



Water Monitoring on the Goat River

CABIN and Water Quality Monitoring Report for 2022-2024



Thank you to all the wonderful water volunteers, water advisors, and funders that made this project possible!

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Project Objectives:

Wildsight Creston Valley Branch (WCVB) is engaged in community-based monitoring on the Goat River. The community-based monitoring includes two components: gathering baseline water quality data, and measuring benthic invertebrates as an indicator for watershed health. These data should reveal if there are effects from agriculture, forestry, climate change and/or urban/rural development in the Creston Valley that have detrimental effects on water quality and river biota. In addition to the scientific data gathered, the program develops community awareness and involvement in watershed health in the Creston Valley.

The objectives of this report are:

1. Summarize baseline water quality data collected on the Goat River from 2022-2024 at two sites.
2. Identify if there are any water quality parameters that are of concern based on provincial freshwater aquatic life guidelines from 2022-2024.
3. Present benthic invertebrate data using CABIN (Canadian Aquatic Biomonitoring Network) protocols and analysis from 2022-2024 at one site on the Goat River. Does the benthic community differ from the Reference Conditions Approach due to stress in the watershed?
4. Relate benthic invertebrate results to water quality data.
5. Provide recommendations for future stream data collection.

Introduction

The Goat River is a major tributary to the Kootenay River in the Creston Valley, drains a watershed area of 1259 km², and is a stream order 4. The headwaters originate near White Grouse Mountain, to the NE of Kianuko Provincial Park. Major tributaries to the Goat River include Arrow Creek, and Kid Creek. The Goat River holds cultural values for the Yaqan Nu?kiy and Ktunaxa Nation members. The Goat River has also historically been an important spawning area for Kokanee salmon (*Oncorhynchus nerka*) and Burbot (*Lota lota*). The Goat River and its associated floodplain and riparian areas have significant ecological values for species-at-risk as well as biodiversity, locally and regionally. It also has important recreational/social value as a swimming spot for Creston residents in the hot summer months.

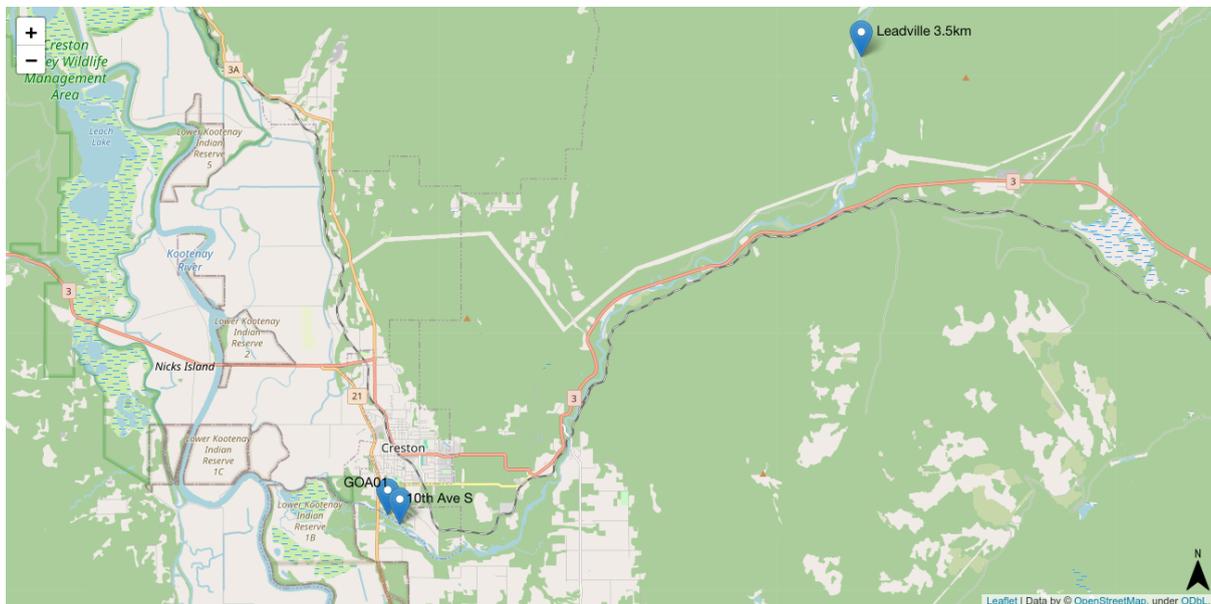
The Goat River has salmonids such as Brook Trout, Kokanee, Mountain Whitefish, Rainbow Trout, Westslope Cutthroat Trout, as well as Burbot (Westslope Fisheries 2001). Fish stocking of Westslope Cutthroat Trout, Eastern Brook Trout and Rainbow Trout goes back to 1916 in the Goat River (HabitatWizard 2024).

The river has been impacted by dyking, gravel removal, a dam, agriculture, forestry, mining, development, and industrial activity. Extensive dyking in the 1930's -1940's rerouted the Goat River to join the Kootenay River upstream of its historic outlet. Climate change effects

such as increased temperature and changes in flows are putting additional stress on the ecological health of the Goat River. Since 2017, Yaqan Nu?kiy (Lower Kootenay Band) has worked to restore the wetlands on the lower reaches of the Goat River. This includes restoring the Goat River South Channel to support the return of the Kokanee, and to restore cultural ties to land and water. Yaqan Nu?kiy is also conducting hydrometric monitoring, and continuous temperature monitoring since 2023 on the Goat River. Living Lakes Canada has been monitoring groundwater in, or adjacent to the Goat River in aquifers 487, 488 and 489 (BC Gov 2025, Living Lakes Canada 2025). Aquifers 488 and 489 have been flagged as 'at risk' due to agricultural demand and risk of drought (Western Water Associates 2025).

Water Quality Monitoring

Figure 1 Map of sampling locations for water monitoring of the Goat River 2022-2024



Methods:

Water Quality

Once a month from May to October, basic water quality measures were taken at two sites on the Goat River during 2022-2024. The '10th Ave S' site was selected near the downstream limit of the river, with cumulative influences such as urbanization, agriculture and forestry. The 'Leadville 3.5km' site was chosen because it is above the agriculture and urbanization influences, although it is still impacted by forestry and mining upstream of this site.

Samples were taken using portable water meters or chemical tests. Water parameter measures were: dissolved oxygen (Hanna multimeter H198194), water temperature (YSI Pro

30), specific conductivity (YSI Pro 30), pH (Oakton pHTestr 5), turbidity (LaMotte 2020i) and air temperature. There were some instances where the Hanna multimeter H198194 was not working so a reading was taken from the CHEMets Dissolved Oxygen kit. Samples were also taken with the Water Rangers sampling kits and uploaded to the Water Rangers data hub.

Figure 2 Description and site locations of May-Oct Monthly water quality sampling 2022-2024

	
<p>10th Ave S 49.0782992, -116.5143657 Goat River at the end of 10th Ave S, downstream view</p>	<p>Leadville 3.5km 49.1917843, -116.3443565 Camping area 3.5km up Leadville Forest Service Road, upstream view</p>

Lab Tests

Once a year during the fall in 2022-2024, lab tests were also collected at GOA01 and Leadville 3.5km on the Goat River (Figure 1 and 3). GOA01 is in riffle/run habitat, 200m upstream of the highway 21 bridge. The study site was chosen near the downstream limit of the river, with cumulative influences such as urbanization, agriculture and forestry. It was selected previously as a CABIN test site in 2008 for the BC MOE-Kootenay Region study. Lab tests were taken at GOA01 instead of 10th Ave S to correspond with CABIN testing once a year. GOA01 can be considered equivalent to the 10th Ave S site. Water samples were collected in laboratory-supplied sample bottles, packed on ice and shipped to CARO Analytical Services (2022-2023) and ALS Calgary (2024) to be analyzed.

- Water samples analyzed in a laboratory were: alkalinity, hardness, total metals, nitrogen (Nitrate, Nitrite, Nitrate+Nitrite, Total Nitrogen, Total Kjeldahl Nitrogen(2022-2023), Ammonia (2024), Total phosphorus, Total dissolved phosphorus, Ortho- Phosphate and Total suspended solids.
- Duplicate grab samples were sent during 2022 and 2024 for quality control. For 2022 one field blank was also sent.

Figure 3 Description and site locations for water samples collected for lab analysis

	
<p>GOA01 49.0807, -116.51907 200m upstream of highway 21 bridge, downstream view</p>	<p>Leadville 3.5km 49.1917843, -116.3443565 Camping area 3.5km up Leadville Forest Service Road, upstream view</p>

Quality Assurance and Quality Control

Water meters were calibrated and maintained according to manufacturer instructions. A calibration log was kept for all meters. The pH (Oakton pHTestr 5) pH meter was calibrated before every sampling using standard calibration solutions. The Conductivity meter (YSI Pro 30) was calibrated twice in the season using standard calibration solutions (2022-2023) and before every sampling in 2024. The Hanna multimeter (H198194) was calibrated before each sampling using standard calibration. The turbidity Meter (LaMotte 2020i) was calibrated using standard calibration solutions (0 NTU, 1 NTU) before each use.

In addition to the QA/QC protocols for Caro Analytical and ALS, the following duplicates and field blanks were implemented during the sampling program.

- Duplicate samples were collected by filling two sample bottles right after each other at a monitoring location. The percent difference between the duplicate samples is calculated. The max acceptable percentage difference is 20%, as long as the results are at least 10x the detectable limits for a given parameter.
 - Relative Percent Difference(RPD), where A is larger than B, the RPD

$$=2*(A-B)/(A+B)*100\%$$
- One field blank (laboratory issued de-ionized water) was added to test for contamination from sample collection equipment, handling and conditions during sampling. Field blanks that are 2 times greater than the reportable detection limit are considered an issue.
 - Blank x difference=Field Blank Value/Reportable Detection Limit

Data Analysis:

Lab tests and water quality data were compared to the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BC Ministry of Environment and Climate Change Strategy 2024). Some of the aquatic guidelines require data over an extended period such as sampling daily for 30 days, to establish baseline information and acceptable ranges.

Additionally, a two sample, two tailed t-test was done to see if there is a significant difference between water quality measurements taken at 10th Ave S and 3.5km Leadville during 2022-2024.

- $H_0: \mu_1 = \mu_2$ Null hypothesis is that there is no difference in water quality measurements between 10th Ave S and 3.5km Leadville.
- $H_1: \mu_1 \neq \mu_2$ The alternative hypothesis is that there is a difference in water quality measurements between the 10th Ave S and 3.5km Leadville.
- $\alpha = 0.05$ Significance level
- $p \geq \alpha$, If the p of the t test greater or equal to 0.05, then fail to reject the null hypothesis. This means there is not enough evidence to conclude a significant difference between the two group means.

Results

Water Quality Results

Water quality data collected during May-October (2022-2024) for specific conductivity, dissolved oxygen, pH, turbidity and water temperature are summarized in Table 1.

Table 1 Summary of Water Quality parameters on the Goat River 2022-2024

Site	Parameter	Mean	Min	Max	# of Samples	Standard deviation
10th Ave S	specific conductivity $\mu\text{s}/\text{cm}$	68.2	33.9	84.5	17	18.0
3.5 km Leadville	specific conductivity $\mu\text{s}/\text{cm}$	62.0	33.7	75.0	17	14.5
10th Ave S	oxygen mg/L	11.1	8.8	15.2	17	1.7
3.5 km Leadville	oxygen mg/L	11.2	9.0	16.5	17	1.7
10th Ave S	ph	7.4	6.9	7.8	17	0.3
3.5 km Leadville	ph	7.5	7.1	7.9	17	0.2
10th Ave S	turbidity_ntu	0.67	0.05	2.62	17	0.7
3.5 km Leadville	turbidity_ntu	0.56	0.01	1.96	16	0.6
10th Ave S	Water temperature C	12.4	5.2	20.3	17	4.7
3.5 km Leadville	Water temperature C	10.9	3.9	18.8	17	4.5

A two tailed t-test was performed for pH, specific conductivity, water temperature, turbidity and dissolved oxygen to compare readings at the 10th ave S and Leadville 3.5km sites between 2022-2024.

pH: A two-sample t-test, two tailed t test was conducted to compare the pH readings of 10th ave S and Leadville 3.5km between 2022-2024. The results showed no significant difference for pH at 10th ave s (M=7.4 , SD=0.30) from the pH at Leadville 3.5km (M=7.5, SD=0.23), $t(32)=1.808$, $p=0.081$, $p>0.05$.

The rest of the t test results are summarized in Table 2. All had $p>0.05$, so accept the null hypothesis that there is no significant difference in water quality measurements at 10th Ave S and 3.5km Leadville between 2022-2024.

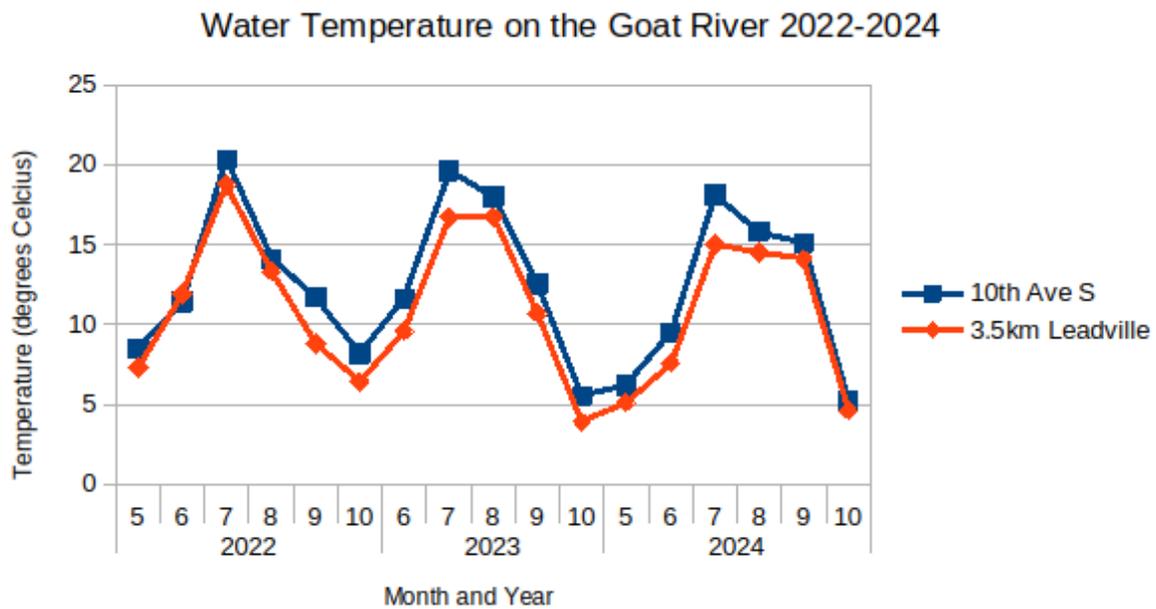
Table 2 Two tailed t-test summary table for water quality measurements of the Goat River 2022-2024

Site	Calculation	ph	specific conductivity (us/cm)	Water temperature C	turbidity_n tu	Dissolved oxygen mg/L
10th ave S	Mean	7.4	68.2	12.4	0.7	11.1
10th ave S	Standard deviation	0.30	18.58	4.88	0.75	1.75
Leadville	Mean	7.5	62.0	10.9	0.6	11.2
Leadville	Standard deviation	0.23	14.98	4.67	0.63	1.78
	degrees of freedom	32	32	32	31	32
	T value	1.808	1.077	0.944	0.446	0.055
	p of t test	0.081	0.290	0.352	0.657	0.957

Water Temperature

Water temperature varied with the seasons (Figure 4). The highest water temperatures were measured during July 2022 (20.3°C) at 10th Ave S and (18.8°C) at 3.5km Leadville.

