WT2428218-020	
					Result	Result	Result	Result	Result	
Field Tests										
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00	
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	1.58	0.336	0.422	0.379	0.335	
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	1.58	0.336	0.422	0.379	0.335	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID	2024-PI-MI-T0C-1m	2024-PI-MI-T0C-5m	2024-PI-MI-T0D-1m	2024-PI-MI-T0D-5m	2024-PI-MI-T1C-1m
					Client sampling date / time	11-Sep-2024 00:00	12-Sep-2024 00:00	12-Sep-2024 00:00	12-Sep-2024 00:00	12-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-021	WT2428218-022	WT2428218-023	WT2428218-024	WT2428218-025	
					Result	Result	Result	Result	Result	
Field Tests										
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00	
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.269	0.504	0.361	0.492	0.499	
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.269	0.504	0.361	0.492	0.499	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Filter (Matrix: Water)					Client sample ID	2024-PI-MI-T1C-5m	2024-PI-MI-T1D-1m	2024-PI-MI-T1D-5m	2024-PI-MI-T3C-1m	2024-PI-MI-T3C-5m
					Client sampling date / time	13-Sep-2024 00:00	13-Sep-2024 00:00	13-Sep-2024 00:00	13-Sep-2024 00:00	13-Sep-2024 00:00
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-026	WT2428218-027	WT2428218-028	WT2428218-029	WT2428218-030	
					Result	Result	Result	Result	Result	
Field Tests										
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	1.00	1.00	1.00	
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.399	0.580	0.862	0.394	0.613	
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.399	0.580	0.862	0.394	0.613	

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Filter
(Matrix: Water)

					Client sample ID		2024-PI-MI-T3D-1m	2024-PI-MI-T3D-5m	----	----	----
					Client sampling date / time		13-Sep-2024 00:00	13-Sep-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab/Accreditation	LOR	Unit	WT2428218-031	WT2428218-032	----	----	----	----	----
					Result	Result	----	----	----	----	----
Field Tests											
Sampling volume, field	----	EF003/WP	0.010	L	1.00	1.00	----	----	----	----	----
Plant Pigments											
Chlorophyll a	479-61-8	EC870A/WP	0.010	µg/L	0.421	0.794	----	----	----	----	----
Chlorophyll a	479-61-8	E870A/WP	0.0020	µg/sample	0.421	0.794	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



QUALITY CONTROL INTERPRETIVE REPORT

<p>Work Order : WT2428218</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : ----</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : CLIENT</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 32</p> <p>No. of samples analysed : 32</p>	<p>Page : 1 of 12</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 18-Sep-2024 10:30</p> <p>Issue Date : 25-Oct-2024 11:18</p>
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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.
- No Laboratory Control Sample (LCS) 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: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T1C-5m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T1D-1m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T1D-5m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T3C-1m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T3C-5m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T3D-1m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T3D-5m	EF003	13-Sep-2024	----	----	----		07-Oct-2024	----	25 days	



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T0C-5m	EF003	12-Sep-2024	----	----	----		07-Oct-2024	----	26 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T0D-1m	EF003	12-Sep-2024	----	----	----		07-Oct-2024	----	26 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T0D-5m	EF003	12-Sep-2024	----	----	----		07-Oct-2024	----	26 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T1C-1m	EF003	12-Sep-2024	----	----	----		07-Oct-2024	----	26 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M0C-5m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M0D-1m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M0D-5m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M1C-1m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M1D-5m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M3C-1m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M3C-5m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-T0C-1m	EF003	11-Sep-2024	----	----	----		07-Oct-2024	----	27 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M0C-1m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P0.5-1m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P0.5-5m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P1.5-1m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P1.5-5m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P1-1m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P1-5m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P2-1m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P2-5m	EF003	10-Sep-2024	----	----	----		07-Oct-2024	----	28 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M1C-5m	EF003	07-Sep-2024	----	----	----		07-Oct-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-M1D-1m	EF003	07-Sep-2024	----	----	----		07-Oct-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P0-1m	EF003	07-Sep-2024	----	----	----		07-Oct-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube 2024-PI-MI-P0-5m	EF003	07-Sep-2024	----	----	----		07-Oct-2024	----	31 days	
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T1C-5m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T1D-1m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T1D-5m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T3C-1m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T3C-5m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T3D-1m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T3D-5m	E870A	13-Sep-2024	03-Oct-2024	28 days	21 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T0C-5m	E870A	12-Sep-2024	03-Oct-2024	28 days	22 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T0D-1m	E870A	12-Sep-2024	03-Oct-2024	28 days	22 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T0D-5m	E870A	12-Sep-2024	03-Oct-2024	28 days	22 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T1C-1m	E870A	12-Sep-2024	03-Oct-2024	28 days	22 days	✔	04-Oct-2024	28 days	1 days	✔