Figure 4 Water Temperature on the Goat River 2022-2024



There are several guidelines for water temperature regulations.

Drinking water: max of 15C for aesthetics (BC Ministry of Environment and Climate Change Strategy 2020) There are licenses for domestic water use on the Goat River (Kootenay Boundary Water Tool 2025). The 10th Ave S site on Goat River exceeded 15°C during July (2022-2024) and August (2023-2024).

Optimal Spawning for Sockeye: 10.6-12.8 C (Oliver and Fidler 2001) Kokanee is a land-locked sockeye. The temperature measured in September 2024 at 10th Ave S (15.1°C) exceeded this optimal spawning temperature range.

pH

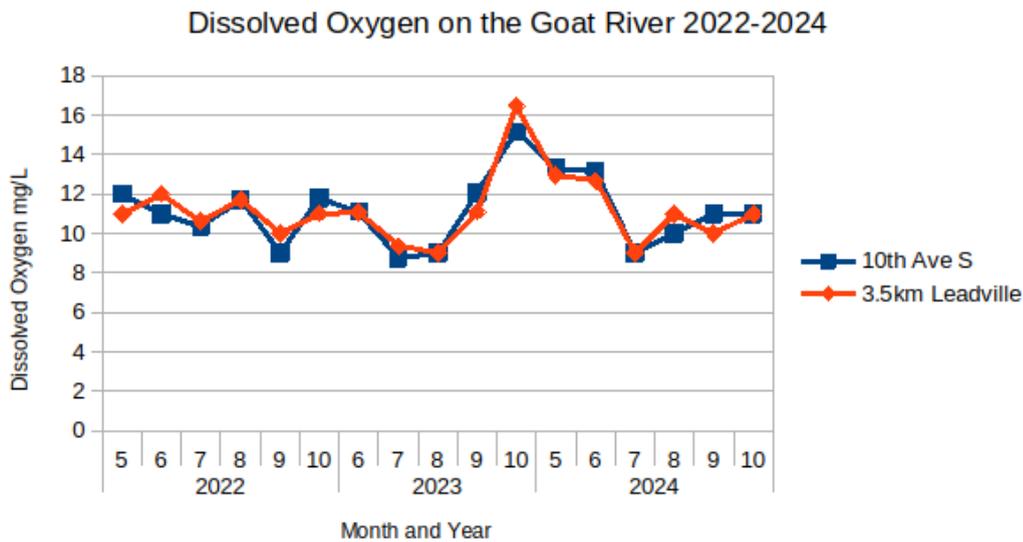
pH values are a measurement of hydrogen-ion concentrations in the water. On the pH scale 7 is neutral, below 7 is acidic, and above is 7 basic. pH can affect the solubility and bioavailability of nutrients and metals. The pH of the Goat River varied between 6.9 and 7.9 during 2022-2024, with a mean pH of 7.5. The BC Aquatic Guidelines allow for unrestricted change permitted within a pH range of 6.5 to 9 (British Columbia Ministry of Environment and Climate Change Strategy. 2024), so all readings were in range.

Dissolved Oxygen

Dissolved oxygen fluctuates with discharge, temperature, photosynthetic activity and presence of organic matter. Dissolved oxygen decreases with increases in temperature, so in the summer months dissolved oxygen is lower. Dissolved oxygen needs to be between at least 5-9 mg/L for aquatic life (life-stage dependent), especially for cold adapted fish species such as salmonids (BC Ministry of Environment 1997). A 30 day mean dissolved oxygen below 8 mg/L, is considered detrimental to cold adapted salmonids (all life stages

other than embryos/allevins) (BC Ministry of Environment 1997). The lowest measurement of dissolved oxygen was 8.75 mg/L (19.6°C) in July 2023 at the 10th Ave S site. All other dissolved oxygen readings were equal or greater than 9 mg/L during 2022-2024 at both sites. Dissolved oxygen readings in Oct 2023 were higher than expected at 15.2 mg/L (5.5°C, 10th Ave S) and 16.5 mg/L (3.9°C, 3.5km Leadville). Water temperatures were cool, and water could have been well aerated, or there could have been a sensor error on that day.

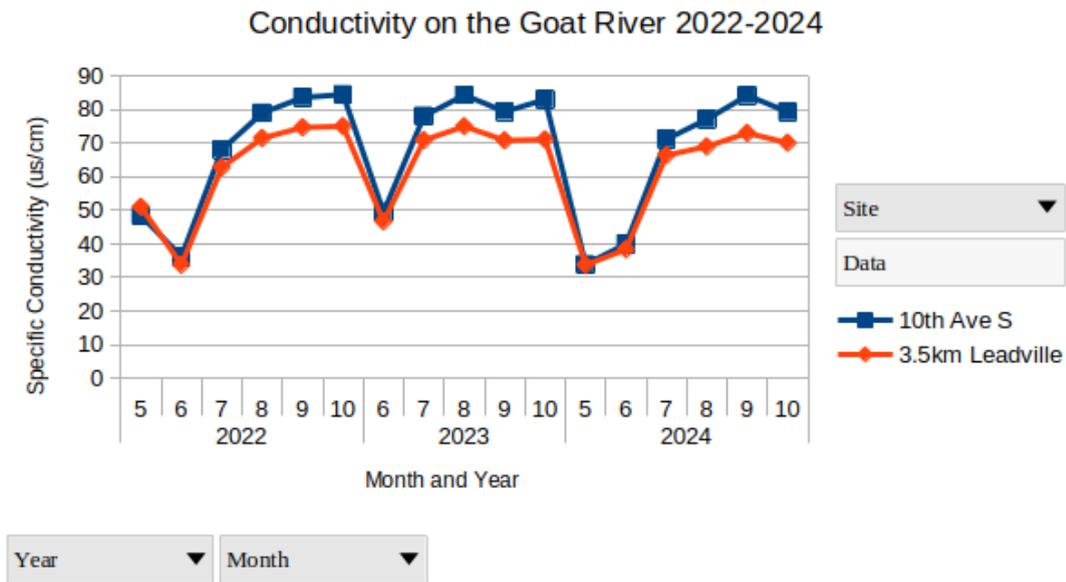
Figure 5 Dissolved Oxygen on the Goat River 2022-2024



Specific Conductivity

Specific conductivity is the measure of water’s ability to conduct electricity at a specific temperature (25°C). The salts dissolved in water conduct this electricity and human activity can change the amount of salts in the water through effluent, road salts and mining. There is no BC aquatic life guideline for conductivity. Specific conductivity varied with water flows, with a range between 33.7µs/cm to 84.5 µs/cm. Higher water in the spring resulted in lower conductivity, and as flows got lower in summer months, conductivity increased.

Figure 6 Specific Conductivity on the Goat River 2022-2024



Turbidity

Turbidity is a measure of the clarity of water. Organic and inorganic particles, algae, microorganism, silt, and clay can increase turbidity. Both anthropogenic activity like forestry, road building, erosion, effluent, and natural activity like freshet can affect turbidity. The B.C. Aquatic Life Guidelines are dependent on the turbidity range of the water body, and during particular times of year. Normal ranges and objectives have not been established for the Goat River. Rivers tend to be more turbid during high water/freshet. For the Goat River, the highest turbidity was 2.62 NTU in June 2022 at 10th Ave S, during high flows. The average turbidity from measurements at both sites was 0.62 NTU which is very clear.

Lab Results

Total Suspended Solids

Total suspended solids is a measurement of suspended particles in water. It is related to turbidity measurement. For aquatic life there is a dose relationship where concentration and duration both matter. The BC aquatic life guidelines need to be compared to background TSS levels which have not been established for Goat River. Measurements were below the detection limits in 2022 (<2 mg/L), 2023 (<10 mg/L), and 2024 (<3 mg/L). Fall sampling times would be considered clear flows and the TSS measurements reflect this.

Hardness and Alkalinity

Hardness is the amount of ions in the water, primarily calcium and magnesium. Alkalinity is related to hardness as they both use measurements of calcium carbonate. Hardness is

known as a toxicity modifying factor because depending on the measurement of hardness certain metals may be toxic to aquatic life (BC Ministry of Environment and Climate Change Strategy 2024). There are no B.C. Aquatic Life Guidelines for Hardness. Hardness levels for 2022-2024 during CABIN sampling ranged between 33.3 to 37 mg/L. Metals that are affected by hardness like copper, iron, lead, cadmium, nickel and zinc were below the detection limit in the samples.

Alkalinity is a measure of calcium carbonate and relates to how sensitive a water body is to acid inputs. The BC guidelines only apply to lakes and are not reflective of rivers/streams unless a large number of samples are taken in one season (Swain 1987). Each water body will have its own typical range of alkalinity. During 2022-2024 it ranged from 26.2 to 34.2mg/L.

Nutrients

Nutrients including nitrogen and phosphorus can be limiting productivity factors in biological systems. However, if nutrients are too high due to anthropogenic factors such as fertilizer, sewage or effluent runoff, algae will grow, which can deplete dissolved oxygen levels. In 2022 and 2023, nutrients arrived at the lab after the hold time (24-48h), so the following parameters: Nitrate, Nitrite, Phosphate, calculated Nitrate+Nitrite (as N) and total Nitrogen, are inconclusive.

In 2024, samples were sent to ALS in Calgary since courier service is quicker to this area from Creston. In 2024, GOA01 had total phosphorus levels of 0.0021mg/L, total dissolved phosphorus of 0.0032mg/L, and orthophosphate of 0.0027 mg/L. The Leadville site was all below the detection limit for the phosphorus parameters. There are no river guidelines for total phosphorus, ortho-phosphates or dissolved phosphorus.

Both sites had similar total nitrogen: 0.033 mg/L at GOA01, 0.0331 mg/L Leadville 3.5km. There are no water quality guidelines for total nitrogen. The rest of the nutrients (Ammonia, Nitrite, calculate Nitrate+Nitrate, Nitrate, Total Kjeldahl Nitrogen) were below the detection limit.

The 2024 results show that nutrient levels were very low during fall sampling in the Goat River.

Metals

In 2022-2024, total metals measurements were below the BC aquatic life guidelines, or below detection limit of the lab test. Total metals were similar at both the 3.5km Leadville site and the GOA01 site. Full results can be found in the Lab Results Appendix.

Quality Assurance and Quality Control

Lab Samples

A duplicate alkalinity test was taken at the 3.5km Leadville site in 2022, of 41.6 and 39.5 mg/L. The relative percent difference is 5% and well below the 20% threshold. A duplicate alkalinity test was taken at the GOA01 site in 2024 of 40.6 and 41.1 mg/L. The relative percent difference is 1% and below the 20% threshold.

A field blank was taken at the GOA01 in 2022 using deionized water. This was also tested for alkalinity and came in below the detection limit (<1.0). This means that there was no contamination in the sampling.

CABIN (Canadian Aquatic Blomonitoring Network)

Methods:

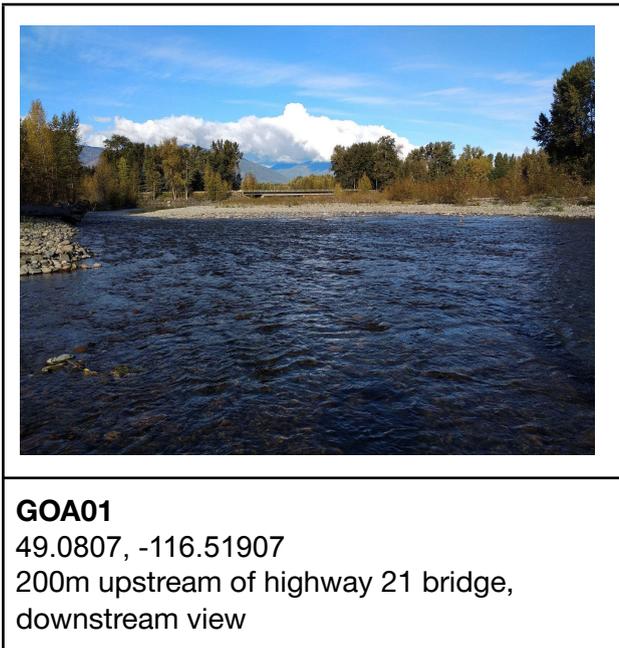
CABIN Sampling

One CABIN site was selected in riffle/run habitat on the Goat River (GOA0, Figure 7). The study site was chosen near the downstream limit of the river, with cumulative influences such as urbanization, agriculture and forestry. This site is 200m upstream of the highway 21 bridge. It was selected previously as a CABIN test site in 2008 for the BC MOE-Kootenay Region study. Benthic invertebrates were collected using CABIN protocol (Environment Canada 2012) in the fall for 3 consecutive years (2022, 2023, 2024). Benthic invertebrate samples were sent to CABIN certified taxonomists: Pina Viola in 2022 and 2023, and Cordillera Consulting in 2024.