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M0C-5m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M0D-1m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M0D-5m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M1C-1m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M1D-5m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M3C-1m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M3C-5m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-T0C-1m	E870A	11-Sep-2024	03-Oct-2024	28 days	23 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M0C-1m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P0.5-1m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P0.5-5m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P1.5-1m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P1.5-5m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P1-1m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P1-5m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P2-1m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P2-5m	E870A	10-Sep-2024	03-Oct-2024	28 days	24 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M1C-5m	E870A	07-Sep-2024	03-Oct-2024	28 days	27 days	✔	04-Oct-2024	28 days	1 days	✔



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method 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 (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-M1D-1m	E870A	07-Sep-2024	03-Oct-2024	28 days	27 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P0-1m	E870A	07-Sep-2024	03-Oct-2024	28 days	27 days	✔	04-Oct-2024	28 days	1 days	✔
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube 2024-PI-MI-P0-5m	E870A	07-Sep-2024	03-Oct-2024	28 days	27 days	✔	04-Oct-2024	28 days	1 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: **Water** Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Analytical Methods							
Laboratory Control Samples (LCS)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	1690991	2	32	6.2	5.0	✔
Method Blanks (MB)							
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	1690991	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").

<i>Analytical Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A ALS Environmental - Winnipeg	Water	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. Sampling volume not provided by client.
Chlorophyll-a by Fluorometry (Field Filtered µg/L)	EC870A ALS Environmental - Winnipeg	Water	CALC	Convert results to sample concentration based on field information.
Field Volume (L)	EF003 ALS Environmental - Winnipeg	Water		Field measurement of sampling volume provided by client and recorded on ALS report may affect the validity of results.
<i>Preparation Methods</i>	<i>Method / Lab</i>	<i>Matrix</i>	<i>Method Reference</i>	<i>Method Descriptions</i>
Chlorophyll-a Extraction (Field Filtered)	EP870A ALS Environmental - Winnipeg	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.



QUALITY CONTROL REPORT

<p>Work Order : WT2428218</p> <p>Client : ArctiConnexion</p> <p>Contact : Gwenaelle Minot-Kohl</p> <p>Address : 422 3e Ave Quebec QC Canada G1L 2W1</p> <p>Telephone : 581 922 1925</p> <p>Project : ----</p> <p>PO : ----</p> <p>C-O-C number : ----</p> <p>Sampler : CLIENT</p> <p>Site : ----</p> <p>Quote number : 2024 Price List</p> <p>No. of samples received : 32</p> <p>No. of samples analysed : 32</p>	<p>Page : 1 of 3</p> <p>Laboratory : ALS Environmental - Waterloo</p> <p>Account Manager : Emily Smith</p> <p>Address : 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8</p> <p>Telephone : +1 519 886 6910</p> <p>Date Samples Received : 18-Sep-2024 10:30</p> <p>Date Analysis Commenced : 03-Oct-2024</p> <p>Issue Date : 25-Oct-2024 11:16</p>
--	---

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:

- 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>
ChrysDanielle Mabalot		Winnipeg Inorganics, Winnipeg, Manitoba
Oleksandr Busel		Winnipeg Administration, Winnipeg, Manitoba
Oleksandr Busel		Winnipeg Inorganics, Winnipeg, Manitoba



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.

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: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Plant Pigments (QCLot: 1690991)						
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----
Plant Pigments (QCLot: 1690992)						
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----



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: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Plant Pigments (QCLot: 1690991)									
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	1.08 µg/sample	97.0	80.0	120	----
Plant Pigments (QCLot: 1690992)									
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	1.08 µg/sample	96.7	80.0	120	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