CABIN protocol also includes habitat reach assessment, channel data, substrate data and water chemistry (Environment Canada 2012). Water chemistry variables included dissolved oxygen (Hanna multimeter H198194 2022, 2023, Hach Dissolved Oxygen Winkler Method in 2024), water temperature (YSI Pro 30), specific conductivity (YSI Pro 30), pH (Oakton pHTestr 5), turbidity (LaMotte 2020i) and air temperature. Lab tests for metals and nutrients were also taken and are described in the Water Quality section above.

Benthic invertebrate samples were also submitted to STREAM (Sequencing The Rivers for Environmental Assessment and Monitoring) at the University of Guelph for 2022 and 2023. Three sample replicates were collected using STREAM protocols (Maitland et al. 2024). Funding for STREAM sample submission in 2024 was not available.

Figure 7 Sampling Location for the 2022-2024 CABIN Benthic Invertebrate Sampling



Data Analysis:

CABIN Analysis

The GOA1 test site sampled in 2022, 2023, 2024, were compared to reference conditions in the Columbia Basin 2020 model developed by Environment and Climate Change Canada (Strachan 2020). Invertebrate counts and habitat data collected in the field were uploaded to the online CABIN database. Several environmental variables required in the Columbia Basin 2020 model were also calculated by Living Lakes Canada GIS specialist and uploaded to each site visit. Once complete datasets were uploaded, CABIN analytic tools were used to calculate the community composition and variation from the reference model.

CABIN analytic tools completed the BEAST (Benthic Assessment of SedimenT) analysis, in which the test site (GOA01) was assigned to the appropriate reference group based on 12 habitat characteristics¹ (Strachan 2020). Then the benthic invertebrate composition of GOA01 was compared to those found in the assigned reference site group in an ordination analysis. The test site benthic communities were plotted with the reference communities on three different vectors (axes) based on taxonomic composition by the CABIN analytic tools. The overall assessment was determined from the vector plot with the most severe rating. Confidence ellipses were drawn around the plotted values to determine how similar the test

¹ The 12 habitat predictors include 4 variables measured on site (longitude, altitude, channel slope and canopy coverage) and 8 landscape GIS calculated variables (Bedrock Geology-Sedimentary%, Climate-Precipitation OCT and Temperature DEC Min; Hydrology- Drainage Area; Landcover- Grassland%, Shrub Low% and Water%; Topography- Max % Slope in the upstream watershed) (Strachan 2020)

site was to reference sites. The further the test site lies from the cloud of reference sites in the ordination group, the higher the environmental stress.

1. A site that falls within the 90% confidence ellipse is designated 'Similar to Reference'.
2. A test site that falls within the 90% and 99% confidence ellipses is designated 'Mildly Divergent'.
3. A test site that falls within the 99% and 99.9% confidence ellipses is designated 'Divergent'.
4. A site that falls outside of the 99.9% confidence ellipses is designated 'Highly Divergent'

CABIN analytic tools were also used to compare the data to:

- River Invertebrate Prediction and Classification System (RIVPACS) Analysis.
 - RIVPACS compares the test sites with benthic communities at reference sites based on habitat characteristics. It uses presence/absence data to compare what taxa were expected (E) to occur at the test site and which taxa were observed (O). These are based on the probability of a greater than 70% occurrence at reference sites.
- Bray-Curtis Dissimilarity analysis
 - Shows the dissimilarity between the test site invertebrate community to the median of the predicted reference sites.
- Metrics calculations:

Metric calculations can help describe the macroinvertebrate community in terms of species abundance, richness and composition.

- % Chironomidae- % of Chironomidae taxa.
- % EPT taxa - Is the percentage of individuals in the Ephemeroptera, Plecoptera and Trichoptera taxa (EPT) divided by the sum of all individuals in the sample.
- EPT taxa (no)- Measure of richness of Ephemeroptera, Plecoptera and Trichoptera taxa (EPT).
- Hilsenhoff Family index- Describes composition in terms of pollution tolerance. It estimates the overall tolerance of the community weighted by relative abundance and pollution/dissolved oxygen sensitivity. Each taxa is assigned a tolerance number from 0-10 for that group's sensitivity to organic pollutants.

- No. EPT individuals/Chironomids+EPT Individuals- Is a ratio of the sensitive EPT taxa to the more tolerant Chironomidae taxa.
- Simpson’s Diversity- Diversity index used to measure how many different taxa are present, and how evenly individuals are distributed among those taxa.
- Simpson’s Evenness is an index of composition of how even the distribution of individuals is among all the taxa.
- Total abundance- Sum of all individuals.
- Functional Feeding Groups: Functional feeding group proportion changes with the availability of food in the creek and can reflect the health of the riparian vegetation, channel stability and impacts from land development

Results

CABIN Results

BEAST Analysis: Comparison to the Reference Model

The test site GOA01 was classified into a reference group using 12 predictor variables (Strachan 2020). GOA01 was consistently classified into reference group 2 in 2022, 2023 and 2024 with a probability of group membership 53.7-53.9% (Table 3).

Table 3 Probability of Assigning the GOA01 test site to the appropriate group

Site	Group Assignment	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
GOA01 (Sep 05 2022)	2	13.4%	53.7%	13.3%	12.1%	2.7%	4.8%
GOA01 (Oct 01 2023)	2	13.1%	53.9%	13.3%	12.2%	2.6%	4.9%
GOA01 (Sep 29 2024)	2	12.8%	53.9%	13.3%	12.4%	2.6%	4.9%

The benthic invertebrate composition of GOA01 was compared to those found in the reference sites for group 2 in an ordination analysis. Results from 2022-2024 are summarized below in Table 4 and in Figures 9-11. GOA01 was mildly divergent in 2022 and 2023, and highly divergent in 2024.

Table 4 BEAST Results of GOA01 2022-2024

Site	Group	Prob.	Vector 1 vs 2	Vector 1 vs 3	Vector 2 vs 3	Overall
GOA01 (Sep 05 2022)	2	0.537	Reference	Mildly Divergent	Mildly Divergent	Mildly Divergent
GOA01 (Oct 01 2023)	2	0.539	Reference	Mildly Divergent	Mildly Divergent	Mildly Divergent
GOA01 (Sep 29, 2024)	2	0.539	Divergent	Highly Divergent	Divergent	Highly Divergent

Figure 9 Ordination Vector Graph for GOA01 Sep 5, 2022

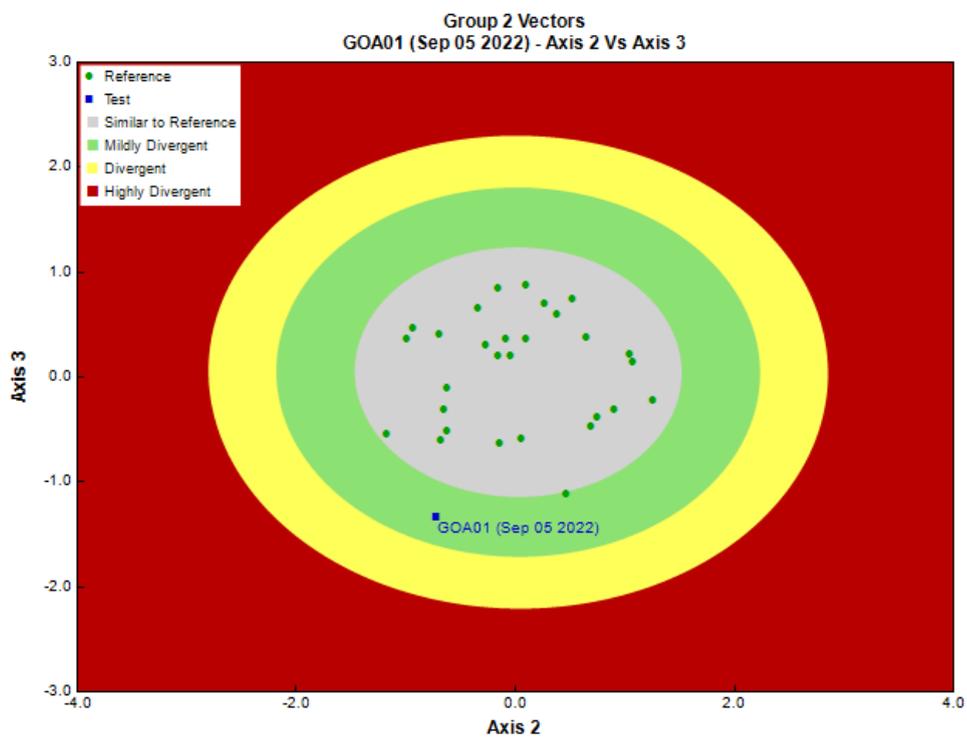


Figure 10 Ordination Vector Graph for GOA01 Oct 1, 2023

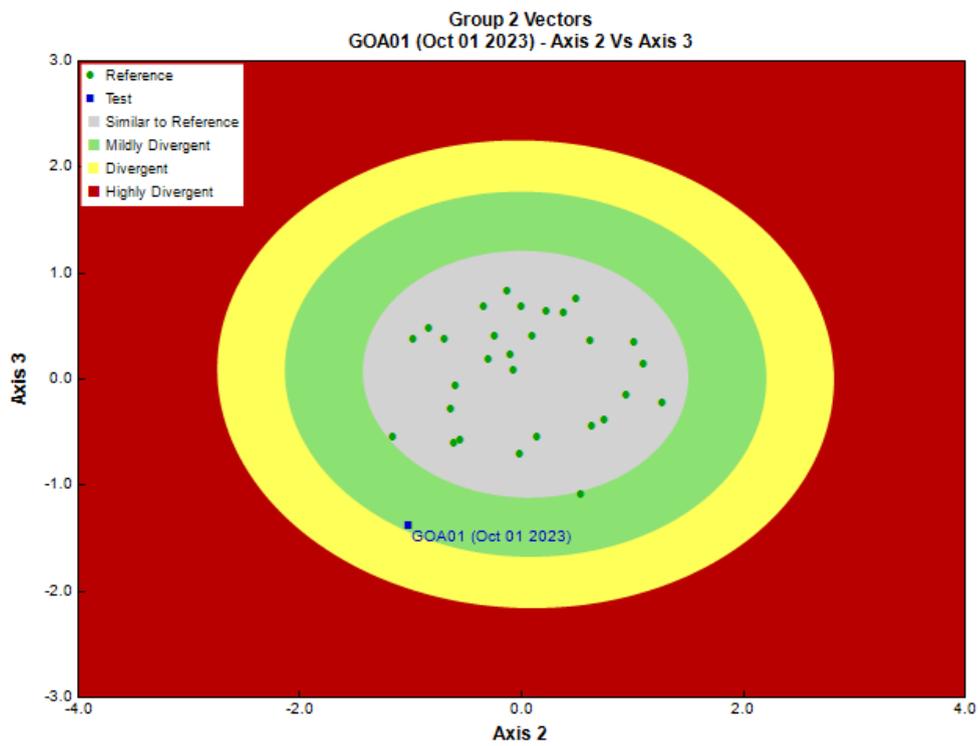
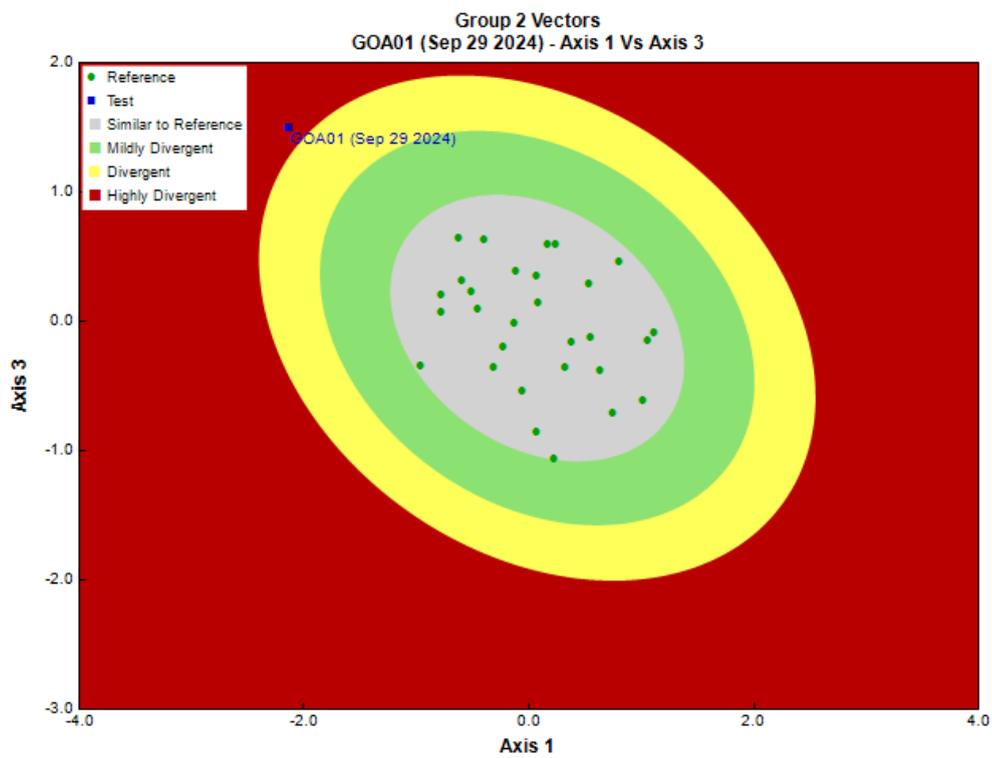


Figure 11 Ordination Vector Graph for GOA01 Sep 29, 2024



Additional Benthic Community Analysis

RIVPACS

GOA01 had a RIVPACS ratio of 0.7 (2022, 2024) and 0.8 (2023) (Table 5). Samples with a RIVPACS ratio of Observed Taxa:Expected Taxa (O:E) that are less than 1 are considered impaired². The missing families in the GOA01 samples (with a $p > 0.7$) are taxa that are sensitive to resource development disturbances in BC (Strachan 2020).

Table 5 RIVPACS Results Goat River 2022-2024

Date Sampled GOA01	RIVPACS Observed:Expected Taxa Ratio with $p > 0.7$	Missing Taxa with $p > 0.7$
Sep 05 2022	0.7	Capniidae, Nemouridae, Rhyacophilidae, Taeniopterygidae
Oct 01 2023	0.8	Capniidae, Nemouridae, Rhyacophilidae
Sep 29 2024	0.7	Baetidae, Nemouridae, Rhyacophilidae, Taeniopterygidae

Bray-Curtis Dissimilarly

If the test site and the median reference site share all the same abundance of taxa the results of the Bray-Curtis Dissimilarity will be 0 and if the test sites do not share the same abundance of taxa the result will be 1. The Bray-Curtis dissimilarity distances indicate that GOA01 does not share the same abundance of taxa to the median reference site. There was a trend from intermediate dissimilarity in 2022 (0.62), 2023 (0.74) to high dissimilarity in 2024 (0.91) (Table 6).

Table 6 Bray-Curtis Dissimilarity for Goat River 2022-2024

Site	Bray-Curtis Distance
GOA01 (Sep 05 2022)	0.62
GOA01 (Oct 01 2023)	0.74
GOA01 (Sep 29 2024)	0.91

Community Metrics

The community metrics can give us a greater understanding of the macroinvertebrates and how they differ from the reference communities. Community metrics are summarized in Table 7.

² O:E ratio =1 are healthy, O:E ratio <1 are impaired, O:E ratio > 1 are biodiversity hotspots/enriched

Table 7 Community Metrics Results for the Goat River 2022-2024

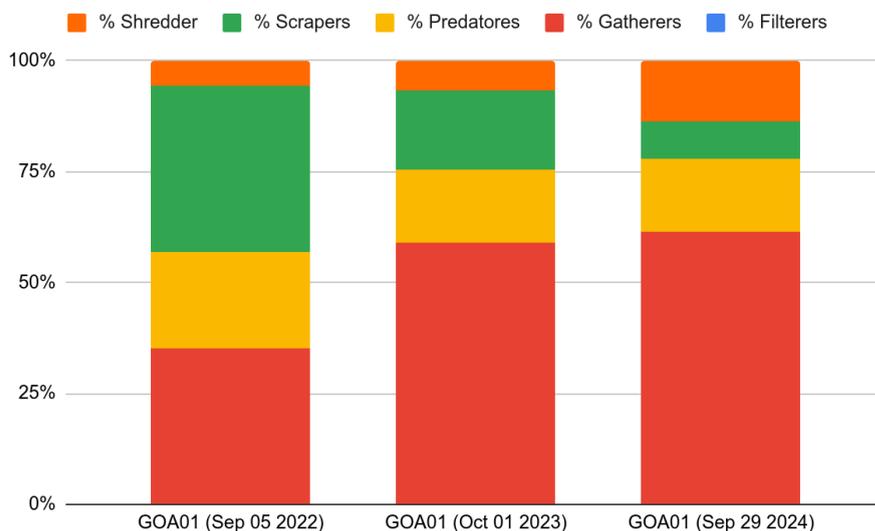
Metric	GOA01 (Sep 05 2022)	GOA01 (Oct 01 2023)	GOA01 (Sep 29 2024)	RefMean	StdDev
% Chironomidae	11.8	15.9	17.9	6.0	5.6
% EPT Individuals	72.6	67.5	62.6	88.1	9.3
EPT taxa (no)	13.0	12.0	11.0	12.4	2.4
Hilsenhoff Family index (North-West)	3.53	3.61	2.89	3.15	0.31
No. EPT individuals/Chironomids+EPT Individuals	0.86	0.81	0.78	0.94	0.06
Simpson's Diversity	0.83	0.86	0.83	0.79	0.08
Simpson's Evenness	0.29	0.38	0.34	0.30	0.08
Total Abundance	1341.7	2458.3	5333.3	1083.1	932.4
Total No. of Taxa	21.0	19.0	18.0	18.2	4.7

***bolded numbers** are >2 standard deviations away from the reference mean

- % Chironomidae- From 2022 to 2024 there was an increase in Chironomidae in the Goat River from 12% (2022), 16% (2023) to 18% (2024). Chironomidae taxa are generally more tolerant of habitat degradation.
- % EPT taxa - From 2022 to 2024 there was a decrease in the percentage of EPT individuals from 73% (2022), 68% (2023) to 63% (2024). EPT taxa are generally sensitive to habitat disturbance and therefore a lower percentage of EPT indicates a potential degradation of habitat.
- EPT taxa number- There was a slight decrease in EPT taxa between 2022-2024 from 13 to 11. EPT taxa are generally sensitive to disturbance so decrease in EPT taxa could indicate habitat disturbance.
- Hilsenhoff Family index- A Hilsenhoff values were 3.5 (2022), 3.6 (2023) and 2.9 (2024). The Hilsenhoff Family index varied between Very Good (2022-2023) to Excellent (2024).
- No. EPT individuals/Chironomids+EPT Individuals- The closer to 1 the more EPT individuals you have compared to the Chironomids. This ratio is showing the community decreased in EPT individuals and increased in Chironomids from 0.86 (2022), 0.81 (2023) and 0.78 (2024).
- Simpson's Diversity- Diverse and even communities can indicate good habitat quality. Values go from 0 to 1 with the greater diversity being higher values. Simpson's Diversity index of 0.8 for all years is excellent.

- Simpson’s Evenness; The composition is relatively even and has been stable throughout the 2022-2024 seasons.
- Total abundance- Abundance can decrease due to habitat degradation, but can also increase if more nutrients are available. There was a very high abundance in 2024 (5333).
- Functional Feeding Groups: Functional feeding groups varied by year (Figure 12) Gatherers were greater than 2 standard deviations above reference mean ($38\% \pm 14$) in 2023 (79%) and 2024 (83%). Gatherers eat fine particulate organic matter in the water and are expected to increase in response to disturbance. Scrapers were greater than 2 standard deviations below reference mean ($61\% \pm 15$) in 2023 (24%) and 2024 (12%). Scrapers are specialized to eat algae material and are expected to decrease at a site in response to disturbance

Figure 12 Functional Feeding Groups Goat River 2022-2024



STREAM Results

The STREAM samples consisted of 3 replicates that were DNA sequenced. In 2022, there were 13 Orders, 33 Families, 51 Genera and 62 species of macroinvertebrates sequenced in the samples. STREAM sequences the whole sample whereas CABIN takes a subset of the sample, which is why more taxa are identified in the STREAM sample. Of the invertebrates sampled in 2022, it included 16 species of Ephemeroptera (mayflies), 12 Plecoptera (stoneflies) and 9 Trichoptera (caddisflies). Of the four families that were missing from RIVPACS in 2022 with a probability of 70% (Capniidae, Nemouridae, Rhyacophilidae and Taeniopterygidae), all except one (Rhyacophilidae) were identified in the STREAM sample.

In 2023, there were 18 Orders, 32 Families and 52 genera sequenced in the samples. Of the invertebrates sampled in 2023, it included 11 genera of Ephemeroptera (mayflies), 11

Plecoptera (stoneflies) and 4 Trichoptera (caddisflies). Of the 3 families that were missing from RIVPACS in 2023 (Capniidae, Nemouridae, Rhyacophilidae), all except one (Rhyacophilidae) were identified in the STREAM sample.

Discussion Water Quality and CABIN

The water quality measurements as well as the lab tests from 2022-2024 give some baseline data for the Goat River. The monthly water quality parameters from 2022-2024 showed seasonal water variations during 2022-2024. Temperature exceeded aesthetic drinking water standards during the summers (2022-2024) as well optimal Kokanee spawning temperatures (Sep 2024).

Continuous temperature monitoring on the Goat River is being collected by Yaqaan Nu?kiy (since 2023) and should help understand trends in water temperature. The continuous temperature monitoring would allow for a comparison to the maximum temperature limit for salmonids of 18-19°C max weekly average (Oliver and Fidler 2001). If summers become hotter and water recharge less abundant, thermal conditions in the Goat River may become unsuitable for cold-water adapted salmonids, especially for spawning Kokanee (Atlas et al. 2021).

Fall lab results showed no significant findings in nutrients, metals, hardness, alkalinity or total suspended solids. Both the 3.5km Leadville site and the 10th Ave S/GOA01 sites did not differ substantially for lab tests or water quality parameter results.

The benthic invertebrate communities trended from mildly divergent to highly divergent from reference conditions during 2022-2024 on the Goat River. This indicates that the Goat River has impaired habitat conditions. Although the benthic communities still show excellent species diversity and evenness, there was a lower proportion of the EPT taxa, which are sensitive to habitat disturbance, than expected (Environment and Climate Change Canada 2024). There is also a higher proportion of Chironomids, which are generally more tolerant to habitat degradation (Environment and Climate Change Canada 2024). Taken together with the BEAST, RIVPACS and Bray-Dissimilarity, there are signs of habitat disturbance and stress in the Goat River.

The most divergent CABIN result was in 2024. The high total abundance in 2024 could be caused by increased nutrients in the system, and/or other climatic factors. The two most abundant families were Ephemerellidae and Chironomidae in 2024 which are both more tolerant to habitat disturbance (Strachan 2024). Although nutrients levels were low during fall CABIN sampling, there may have been anthropogenic nutrient inputs earlier in the season.

Climatic factors may have also contributed to the 'highly divergent' results in 2024. In the West Kootenays, the snowpack was at 72% level as of April 1, 2024 (Gov. BC 2024). Lower snowpacks can lead to lower summer runoff and increased summer stream temperatures.

However, snowpack is not the only variable contributing to summer flows: extraction of water, groundwater influence, land management (forestry, agriculture, etc), summer temperatures and summer precipitation also contribute (Ruzzante and Gleeson 2025, Dekker et al. 2024). Hydrological changes can have varied effects on the benthic community such as increased abundance and changes in community composition (Dunkle et al. 2023). In particular, hydrology models predict that climate change will result in low flows in the Goat River that are detrimental to fish and ecological function in the river (Dekker et al. 2024).

The benthic community results from 2022-2024 indicates that the Goat River has been trending towards increasingly impaired habitat conditions. With ongoing threats in the form of development, increased water demand and climate change, continued monitoring of flow, temperature, and biomonitoring is recommended. In addition, activities to protect riparian habitat along the Goat River and to improve land management practices in this watershed would both improve the resiliency of this watershed and help restore ecological health and fish populations in this river.

Recommendations

- Lab tests for GOA01 could be continued in the fall with CABIN sampling to help interpret CABIN results. Lab tests in the fall for Leadville 3.5km could be discontinued.
- If resources permit, lab tests for nutrients would be recommended at GOA01 site in May/June after a rain event to capture the presence/absence of runoff from surrounding farms when there is more fertilizer application.
- With increasing anthropogenic pressures on the Goat River as well as impacts on flow and temperatures due to climate change, CABIN sampling on the Goat River should continue to capture variation of the benthic community.

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Appendices

Some of the data listed in the appendices are also available online:

- CABIN specific data available at <https://www.canada.ca/en/environment-climate-change/services/canadian-aquatic-biomonitoring-network/database.html>
- Water quality and lab data are available on the Columbia Basin Water hub: <https://data.cbwaterhub.ca/dataset/goat-river-cabin-water-quality>

CABIN Appendix

2022 CABIN Report (5 pages)

2023 CABIN Report (5 pages)

2024 CABIN Report (5 pages)

Site Description

Study Name	BC NGO-Goat River Ecological Monitoring
Site	GOA01
Sampling Date	Sep 05 2022
Know Your Watershed Basin	Lower Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Columbia Mountains and Highlands EcoRegion
Coordinates (decimal degrees)	49.08070 N, 116.51907 W
Altitude	545
Local Basin Name	Goat River
	Kootenay River
Stream Order	5



Up Stream

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	October 22, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin
Reference Groups	1 2 3 4 5 6
Number of Reference Sites	13 24 28 35 32 15
Group Error Rate	53.8% 55.2% 34.1% 52.2% 23.1% 29.4%
Overall Model Error Rate	39.4%
Probability of Group Membership	13.4% 53.7% 13.3% 12.1% 2.7% 4.8%
CABIN Assessment of GOA01 on Sep 05, 2022	Mildly Divergent