Canada Toll Free: 1 800 668 9878

Page 1 of 2



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Report To	Contact and company name below will appear on the final report.	
Company:	ArcticConnexion	
Contact:	Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	
Phone:	Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A	
Street:	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked	
City/Province:	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	
Postal Code:	Email 1 or Fax: <u>gwena@arcticconnexion.ca</u>	
	Email 2	
	Email 3	
Invoice To	Same as Report To <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Company:	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	
Contact:	Email 1 or Fax: <u>info@arcticconnexion.ca</u>	
	Email 2	
ALS Account # / Quote #:	2024 Price List	
Job #:	AFI/Cost Center: _____	
PO / AFE:	Major/Minor Code: _____	
LSD:	Requisitioner: _____	
	Location: _____	
ALS Lab Work Order # (ALS use only):	ALS Contact: Emily Smith	Sampler:
ALS Sample # (ALS use only)	Date (dd-mm-yy)	Time (hh:mm)
	Sample Identification and/or Coordinates (This description will appear on the report)	
	2024-PI-MI-M0D-1m	Filter
	2024-PI-MI-M0D-5m	Filter
	2024-PI-MI-M1C-1m	Filter
	2024-PI-MI-M1C-5m	Filter
	2024-PI-MI-M1D-1m	Filter
	2024-PI-MI-M1D-5m	Filter
	2024-PI-MI-M3C-1m	Filter
	2024-PI-MI-M3C-5m	Filter
	2024-PI-MI-T0C-1m	Filter
	2024-PI-MI-T0C-5m	Filter
	2024-PI-MI-T0D-1m	Filter
	2024-PI-MI-T0D-5m	Filter
Drinking Water (DW) Samples (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)	
Are samples taken from a Regulated DW System?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Are samples for human consumption use?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
SHIPMENT RELEASE (client use)	Date:	Time:
Released by:		
SHIPPING RELEASE (ALS use only)	Received by:	Date:
Drinking Water (DW) Samples (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)	
Are samples taken from a Regulated DW System?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Are samples for human consumption use?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
SHIPMENT RELEASE (client use)	Date:	Time:
Released by:		
SHIPPING RELEASE (ALS use only)	Received by:	Date:
Drinking Water (DW) Samples (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)	
Are samples taken from a Regulated DW System?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Are samples for human consumption use?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
SHIPMENT RELEASE (client use)	Date:	Time:
Released by:		
SHIPPING RELEASE (ALS use only)	Received by:	Date:

Drinking Water (DW) Samples (client use)

Are samples taken from a Regulated DW System? YES NO

Are samples for human consumption use? YES NO

SHIPMENT RELEASE (client use) Date: _____ Time: _____

SHIPPING RELEASE (ALS use only) Received by: _____ Date: _____

Drinking Water (DW) Samples (client use)

Are samples taken from a Regulated DW System? YES NO

Are samples for human consumption use? YES NO

SHIPMENT RELEASE (client use) Date: _____ Time: _____

SHIPPING RELEASE (ALS use only) Received by: _____ Date: _____

Drinking Water (DW) Samples (client use)

Are samples taken from a Regulated DW System? YES NO

Are samples for human consumption use? YES NO

SHIPMENT RELEASE (client use) Date: _____ Time: _____

SHIPPING RELEASE (ALS use only) Received by: _____ Date: _____

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

Page 1 of 2

Canada Toll Free: 1 800 668 9878

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Report To Contact and company name below will appear on the final report Company: ArcticConnexion Contact: Phone: Company address below will appear on the final report Street: City/Province: Postal Code:		Reports / Recipients Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Merge OC/OCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A <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 Email 1 or Fax: gwenaelle@arcticconnexion.ca Email 2 Email 3		Turnaround Time (TAT) Requested <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 Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests GO BY: 17:00 AM/PM		AFFIX ALS BARCODE LABEL HERE (ALS use only)	
Invoice To Same as Report To <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO Copy of invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Recipients Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: info@arcticconnexion.ca Email 2		Date and Time Required for all E&P TATS: For all tests with rush TATs requested, please contact your AM to confirm availability.			
Company: Contact: Project Information ALS Account # / Quote #: 2024 Price List Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) AFE/Cost Center: Major/Minor Code: Requisitioner: Location:		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below			
ALS Lab Work Order # (ALS use only):		ALS Contact: Emily Smith Sampler:		NUMBER OF CONTAINERS			
ALS Sample # (ALS use only) Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mm-yy)		Time (hh:mm)			
2024-PI-MI-T1C-1m 2024-PI-MI-T1C-5m 2024-PI-MI-T1D-1m 2024-PI-MI-T1D-5m 2024-PI-MI-T3C-1m 2024-PI-MI-T3C-5m 2024-PI-MI-T3D-1m 2024-PI-MI-T3D-5m		Filter Filter Filter Filter Filter Filter Filter Filter Filter Filter		1 1 1 1 1 1 1 1 1 1			
Chlorophyll (a) - Client Filtered		Filteration Volume (L)		SUSPECTED HAZARD (see notes) EXTENDED STORAGE REQUIRED SAMPLES ON HOLD			
Drinking Water (DW) Samples (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO Are samples for human consumption/use? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)		SAMPLE RECEIPT DETAILS (ALS use only) Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE BAGS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED			
SHIPMENT RELEASE (client use) Released by: _____ Date: _____ Time: _____		INITIAL SHIPMENT RECEPTION (ALS use only) Received by: _____ Date: _____ Time: _____		Submission Comments identified on Sample Receipt/Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO Cooler Custody Seals Intact: <input checked="" 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: _____			
FINAL SHIPMENT RECEPTION (ALS use only) Received by: <i>AP</i> Date: <i>18 Sept 24</i> Time: <i>10:30</i>		WHITE - LABORATORY COPY YELLOW - CLIENT COPY		ALS 2023 FRONT			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
 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.