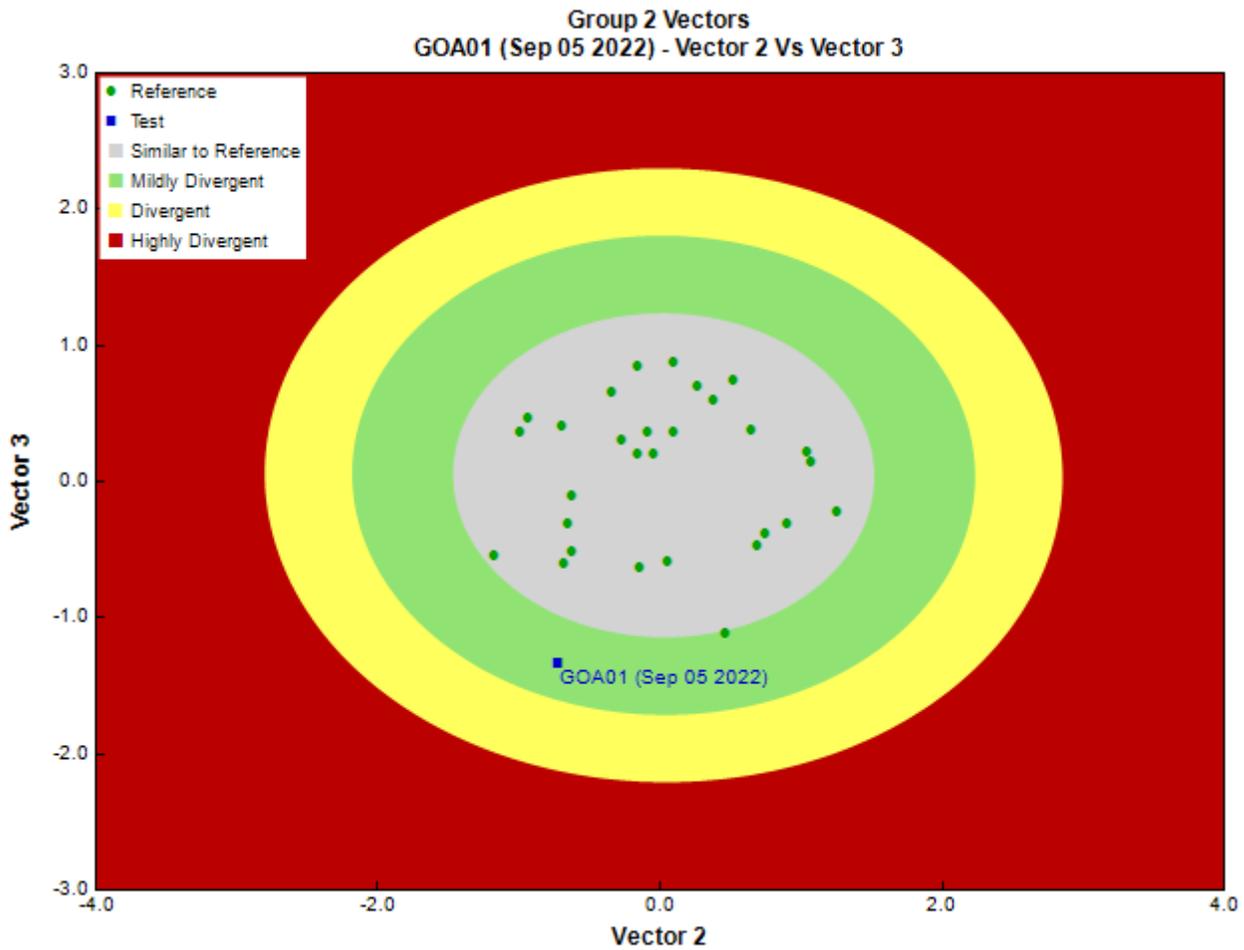


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	24/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count		
Arthropoda	Arachnida	Trombidiformes		1	4.2		
			Hygrobatidae	1	4.2		
				Lebertiidae	8	33.3	
				Sperchontidae	2	8.3	
				Torrenticolidae	26	108.3	
	Insecta	Coleoptera		Dytiscidae	1	4.2	
				Elmidae	7	29.2	
		Diptera		Chironomidae	38	158.3	
				Tipulidae	5	20.9	
				Ephemeroptera	Ameletidae	2	8.3
					Baetidae	38	158.3
					Ephemerellidae	70	291.7
					Heptageniidae	91	379.3
				Leptohyphidae	1	4.2	
				Leptophlebiidae	4	16.7	
		Plecoptera		Chloroperlidae	3	12.5	

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Perlidae	2	8.3
			Perlodidae	2	8.3
		Trichoptera	Apataniidae	1	4.2
			Hydropsychidae	6	25.0
			Hydroptilidae	4	16.7
			Lepidostomatidae	9	37.5
			Total	322	1,341.9

Metrics

Name	GOA01	Predicted Group Reference Mean \pm SD
Bray-Curtis Distance	0.62	0.3 \pm 0.1
Biotic Indices		
Hilsenhoff Family index (North-West)	3.5	3.2 \pm 0.3
Number Of Individuals		
% Chironomidae	11.8	6.0 \pm 5.6
% EPT Individuals	72.6	88.1 \pm 9.3
% of 2 dominant taxa	50.2	54.4 \pm 11.4
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 \pm 0.1
Total Abundance	1341.7	1083.1 \pm 932.3
Richness		
EPT taxa (no)	13.0	12.4 \pm 2.4
Simpson's Diversity	0.8	0.8 \pm 0.1
Simpson's Evenness	0.3	0.3 \pm 0.1
Total No. of Taxa	21.0	18.2 \pm 4.7

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites						Probability Of Occurrence at GOA01
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00
Capniidae	77%	79%	63%	74%	63%	76%	0.76
Chironomidae	100%	100%	100%	93%	100%	88%	0.99
Chloroperlidae	77%	93%	88%	93%	96%	82%	0.90
Ephemereididae	85%	97%	98%	98%	98%	82%	0.95
Heptageniidae	92%	100%	100%	100%	100%	100%	0.99
Hydropsychidae	46%	72%	71%	91%	79%	53%	0.70
Nemouridae	85%	100%	98%	98%	98%	100%	0.97
Perlodidae	77%	97%	85%	83%	90%	82%	0.90
Rhyacophilidae	69%	100%	83%	91%	98%	82%	0.92
Taeniopterygidae	69%	97%	88%	100%	100%	88%	0.92

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.33
RIVPACS : Observed taxa P>0.50	10.00
RIVPACS : O:E (p > 0.5)	0.81
RIVPACS : Expected taxa P>0.70	9.99
RIVPACS : Observed taxa P>0.70	7.00
RIVPACS : O:E (p > 0.7)	0.70

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Bedrock Geology		
Sedimentary (%)	90.91000	91.25558 \pm 24.81348
Channel		
Depth-Avg (cm)	20.0	31.4 \pm 15.4
Depth-BankfullMinusWetted (cm)	185.00	54.15 \pm 36.59
Depth-Max (cm)	37.5	46.8 \pm 23.7

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Macrophyte (PercentRange)	0	0 \pm 0
Reach-%CanopyCoverage (PercentRange)	0.00	1.00 \pm 0.96
Reach-DomStreamsideVeg (Category(1-4))	3	3 \pm 1
Reach-Pools (Binary)	0	1 \pm 1
Reach-Rapids (Binary)	0	0 \pm 0
Reach-Riffles (Binary)	1	1 \pm 0
Reach-StraightRun (Binary)	1	1 \pm 1
Slope (m/m)	0.0070000	0.0435622 \pm 0.0544263
Veg-Coniferous (Binary)	1	1 \pm 0
Veg-Deciduous (Binary)	1	1 \pm 0
Veg-GrassesFerns (Binary)	1	1 \pm 0
Veg-Shrubs (Binary)	1	1 \pm 0
Velocity-Avg (m/s)	0.44	0.63 \pm 0.23
Velocity-Max (m/s)	0.71	0.95 \pm 0.33
Width-Bankfull (m)	98.0	23.6 \pm 18.9
Width-Wetted (m)	24.5	14.0 \pm 9.6
XSEC-VelInstrumentDirect (Category(1-3))	3	2 \pm 0
XSEC-VelMethod (Category(1-3))	3	2 \pm 1
Climate		
Precip10_OCT (mm)	65.43328	93.78954 \pm 37.73803
Temp12_DECmin (Degrees Celsius)	-10.60250	-12.77499 \pm 1.90440
Hydrology		
Drainage-Area (km^2)	1256.53600	267.49128 \pm 347.95771
Perimeter (Km)	193.03860	107.09622 \pm 85.97364
Landcover		
Natl-Grassland (%)	5.43000	4.84000 \pm 3.39798
Natl-ShrubLow (%)	0.07000	4.94988 \pm 4.53147
Natl-Water (%)	0.29000	0.22026 \pm 0.32058
Substrate Data		
%Bedrock (%)	0	0 \pm 1
%Boulder (%)	0	6 \pm 7
%Cobble (%)	34	51 \pm 23
%Gravel (%)	0	4 \pm 6
%Pebble (%)	66	39 \pm 23
%Sand (%)	0	0 \pm 0
%Silt+Clay (%)	0	0 \pm 0
D50 (cm)	5.60	8.79 \pm 6.32
Dg (cm)	5.2	7.7 \pm 3.1
Dominant-1st (Category(0-9))	5	6 \pm 1
Dominant-2nd (Category(0-9))	6	6 \pm 1
Embeddedness (Category(1-5))	4	4 \pm 1
PeriphytonCoverage (Category(1-5))	3	2 \pm 1
SurroundingMaterial (Category(0-9))	3	3 \pm 1
Topography		
SlopeMax (%)	923.50000	475.68167 \pm 413.51912
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000038 \pm 0.0000018
Al (mg/L)	0.0096000	0.0064450 \pm 0.0021850
As (mg/L)	0.0025000	0.0002615 \pm 0.0000120
B (mg/L)	0.0250000	0.0262500 \pm 0.0335876
Ba (mg/L)	0.0127000	0.0683500 \pm 0.0002121
Be (mg/L)	0.0000500	0.0000075 \pm 0.0000035
Bi (mg/L)	0.0000500	0.0000038 \pm 0.0000018
Ca (mg/L)	9.4400000	24.6363636 \pm 20.0629852
Cd (mg/L)	0.0000050	0.0000038 \pm 0.0000018
Co (mg/L)	0.0000500	0.0000114 \pm 0.0000019
Cr (mg/L)	0.0002500	0.0000750 \pm 0.0000354
Cu (mg/L)	0.0002000	0.0001155 \pm 0.0000219
Fe (mg/L)	0.0270000	0.0105500 \pm 0.0036062
General-Alkalinity (mg/L)	46.2000000	74.2125000 \pm 53.9915558
General-Conductivity (μ S/cm)	82.8000000	121.7600000 \pm 104.0053005
General-DO (mg/L)	9.9300000	11.0129630 \pm 0.8955266

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
General-Hardness (mg/L)	35.7000000	95.8956522 \pm 77.3576081
General-pH (pH)	6.7	7.7 \pm 0.8
General-SolidsTSS (mg/L)	1.0000000	5.9463636 \pm 8.6422279
General-SpCond (μ S/cm)	81.2000000	165.1777778 \pm 128.4575336
General-TempAir (Degrees Celsius)	26.0	11.5 \pm 5.9
General-TempWater (Degrees Celsius)	17.2000000	6.4451852 \pm 2.2997548
General-Turbidity (NTU)	0.1700000	5.7154545 \pm 6.9690564
K (mg/L)	0.4700000	0.4604091 \pm 0.2737828
Li (mg/L)	0.0004500	0.0011000 \pm 0.0000000
Mg (mg/L)	2.9400000	8.6045455 \pm 7.5439965
Mn (mg/L)	0.0023300	0.0007470 \pm 0.0001937
Mo (mg/L)	0.0004400	0.0006780 \pm 0.0000170
Na (mg/L)	1.9000000	1.0881818 \pm 0.7163042
Ni (mg/L)	0.0002000	0.0001625 \pm 0.0001945
Nitrogen-NO2 (mg/L)	0.0050000	0.0034091 \pm 0.0048394
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0789333 \pm 0.0140433
Nitrogen-NO3 (mg/L)	0.0050000	0.0719000 \pm 0.0408583
Nitrogen-TKN (mg/L)	0.0250000	0.0200000
Nitrogen-TN (mg/L)	0.0250000	0.0929091 \pm 0.0373336
Pb (mg/L)	0.0001000	0.0000337 \pm 0.0000259
Phosphorus-OrthoP (mg/L)	0.0050000	0.0005167 \pm 0.0006974
Phosphorus-TDP (mg/L)	0.0025000	0.0010200 \pm 0.0007879
Phosphorus-TP (mg/L)	0.0250000	0.0049864 \pm 0.0043795
S (mg/L)	1.5000000	5.0000000
Sb (mg/L)	0.0002000	0.0000635 \pm 0.0000092
Se (mg/L)	0.0002500	0.0001105 \pm 0.0000134
Si (mg/L)	4.3000000	2.5681818 \pm 1.4562562
Sn (mg/L)	0.0001000	0.0000075 \pm 0.0000035
Sr (mg/L)	0.0340000	0.0445000 \pm 0.0002828
Te (mg/L)	0.0002500	0.0000000 \pm 0.0000000
Th (mg/L)	0.0000500	0.0000000 \pm 0.0000000
Ti (mg/L)	0.0025000	0.0005000
Tl (mg/L)	0.0000100	0.0000015 \pm 0.0000007
U (mg/L)	0.0003750	0.0012050 \pm 0.0000495
V (mg/L)	0.0025000	0.0001500 \pm 0.0000707
Zn (mg/L)	0.0020000	0.0006400 \pm 0.0005091
Zr (mg/L)	0.0000500	0.0000000 \pm 0.0000000

Site Description

Study Name	BC NGO-Goat River Ecological Monitoring
Site	GOA01
Sampling Date	Oct 01 2023
Know Your Watershed Basin	Lower Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Columbia Mountains and Highlands EcoRegion
Coordinates (decimal degrees)	49.08070 N, 116.51980 W
Altitude	541
Local Basin Name	Goat River
	Kootenay River
Stream Order	5



Up Stream

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	October 22, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin
Reference Groups	1 2 3 4 5 6
Number of Reference Sites	13 24 28 35 32 15
Group Error Rate	53.8% 55.2% 34.1% 52.2% 23.1% 29.4%
Overall Model Error Rate	39.4%
Probability of Group Membership	13.1% 53.9% 13.3% 12.2% 2.6% 4.9%
CABIN Assessment of GOA01 on Oct 01, 2023	Mildly Divergent

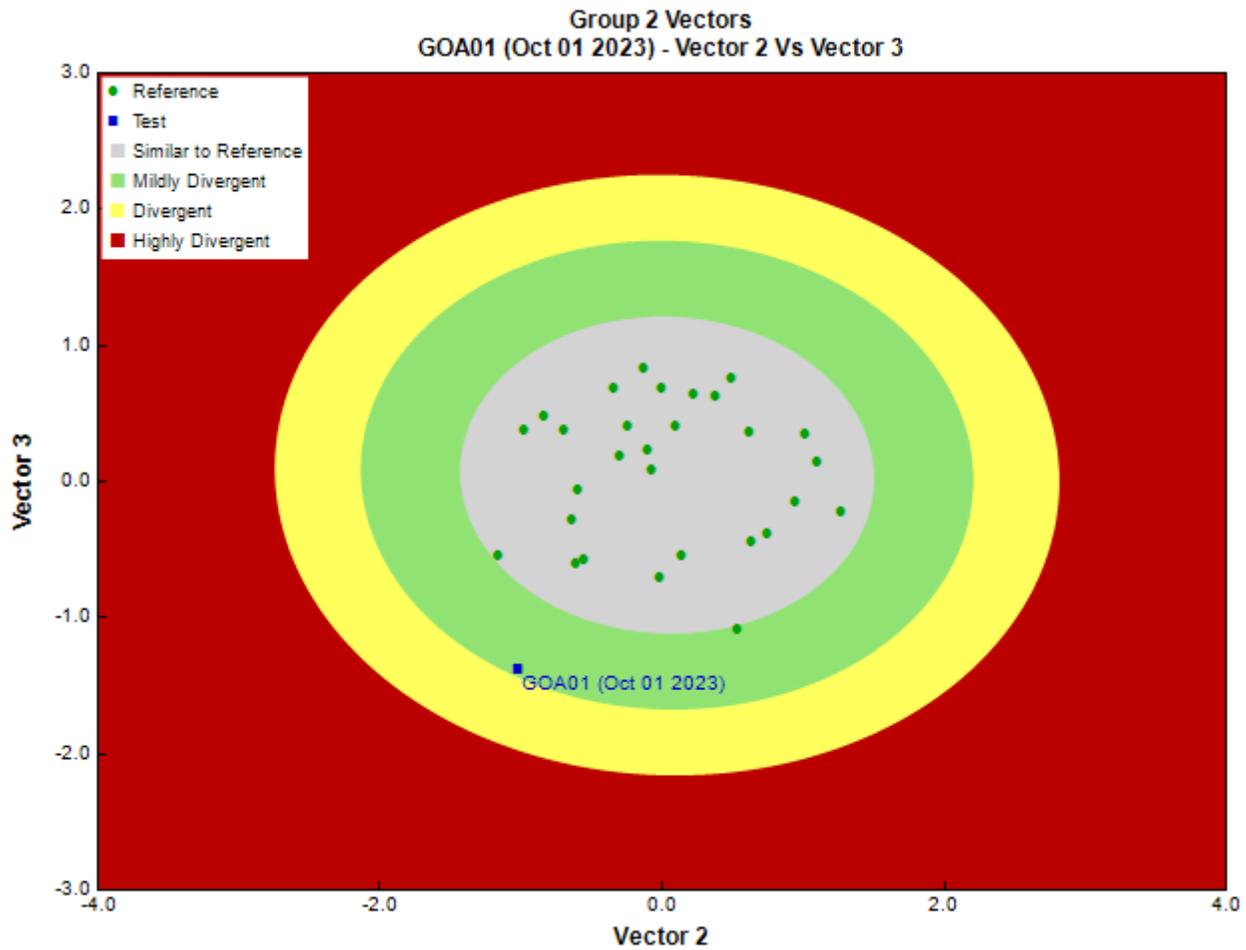


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	12/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count	
Annelida	Clitellata	Tubificida	Naididae	21	175.0	
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	6	50.0	
			Torrenticolidae	3	25.0	
	Insecta	Coleoptera	Elmidae	3	25.0	
			Diptera	Chironomidae	47	391.7
				Empididae	1	8.3
				Tipulidae	15	125.0
			Ephemeroptera	Ameletidae	5	41.7
				Baetidae	11	91.6
				Ephemerellidae	54	450.0
				Heptageniidae	49	408.2
				Leptophlebiidae	60	500.0
			Plecoptera	Chloroperlidae	2	16.7
				Leuctridae	1	8.3
				Perlidae	3	25.0
		Perlodidae	5	41.7		

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Taeniopterygidae	6	50.0
		Trichoptera	Hydropsychidae	1	8.3
			Lepidostomatidae	2	16.7
			Total	295	2,458.2

Metrics

Name	GOA01	Predicted Group Reference Mean \pm SD
Bray-Curtis Distance	0.74	0.3 \pm 0.1
Biotic Indices		
Hilsenhoff Family index (North-West)	3.6	3.2 \pm 0.3
Number Of Individuals		
% Chironomidae	15.9	6.0 \pm 5.6
% EPT Individuals	67.5	88.1 \pm 9.3
% of 2 dominant taxa	38.6	54.4 \pm 11.4
No. EPT individuals/Chironomids+EPT Individuals	0.8	0.9 \pm 0.1
Total Abundance	2458.3	1083.1 \pm 932.3
Richness		
EPT taxa (no)	12.0	12.4 \pm 2.4
Simpson's Diversity	0.9	0.8 \pm 0.1
Simpson's Evenness	0.4	0.3 \pm 0.1
Total No. of Taxa	19.0	18.2 \pm 4.7

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites						Probability Of Occurrence at GOA01
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00
Capniidae	77%	79%	63%	74%	63%	76%	0.76
Chironomidae	100%	100%	100%	93%	100%	88%	0.99
Chloroperlidae	77%	93%	88%	93%	96%	82%	0.90
EphemereIIDae	85%	97%	98%	98%	98%	82%	0.95
Heptageniidae	92%	100%	100%	100%	100%	100%	0.99
Hydropsychidae	46%	72%	71%	91%	79%	53%	0.70
Nemouridae	85%	100%	98%	98%	98%	100%	0.97
Perlodidae	77%	97%	85%	83%	90%	82%	0.90
Rhyacophilidae	69%	100%	83%	91%	98%	82%	0.92
Taeniopterygidae	69%	97%	88%	100%	100%	88%	0.92

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.34
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.89
RIVPACS : Expected taxa P>0.70	9.99
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.80

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Bedrock Geology		
Sedimentary (%)	90.91000	91.25558 \pm 24.81348
Channel		
Depth-Avg (cm)	30.3	31.4 \pm 15.4
Depth-BankfullMinusWetted (cm)	130.00	54.15 \pm 36.59
Depth-Max (cm)	37.0	46.8 \pm 23.7
Macrophyte (PercentRange)	1	0 \pm 0
Reach-%CanopyCoverage (PercentRange)	0.00	1.00 \pm 0.96
Reach-DomStreamsideVeg (Category(1-4))	3	3 \pm 1

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Reach-Pools (Binary)	0	1 \pm 1
Reach-Rapids (Binary)	0	0 \pm 0
Reach-Riffles (Binary)	1	1 \pm 0
Reach-StraightRun (Binary)	0	1 \pm 1
Slope (m/m)	0.0060000	0.0435622 \pm 0.0544263
Veg-Coniferous (Binary)	0	1 \pm 0
Veg-Deciduous (Binary)	1	1 \pm 0
Veg-GrassesFerns (Binary)	1	1 \pm 0
Veg-Shrubs (Binary)	1	1 \pm 0
Velocity-Avg (m/s)	0.28	0.63 \pm 0.23
Velocity-Max (m/s)	0.31	0.95 \pm 0.33
Width-Bankfull (m)	98.0	23.6 \pm 18.9
Width-Wetted (m)	46.3	14.0 \pm 9.6
XSEC-VelInstrumentDirect (Category(1-3))	3	2 \pm 0
XSEC-VelMethod (Category(1-3))	3	2 \pm 1
Climate		
Precip10_OCT (mm)	65.43328	93.78954 \pm 37.73803
Temp12_DECmin (Degrees Celsius)	-10.60250	-12.77499 \pm 1.90440
Hydrology		
Drainage-Area (km ²)	1256.53600	267.49128 \pm 347.95771
Perimeter (Km)	193.03860	107.09622 \pm 85.97364
Landcover		
Natl-Grassland (%)	5.43000	4.84000 \pm 3.39798
Natl-ShrubLow (%)	0.07000	4.94988 \pm 4.53147
Natl-Water (%)	0.29000	0.22026 \pm 0.32058
Substrate Data		
%Bedrock (%)	0	0 \pm 1
%Boulder (%)	0	6 \pm 7
%Cobble (%)	57	51 \pm 23
%Gravel (%)	0	4 \pm 6
%Pebble (%)	43	39 \pm 23
%Sand (%)	0	0 \pm 0
%Silt+Clay (%)	0	0 \pm 0
D50 (cm)	7.30	8.79 \pm 6.32
Dg (cm)	6.6	7.7 \pm 3.1
Dominant-1st (Category(0-9))	6	6 \pm 1
Dominant-2nd (Category(0-9))	5	6 \pm 1
Embeddedness (Category(1-5))	4	4 \pm 1
PeriphytonCoverage (Category(1-5))	2	2 \pm 1
SurroundingMaterial (Category(0-9))	3	3 \pm 1
Topography		
SlopeMax (%)	923.50000	475.68167 \pm 413.51912
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000038 \pm 0.0000018
Al (mg/L)	0.0025000	0.0064450 \pm 0.0021850
As (mg/L)	0.0002500	0.0002615 \pm 0.0000120
B (mg/L)	0.0250000	0.0262500 \pm 0.0335876
Ba (mg/L)	0.0118000	0.0683500 \pm 0.0002121
Be (mg/L)	0.0000500	0.0000075 \pm 0.0000035
Bi (mg/L)	0.0000500	0.0000038 \pm 0.0000018
Ca (mg/L)	9.6600000	24.6363636 \pm 20.0629852
Cd (mg/L)	0.0000050	0.0000038 \pm 0.0000018
Co (mg/L)	0.0000500	0.0000114 \pm 0.0000019
Cr (mg/L)	0.0002500	0.0000750 \pm 0.0000354
Cu (mg/L)	0.0002000	0.0001155 \pm 0.0000219
Fe (mg/L)	0.0210000	0.0105500 \pm 0.0036062
General-Alkalinity (mg/L)	36.5000000	74.2125000 \pm 53.9915558
General-Conductivity (μ S/cm)	59.2000000	121.7600000 \pm 104.0053005
General-DO (mg/L)	11.3000000	11.0129630 \pm 0.8955266
General-Hardness (mg/L)	36.6000000	95.8956522 \pm 77.3576081
General-pH (pH)	7.8	7.7 \pm 0.8
General-SolidsTSS (mg/L)	1.0000000	5.9463636 \pm 8.6422279

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
General-SpCond (μ S/cm)	80.7000000	165.1777778 \pm 128.4575336
General-TempAir (Degrees Celsius)	17.0	11.5 \pm 5.9
General-TempWater (Degrees Celsius)	11.7000000	6.4451852 \pm 2.2997548
General-Turbidity (NTU)	0.2500000	5.7154545 \pm 6.9690564
K (mg/L)	0.4600000	0.4604091 \pm 0.2737828
Li (mg/L)	0.0003700	0.0011000 \pm 0.0000000
Mg (mg/L)	3.0200000	8.6045455 \pm 7.5439965
Mn (mg/L)	0.0015100	0.0007470 \pm 0.0001937
Mo (mg/L)	0.0004700	0.0006780 \pm 0.0000170
Na (mg/L)	2.0800000	1.0881818 \pm 0.7163042
Ni (mg/L)	0.0002000	0.0001625 \pm 0.0001945
Nitrogen-NO2 (mg/L)	0.0050000	0.0034091 \pm 0.0048394
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0789333 \pm 0.0140433
Nitrogen-NO3 (mg/L)	0.0050000	0.0719000 \pm 0.0408583
Nitrogen-TKN (mg/L)	0.0250000	0.0200000
Nitrogen-TN (mg/L)	0.0250000	0.0929091 \pm 0.0373336
Pb (mg/L)	0.0001000	0.0000337 \pm 0.0000259
Phosphorus-OrthoP (mg/L)	0.0085000	0.0005167 \pm 0.0006974
Phosphorus-TDP (mg/L)	0.0025000	0.0010200 \pm 0.0007879
Phosphorus-TP (mg/L)	0.0250000	0.0049864 \pm 0.0043795
S (mg/L)	1.5000000	5.0000000
Sb (mg/L)	0.0001000	0.0000635 \pm 0.0000092
Se (mg/L)	0.0002500	0.0001105 \pm 0.0000134
Si (mg/L)	3.9000000	2.5681818 \pm 1.4562562
Sn (mg/L)	0.0001000	0.0000075 \pm 0.0000035
Sr (mg/L)	0.0356000	0.0445000 \pm 0.0002828
Te (mg/L)	0.0002500	0.0000000 \pm 0.0000000
Th (mg/L)	0.0000500	0.0000000 \pm 0.0000000
Ti (mg/L)	0.0025000	0.0005000
Tl (mg/L)	0.0000100	0.0000015 \pm 0.0000007
U (mg/L)	0.0004100	0.0012050 \pm 0.0000495
V (mg/L)	0.0025000	0.0001500 \pm 0.0000707
Zn (mg/L)	0.0020000	0.0006400 \pm 0.0005091
Zr (mg/L)	0.0000500	0.0000000 \pm 0.0000000

Site Description

Study Name	BC NGO-Goat River Ecological Monitoring
Site	GOA01
Sampling Date	Sep 29 2024
Know Your Watershed Basin	Lower Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Columbia Mountains and Highlands EcoRegion
Coordinates (decimal degrees)	49.08073 N, 116.51954 W
Altitude	539
Local Basin Name	Goat River
	Kootenay River
Stream Order	5



Down Stream

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	December 17, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin
Reference Groups	1 2 3 4 5 6
Number of Reference Sites	13 24 28 35 32 15
Group Error Rate	53.8% 55.2% 34.1% 52.2% 23.1% 29.4%
Overall Model Error Rate	39.4%
Probability of Group Membership	12.8% 53.9% 13.3% 12.4% 2.6% 4.9%
CABIN Assessment of GOA01 on Sep 29, 2024	Highly Divergent