AC-Project-ID: September2024_PI_Miline Inlet_CHL				
ArctConneXion ID	Sample	Type	Date	Volume (L)
2024-PI-MI-P0-1m	Water	Filter	2024-09-07	1
2024-PI-MI-P0-5m	Water	Filter	2024-09-07	1
2024-PI-MI-P0.5-1m	Water	Filter	2024-09-10	1
2024-PI-MI-P0.5-5m	Water	Filter	2024-09-10	1
2024-PI-MI-P1-1m	Water	Filter	2024-09-10	1
2024-PI-MI-P1-5m	Water	Filter	2024-09-10	1
2024-PI-MI-P1.5-1m	Water	Filter	2024-09-10	1
2024-PI-MI-P1.5-5m	Water	Filter	2024-09-10	1
2024-PI-MI-P2-1m	Water	Filter	2024-09-10	1
2024-PI-MI-P2-5m	Water	Filter	2024-09-10	1
2024-PI-MI-MOC-1m	Water	Filter	2024-09-10	1
2024-PI-MI-MOC-5m	Water	Filter	2024-09-10	1
2024-PI-MI-MOD-1m	Water	Filter	2024-09-11	1
2024-PI-MI-MOD-5m	Water	Filter	2024-09-11	1
2024-PI-MI-M1C-1m	Water	Filter	2024-09-11	1
2024-PI-MI-M1C-5m	Water	Filter	2024-09-11	1
2024-PI-MI-M1D-1m	Water	Filter	2024-09-07	1
2024-PI-MI-M1D-5m	Water	Filter	2024-09-11	1
2024-PI-MI-M3C-1m	Water	Filter	2024-09-11	1
2024-PI-MI-M3C-5m	Water	Filter	2024-09-11	1
2024-PI-MI-TOC-1m	Water	Filter	2024-09-11	1
2024-PI-MI-TOC-5m	Water	Filter	2024-09-12	1
2024-PI-MI-TOD-1m	Water	Filter	2024-09-12	1
2024-PI-MI-TOD-5m	Water	Filter	2024-09-12	1
2024-PI-MI-T1C-1m	Water	Filter	2024-09-12	1
2024-PI-MI-T1C-5m	Water	Filter	2024-09-13	1
2024-PI-MI-T1D-1m	Water	Filter	2024-09-13	1
2024-PI-MI-T1D-5m	Water	Filter	2024-09-13	1
2024-PI-MI-T3C-1m	Water	Filter	2024-09-13	1
2024-PI-MI-T3C-5m	Water	Filter	2024-09-13	1
2024-PI-MI-T3D-1m	Water	Filter	2024-09-13	1
2024-PI-MI-T3D-5m	Water	Filter	2024-09-13	1
TOTAL CHLA				

Appendix 5

Table 1. Contribution (wt.%) of trace metals in marine sediments sampled in Qingua (Milne Port and Philips Creek's plume) and Tremblay Sound and in a source sample (bold) collected near the stockpiles at the Milne Inlet port. Trace metals concentrations were obtained using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) with a Collision/Reaction Cell. LOD: concentration under the limit of detection