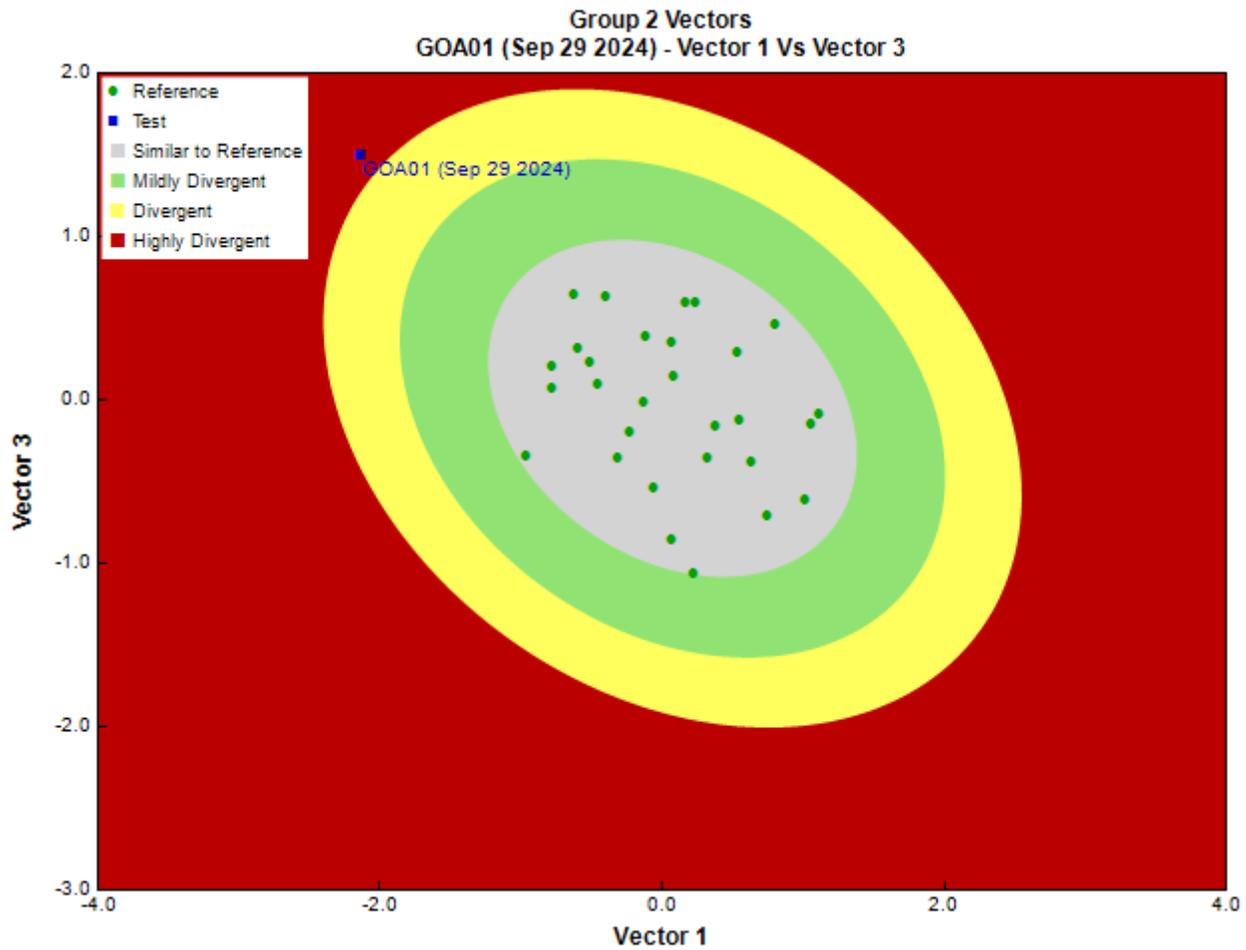


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	6/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	3	50.0
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	1	16.7
			Sperchontidae	1	16.7
			Torrenticolidae	7	116.7
	Insecta	Coleoptera	Elmidae	2	33.4
			Diptera	Chironomidae	57
			Tipulidae	48	800.0
		Ephemeroptera	Ameletidae	14	233.3
			Ephemerellidae	83	1,383.3
			Heptageniidae	33	550.0
			Leptophlebiidae	54	900.0
		Plecoptera		2	33.3
			Capniidae	1	16.7
			Chloroperlidae	1	16.7
			Leuctridae	1	16.7
			Perlodidae	3	50.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
		Trichoptera	Hydropsychidae	1	16.7
			Hydroptilidae	1	16.7
			Lepidostomatidae	7	116.7
			Total	320	5,333.7

Metrics

Name	GOA01	Predicted Group Reference Mean \pm SD
Bray-Curtis Distance	0.91	0.3 \pm 0.1
Biotic Indices		
Hilsenhoff Family index (North-West)	2.9	3.2 \pm 0.3
Number Of Individuals		
% Chironomidae	17.9	6.0 \pm 5.6
% EPT Individuals	62.6	88.1 \pm 9.3
% of 2 dominant taxa	44.0	54.4 \pm 11.4
No. EPT individuals/Chironomids+EPT Individuals	0.8	0.9 \pm 0.1
Total Abundance	5333.3	1083.1 \pm 932.3
Richness		
EPT taxa (no)	11.0	12.4 \pm 2.4
Simpson's Diversity	0.8	0.8 \pm 0.1
Simpson's Evenness	0.3	0.3 \pm 0.1
Total No. of Taxa	18.0	18.2 \pm 4.7

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites						Probability Of Occurrence at GOA01
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	
Ameletidae	69%	59%	68%	57%	58%	65%	0.61
Baetidae	100%	100%	100%	100%	100%	100%	1.00
Capniidae	77%	79%	63%	74%	63%	76%	0.76
Chironomidae	100%	100%	100%	93%	100%	88%	0.99
Chloroperlidae	77%	93%	88%	93%	96%	82%	0.90
Empididae	54%	62%	71%	50%	62%	65%	0.61
Ephemerellidae	85%	97%	98%	98%	98%	82%	0.95
Heptageniidae	92%	100%	100%	100%	100%	100%	0.99
Hydropsychidae	46%	72%	71%	91%	79%	53%	0.70
Nemouridae	85%	100%	98%	98%	98%	100%	0.97
Perlodidae	77%	97%	85%	83%	90%	82%	0.90
Rhyacophilidae	69%	100%	83%	91%	98%	82%	0.92
Sperchontidae	23%	76%	46%	43%	44%	59%	0.59
Taeniopterygidae	69%	97%	88%	100%	100%	88%	0.92
Tipulidae	69%	48%	49%	65%	40%	53%	0.53

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.34
RIVPACS : Observed taxa P>0.50	10.00
RIVPACS : O:E (p > 0.5)	0.81
RIVPACS : Expected taxa P>0.70	9.99
RIVPACS : Observed taxa P>0.70	7.00
RIVPACS : O:E (p > 0.7)	0.70

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Bedrock Geology		
Sedimentary (%)	90.91000	91.25558 \pm 24.81348
Channel		
Depth-Avg (cm)	19.5	31.4 \pm 15.4
Depth-BankfullMinusWetted (cm)	115.00	54.15 \pm 36.59

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
Depth-Max (cm)	27.0	46.8 \pm 23.7
Macrophyte (PercentRange)	0	0 \pm 0
Reach-%CanopyCoverage (PercentRange)	0.00	1.00 \pm 0.96
Reach-DomStreamsideVeg (Category(1-4))	3	3 \pm 1
Reach-Pools (Binary)	0	1 \pm 1
Reach-Rapids (Binary)	0	0 \pm 0
Reach-Riffles (Binary)	1	1 \pm 0
Reach-StraightRun (Binary)	1	1 \pm 1
Slope (m/m)	0.0050000	0.0435622 \pm 0.0544263
Veg-Coniferous (Binary)	1	1 \pm 0
Veg-Deciduous (Binary)	1	1 \pm 0
Veg-GrassesFerns (Binary)	1	1 \pm 0
Veg-Shrubs (Binary)	1	1 \pm 0
Velocity-Avg (m/s)	0.25	0.63 \pm 0.23
Velocity-Max (m/s)	0.36	0.95 \pm 0.33
Width-Bankfull (m)	98.2	23.6 \pm 18.9
Width-Wetted (m)	52.9	14.0 \pm 9.6
XSEC-VelInstrumentDirect (Category(1-3))	3	2 \pm 0
XSEC-VelMethod (Category(1-3))	3	2 \pm 1
Climate		
Precip10_OCT (mm)	65.43328	93.78954 \pm 37.73803
Temp12_DECmin (Degrees Celsius)	-10.60250	-12.77499 \pm 1.90440
Hydrology		
Drainage-Area (km^2)	1256.53600	267.49128 \pm 347.95771
Perimeter (Km)	193.03860	107.09622 \pm 85.97364
Landcover		
Natl-Grassland (%)	5.43000	4.84000 \pm 3.39798
Natl-ShrubLow (%)	0.07000	4.94988 \pm 4.53147
Natl-Water (%)	0.29000	0.22026 \pm 0.32058
Substrate Data		
%Bedrock (%)	0	0 \pm 1
%Boulder (%)	1	6 \pm 7
%Cobble (%)	48	51 \pm 23
%Gravel (%)	0	4 \pm 6
%Pebble (%)	51	39 \pm 23
%Sand (%)	0	0 \pm 0
%Silt+Clay (%)	0	0 \pm 0
D50 (cm)	6.05	8.79 \pm 6.32
Dg (cm)	6.3	7.7 \pm 3.1
Dominant-1st (Category(0-9))	6	6 \pm 1
Dominant-2nd (Category(0-9))	5	6 \pm 1
Embeddedness (Category(1-5))	4	4 \pm 1
PeriphytonCoverage (Category(1-5))	3	2 \pm 1
SurroundingMaterial (Category(0-9))	3	3 \pm 1
Topography		
SlopeMax (%)	923.50000	475.68167 \pm 413.51912
Water Chemistry		
Ag (mg/L)	0.0000050	0.0000038 \pm 0.0000018
Al (mg/L)	0.0055000	0.0064450 \pm 0.0021850
As (mg/L)	0.0003500	0.0002615 \pm 0.0000120
B (mg/L)	0.0050000	0.0262500 \pm 0.0335876
Ba (mg/L)	0.0139000	0.0683500 \pm 0.0002121
Be (mg/L)	0.0000100	0.0000075 \pm 0.0000035
Bi (mg/L)	0.0000250	0.0000038 \pm 0.0000018
Ca (mg/L)	9.3000000	24.6363636 \pm 20.0629852
Cd (mg/L)	0.0000025	0.0000038 \pm 0.0000018
Co (mg/L)	0.0000500	0.0000114 \pm 0.0000019
Cr (mg/L)	0.0002500	0.0000750 \pm 0.0000354
Cu (mg/L)	0.0002500	0.0001155 \pm 0.0000219
Fe (mg/L)	0.0310000	0.0105500 \pm 0.0036062
General-Alkalinity (mg/L)	40.6000000	74.2125000 \pm 53.9915558
General-Conductivity (μ S/cm)	67.9000000	121.7600000 \pm 104.0053005

Habitat Description

Variable	GOA01	Predicted Group Reference Mean \pm SD
General-DO (mg/L)	10.0000000	11.0129630 \pm 0.8955266
General-Hardness (mg/L)	37.0000000	95.8956522 \pm 77.3576081
General-pH (pH)	7.7	7.7 \pm 0.8
General-SolidsTSS (mg/L)	1.5000000	5.9463636 \pm 8.6422279
General-SpCond (μ S/cm)	84.5000000	165.1777778 \pm 128.4575336
General-TempAir (Degrees Celsius)	21.0	11.5 \pm 5.9
General-TempWater (Degrees Celsius)	14.7000000	6.4451852 \pm 2.2997548
General-Turbidity (NTU)	0.5300000	5.7154545 \pm 6.9690564
K (mg/L)	0.4990000	0.4604091 \pm 0.2737828
Li (mg/L)	0.0005000	0.0011000 \pm 0.0000000
Mg (mg/L)	3.3400000	8.6045455 \pm 7.5439965
Mn (mg/L)	0.0010300	0.0007470 \pm 0.0001937
Mo (mg/L)	0.0004150	0.0006780 \pm 0.0000170
Na (mg/L)	2.2400000	1.0881818 \pm 0.7163042
Ni (mg/L)	0.0002500	0.0001625 \pm 0.0001945
Nitrogen-NH3 (mg/L)	0.0025000	0.0014722 \pm 0.0022127
Nitrogen-NO2 (mg/L)	0.0005000	0.0034091 \pm 0.0048394
Nitrogen-NO2+NO3 (mg/L)	0.0025500	0.0789333 \pm 0.0140433
Nitrogen-NO3 (mg/L)	0.0025000	0.0719000 \pm 0.0408583
Nitrogen-TN (mg/L)	0.0330000	0.0929091 \pm 0.0373336
Pb (mg/L)	0.0000250	0.0000337 \pm 0.0000259
Phosphorus-OrthoP (mg/L)	0.0027000	0.0005167 \pm 0.0006974
Phosphorus-TDP (mg/L)	0.0032000	0.0010200 \pm 0.0007879
Phosphorus-TP (mg/L)	0.0021000	0.0049864 \pm 0.0043795
S (mg/L)	1.1800000	5.0000000
Sb (mg/L)	0.0000500	0.0000635 \pm 0.0000092
Se (mg/L)	0.0000250	0.0001105 \pm 0.0000134
Si (mg/L)	4.1100000	2.5681818 \pm 1.4562562
Sn (mg/L)	0.0000500	0.0000075 \pm 0.0000035
Sr (mg/L)	0.0390000	0.0445000 \pm 0.0002828
Te (mg/L)	0.0001000	0.0000000 \pm 0.0000000
Th (mg/L)	0.0000500	0.0000000 \pm 0.0000000
Ti (mg/L)	0.0001500	0.0005000
Tl (mg/L)	0.0000050	0.0000015 \pm 0.0000007
U (mg/L)	0.0003600	0.0012050 \pm 0.0000495
V (mg/L)	0.0002500	0.0001500 \pm 0.0000707
Zn (mg/L)	0.0015000	0.0006400 \pm 0.0005091
Zr (mg/L)	0.0001000	0.0000000 \pm 0.0000000

Stream Data Appendix

STREAM Data 2022 (1 page)

STREAM Data 2023 (1 page)