Metals (wt.%)	M0C	M1C	M3C	P0	P0.5	P1	P1.5	P2	T0C	T1C	T3C	Source
Calcium	4.84	7.09	2.14	10	8.07	5.01	10.5	13.1	6.4	7.56	3.42	0.0677
Magnesium	2.8	3.73	1.29	5.65	4.53	2.35	4.9	5.31	2.64	3.21	1.57	0.626
Iron	1.23	1.29	0.532	1.35	1.64	1.34	1.59	1.34	2.92	2.6	3.35	20.4
Aluminium	0.461	0.886	0.308	0.573	0.612	0.307	0.716	0.781	1.57	1.54	1.66	0.65
Sodium	0.393	0.557	0.237	0.4	0.466	0.318	0.515	0.596	0.728	1.21	0.621	0.005
Potassium	0.216	0.365	0.118	0.274	0.257	0.148	0.309	0.345	0.4	0.438	0.387	0.01
Sulfur	LOD	0.11	LOD	0.14	LOD	LOD	LOD	LOD	0.17	0.22	0.18	0.1
Phosphorus	0.063	0.0469	0.0201	0.0402	0.0548	0.0342	0.0503	0.0563	0.063	0.0865	0.0535	0.0385
Titanium	0.0227	0.0293	0.0154	0.0341	0.0287	0.0205	0.0269	0.0274	0.00816	0.00826	0.00673	0.00884
Manganese	0.0101	0.0137	0.00566	0.0169	0.014	0.0101	0.0153	0.015	0.0279	0.0304	0.0192	0.0531
Strontium	0.00428	0.00522	0.00178	0.00555	0.00529	0.00607	0.00845	0.0145	0.0082	0.0129	0.00758	0.000307
Boron	0.00362	0.00558	0.00214	0.00432	0.00448	0.00241	0.00587	0.0065	0.00483	0.00525	0.00402	0.00058
Lithium	0.00196	0.0039	0.00126	0.00332	0.00305	0.00142	0.00349	0.00377	0.00357	0.00338	0.0037	0.00096
Chromium	0.00151	0.00252	0.001	0.00204	0.00203	0.00118	0.00201	0.00228	0.0021	0.00216	0.00218	0.0025
Vanadium	0.00196	0.00265	0.00106	0.00182	0.0023	0.00119	0.00236	0.00269	0.00363	0.00427	0.00384	0.00093
Barium	0.00135	0.0019	0.000632	0.00166	0.00171	0.00101	0.00188	0.00203	0.00796	0.00776	0.00749	0.00056
Zinc	0.00146	0.00202	0.0009	0.00151	0.00154	0.00095	0.0016	0.00185	0.00569	0.00523	0.00687	0.00104
Nickel	0.000875	0.0014	0.00063	0.00112	0.00112	0.000655	0.00113	0.00121	0.00227	0.00209	0.0026	0.00309
Copper	0.000565	0.000908	0.000295	0.000808	0.000772	0.000335	0.0008	0.000801	0.00246	0.00239	0.00276	0.000706
Zirconium	0.00043	0.00114	0.00038	0.00078	0.00068	0.00037	0.00072	0.00062	0.00042	0.00026	0.00058	0.00022
Lead	0.000451	0.000736	0.00025	0.000446	0.000502	0.000258	0.000566	0.000626	0.00142	0.00147	0.00161	0.000152
Cobalt	0.000264	0.000449	0.000171	0.000402	0.000364	0.000228	0.000364	0.000378	0.000956	0.000841	0.00104	0.00125
Arsenic	0.000638	0.000327	0.000104	0.000251	0.00061	0.000269	0.000627	0.00062	0.00117	0.00134	0.00104	0.000509
Uranium	0.0000743	0.00013	0.0000671	0.0000865	0.0000843	0.0000464	0.0000844	0.0000803	0.0000861	0.0000754	0.000077	0.000074
Molybdenum	0.000046	0.000089	0.000041	0.000054	0.000063	0.000036	0.000053	0.000043	0.000186	0.000171	0.000184	0.000262
Beryllium	0.000028	0.000057	0.000021	0.000035	0.000039	0.00002	0.00004	0.000044	0.000073	0.000075	0.000079	0.000036
Thallium	0.0000084	0.0000146	0.0000054	0.0000116	0.0000103	0.0000066	0.0000102	0.000011	0.0000167	0.0000169	0.0000146	0.000005
Cadmium	0.000004	0.0000071	0.0000029	0.0000027	0.0000059	0.0000032	0.0000052	0.0000114	0.0000107	0.0000111	0.0000168	0.000002
Mercury	0.00000094	0.00000139	LOD	0.0000008	0.00000101	LOD	0.00000178	0.00000157	0.00000137	0.00000183	0.00000107	0.0000005
Antimony	LOD	LOD	LOD	LOD	LOD	LOD	LOD	0.00001	0.000018	0.000018	0.000019	0.000014
Bismuth	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	0.00002
Selenium	0.000027	0.000024	LOD	LOD	LOD	LOD	0.000021	0.000024	0.000028	0.00004	0.000025	0.00002
Silver	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	0.00001
Tin	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	0.0002
Tungsten	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	LOD	0.00005



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