STREAM DATA: Sep 5, 2022

GOA01 3 replicates

Phylum	Class	Order	Family	Genus	Species	GOA_1_A	GOA_1_B	GOA_1_C
Annelida	Clitellata	Haplotaxida	Naididae	Nais	<i>Nais variabilis</i>	P	P	
Arthropoda	Insecta	Coleoptera	Chrysomelidae	Donacia	<i>Donacia clavipes</i>			P
Arthropoda	Insecta	Diptera	Chironomidae	Conchapelopia	<i>Conchapelopia pallens</i>	P		P
Arthropoda	Insecta	Diptera	Chironomidae	Cricotopus	<i>Cricotopus bicinctus</i>		P	
Arthropoda	Insecta	Diptera	Chironomidae	Nilotanypus	<i>Nilotanypus fimbriatus</i>	P		
Arthropoda	Insecta	Diptera	Chironomidae	Orthocladus	<i>Orthocladus carlatus</i>		P	
Arthropoda	Insecta	Diptera	Chironomidae	Orthocladus	<i>Orthocladus fuscimanus</i>		P	
Arthropoda	Insecta	Diptera	Chironomidae	Orthocladus	<i>Orthocladus glabripennis</i>	P		
Arthropoda	Insecta	Diptera	Chironomidae	Pagastia	<i>Pagastia orthogonia</i>			P
Arthropoda	Insecta	Diptera	Chironomidae	Paralauterborniella	<i>Paralauterborniella nigrohalteralis</i>	P		
Arthropoda	Insecta	Diptera	Chironomidae	Potthastia	<i>Potthastia gaedii</i>		P	
Arthropoda	Insecta	Diptera	Chironomidae	Synorthocladus	<i>Synorthocladus semivirens</i>		P	
Arthropoda	Insecta	Diptera	Chloropidae	Thaumatomyia	<i>Thaumatomyia bistrata</i>			P
Arthropoda	Insecta	Diptera	Dolichopodidae	Peloropecodes	<i>Peloropecodes cornutus</i>	P		
Arthropoda	Insecta	Diptera	Empididae	Neoplasta	<i>Neoplasta megorchis</i>			P
Arthropoda	Insecta	Diptera	Simuliidae	Simulium	<i>Simulium defoliati</i>	P		
Arthropoda	Insecta	Diptera	Simuliidae	Simulium	<i>Simulium negativum</i>	P		
Arthropoda	Insecta	Ephemeroptera	Ameletidae	Ameletus	<i>Ameletus subnotatus</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acentrella	<i>Acentrella insignificans</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acentrella	<i>Acentrella turbida</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis	<i>Baetis phoebus</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis	<i>Baetis tricaudatus</i>	P		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Dipheter	<i>Dipheter hageni</i>	P	P	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Attenella	<i>Attenella margarita</i>	P		P
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Drunella	<i>Drunella doddii</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Drunella	<i>Drunella grandis</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	<i>Ephemerella tibialis</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Ecdyonurus	<i>Ecdyonurus simplicioides</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Epeorus	<i>Epeorus albertae</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Leptohyphidae	Tricorythodes	<i>Tricorythodes mosegus</i>	P		P
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	<i>Paraleptophlebia heteronea</i>	P	P	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	<i>Paraleptophlebia memorialis</i>	P	P	P
Arthropoda	Insecta	Ephemeroptera	Siphonuridae	Siphonurus	<i>Siphonurus occidentalis</i>			P
Arthropoda	Insecta	Megaloptera	Corydalidae	Nigronia	<i>Nigronia serricornis</i>		P	
Arthropoda	Insecta	Plecoptera_Insecta	Capniidae	Eucapnopsis	<i>Eucapnopsis brevicauda</i>		P	
Arthropoda	Insecta	Plecoptera_Insecta	Chloroperlidae	Alloperla	<i>Alloperla severa</i>	P	P	
Arthropoda	Insecta	Plecoptera_Insecta	Chloroperlidae	Sweltsa	<i>Sweltsa coloradensis</i>	P	P	P
Arthropoda	Insecta	Plecoptera_Insecta	Nemouridae	Zapada	<i>Zapada cinctipes</i>	P	P	
Arthropoda	Insecta	Plecoptera_Insecta	Nemouridae	Zapada	<i>Zapada columbiana</i>		P	
Arthropoda	Insecta	Plecoptera_Insecta	Perlidae	Hesperoperla	<i>Hesperoperla pacifica</i>	P	P	
Arthropoda	Insecta	Plecoptera_Insecta	Perlodidae	Isoperla	<i>Isoperla fulva</i>	P	P	P
Arthropoda	Insecta	Plecoptera_Insecta	Perlodidae	Kogotus	<i>Kogotus modestus</i>	P		
Arthropoda	Insecta	Plecoptera_Insecta	Perlodidae	Megarcys	<i>Megarcys watertoni</i>	P		
Arthropoda	Insecta	Plecoptera_Insecta	Pteronarcyidae	Pteronarcys	<i>Pteronarcys princeps</i>			P
Arthropoda	Insecta	Plecoptera_Insecta	Taeniopterygidae	Doddzia	<i>Doddzia occidentalis</i>	P		
Arthropoda	Insecta	Plecoptera_Insecta	Taeniopterygidae	Taenionema	<i>Taenionema pacificum</i>	P	P	P
Arthropoda	Insecta	Trichoptera	Brachycentridae	Brachycentrus	<i>Brachycentrus americanus</i>	P		
Arthropoda	Insecta	Trichoptera	Brachycentridae	Brachycentrus	<i>Brachycentrus occidentalis</i>	P	P	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Arctopsyche	<i>Arctopsyche grandis</i>	P		
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	<i>Ceratopsyche cockerelli</i>	P	P	P
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	<i>Ceratopsyche oslari</i>	P	P	P
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsyche	<i>Hydropsyche oslari</i>	P		
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	<i>Lepidostoma pluviale</i>		P	P
Arthropoda	Insecta	Trichoptera	Leptoceridae	Ceraclea	<i>Ceraclea nepha</i>	P		
Arthropoda	Insecta	Trichoptera	Limnephilidae	Dicosmoecus	<i>Dicosmoecus gilvipes</i>	P	P	
Gastrotricha	undef_Gastrotricha	Chaetonotida	Chaetonotidae	Chaetonotus	<i>Chaetonotus gelidus</i>		P	
Gastrotricha	undef_Gastrotricha	Chaetonotida	Chaetonotidae	Chaetonotus	<i>Chaetonotus persimilis</i>		P	
Nematoda	Chromadorea	Plectida	Plectidae	Plectus	<i>Plectus aquatilis</i>	P		P
Nematomorpha	Gordioida	Gordea	Gordiidae	Paragordius	<i>Paragordius varius</i>	P	P	P
Rotifera	Bdelloidea	Adinetida	Adinetidae	Adineta	<i>Adineta vaga</i>			P
Rotifera	Bdelloidea	Philodinida	Philodinidae	Philodina	<i>Philodina flaviceps</i>		P	
Rotifera	Bdelloidea	undef_Bdelloidea	undef_undef_Bdelloidea	Rotaria	<i>Rotaria rotatoria</i>			P

STREAM DATA: Oct 1, 2023					GOA01 3 replicates		
Phylum	Class	Order	Family	Genus	XGOA_00	XGOA_00	XGOA_0001_C_2023
Annelida	Clitellata	Crassiclitellata	Lumbricidae	Eiseniella		P	
Annelida	Clitellata	Lumbriculida	Lumbriculidae	Stylodrilus	P		
Annelida	Clitellata	Tubificida	Naididae	Nais		P	P
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	Atractides	P	P	P
Arthropoda	Collembola	Entomobryomorpha	Tomoceridae	Tomocerus		P	
Arthropoda	Insecta	Coleoptera	Elmidae	Optioservus	P	P	P
Arthropoda	Insecta	Coleoptera	Elmidae	Ordobrevia	P	P	P
Arthropoda	Insecta	Diptera	Athericidae	Atherix		P	
Arthropoda	Insecta	Diptera	Chironomidae	Cladotanytarsus	P		
Arthropoda	Insecta	Diptera	Chironomidae	Cricotopus		P	P
Arthropoda	Insecta	Diptera	Chironomidae	Demicryptochironomus		P	
Arthropoda	Insecta	Diptera	Chironomidae	Microtendipes		P	
Arthropoda	Insecta	Diptera	Chironomidae	Sublettea	P	P	P
Arthropoda	Insecta	Diptera	Chironomidae	Tanytarsus	P	P	P
Arthropoda	Insecta	Diptera	Chironomidae	Thienemanniella	P		
Arthropoda	Insecta	Diptera	Limoniidae	Hexatoma		P	
Arthropoda	Insecta	Diptera	Tipulidae	Tipula_genus	P	P	
Arthropoda	Insecta	Ephemeroptera	Ameletidae	Ameletus	P	P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acentrella		P	P
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis		P	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Attenella			P
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Drunella	P	P	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	P	P	P
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Cinygmula		P	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Epeorus		P	P
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	P	P	P
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Neoleptophlebia	P	P	P
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	P	P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Capniidae	Capnia	P	P	
Arthropoda	Insecta	Plecoptera_stoneflies	Capniidae	Eucapnopsis	P	P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Chloroperlidae	Alloperla		P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Chloroperlidae	Sweltsa	P	P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Nemouridae	Zapada	P	P	
Arthropoda	Insecta	Plecoptera_stoneflies	Perlidae	Hesperoperla		P	
Arthropoda	Insecta	Plecoptera_stoneflies	Perlodidae	Isoperla	P	P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Perlodidae	Kogotus		P	
Arthropoda	Insecta	Plecoptera_stoneflies	Perlodidae	Skwala	P	P	P
Arthropoda	Insecta	Plecoptera_stoneflies	Pteronarcyidae	Pteronarcys	P	P	
Arthropoda	Insecta	Plecoptera_stoneflies	Taeniopterygidae	Taenionema	P	P	P
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Arctopsyche		P	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	P	P	P
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsyche	P	P	
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	P	P	
Gastrotricha	undef_Gastrotricha	Chaetonotida	Chaetonotidae	Chaetonotus		P	
Gastrotricha	undef_Gastrotricha	Macrodasysida	Thaumastodermatidae	Chimaeradasys		P	
Mollusca	Bivalvia	Venerida	Sphaeriidae	Pisidium	P		
Rotifera	Eurotatoria	Adinetida	Adinetidae	Adineta		P	
Rotifera	Eurotatoria	Philodinida	Philodinidae	Dissotrocha		P	
Rotifera	Eurotatoria	Philodinida	Philodinidae	Philodina	P	P	
Rotifera	Eurotatoria	Ploima	Brachionidae	Brachionus		P	
Rotifera	Eurotatoria	undef_Eurotatoria	undef_undef_Eurotatoria	Rotaria	P		
Tardigrada	Eutardigrada	Parachela_tardigrades	Murrayidae	Dactylobiotus		P	

Monthly Water Quality Appendix

Summary of Monthly Water Sampling 2022-2024 (1 page)

Goat River Water Quality Data May 2022-Oct 2024												
date_time	site_id	latitude	longitude	pH- pH units	conductivity- μS/cm	specific_cond uctivity- μS/cm	water_tempe rature- °C	turbidity- NTU	dissolved_o xygen- %	dissolved_ oxygen- mg/L	air_temp erature- ° C	notes
2022-05-01 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.3	33	48.4	8.5	0.26		12	22	DO from CHEMETS Dissolved Oxygen, water temperature via thermometer
2022-06-25 13:30	Goat River (10th Ave S)	49.0782992	-116.5143657	6.92	26.4	36.3	11.4	2.62		11	25	DO from CHEMETS Dissolved Oxygen, water temperature via thermometer
2022-07-30 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.26	61.3	68.1	20.3	0.22	118	10.35	32	Water temperature taken by via thermometer
2022-08-29 09:15	Goat River (10th Ave S)	49.0782992	-116.5143657	7.03	63	79	14.1	0.05	111.9	11.7	19	Water temperature taken by via thermometer
2022-09-27 09:05	Goat River (10th Ave S)	49.0782992	-116.5143657	6.9	61.6	83.6	11.7	0.16		9	15	DO from CHEMETS Dissolved Oxygen, water temperature via thermometer
2022-10-29 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.1	55.7	84.5	8.2	0.34	96	11.78	15	Water temperature taken by via thermometer
2022-05-01 14:00	Goat River 3.5km	49.1917843	-116.3443565	7.5	34	51	7.3	0.42		11	18	DO from CHEMETS Dissolved Oxygen, water temperature via thermometer
2022-06-25 14:30	Goat River 3.5km	49.1917843	-116.3443565	7.06	24.9	33.8	11.9	1.27		12	24	DO from CHEMETS Dissolved Oxygen, water temperature via thermometer
2022-07-30 14:05	Goat River 3.5km	49.1917843	-116.3443565	7.3	55.9	62.8	18.8	0.14		10.61	34	Water temperature taken by via thermometer
2022-08-29 11:20	Goat River 3.5km	49.1917843	-116.3443565	7.5	53.6	71.5	13.3	0.03	109.1	11.71	23	Water temperature taken by via thermometer
2022-09-27 10:07	Goat River 3.5km	49.1917843	-116.3443565	7.29	51.5	74.7	8.8	0.39		10	15.5	DO from CHEMETS Dissolved Oxygen
2022-10-29 14:10	Goat River 3.5km	49.1917843	-116.3443565	7.3	48.4	75	6.4	0.05	90.1	11.02	15	
2022-09-05 11:30	Goat River GOA01	49.0807	-116.51907	6.66	82.82	81.2	17.2	0.17	101	9.93	26	
2023-10-01 13:32	Goat River GOA01	49.0807	-116.51907	7.84		80.7	11.7	0.25		11.28	17	
2023-06-26 09:05	Goat River (10th Ave S)	49.0782992	-116.5143657	7.7	36.8	49.5	11.6	0.18	101.6	11.12	19.5	
2023-07-29 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.83	70	78.1	19.6	0.31	94.1	8.75	28	
2023-08-26 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.7	73	84.3	18	0.16		9	28.5	Hanna multimeter no batteries- DO from CHEMets Dissolved Oxygen kit
2023-09-29 14:30	Goat River (10th Ave S)	49.0782992	-116.5143657	7.76	60.2	79.4	12.5	0.24	110.2	12.08	19	
2023-10-25 12:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.4	51	83	5.5	0.74	117.7	15.16	8	Water temperature taken by via thermometer
2023-06-26 10:05	Goat River 3.5km	49.1917843	-116.3443565	7.7	32.9	46.7	9.6	0.08	97.9	11.08	21	
2023-07-29 14:00:00	Goat River 3.5km	49.1917843	-116.3443565	7.75	59.7	70.9	16.7		96.3	9.35	32	
2023-08-26 14:00:00	Goat River 3.5km	49.1917843	-116.3443565	7.7	63.3	75	16.7	0.28		9	30	Hanna multimeter no batteries- DO from CHEMets Dissolved Oxygen kit
2023-09-29 15:20	Goat River 3.5km	49.1917843	-116.3443565	7.9	51.5	70.8	10.7	0.13	102.9	11.1	21	
2023-10-25 12:50	Goat River 3.5km	49.1917843	-116.3443565	7.6	42.5	71.1	3.9	0.01	128.3	16.48	5	
2024-09-29 14:05	Goat River GOA01	49.0807	-116.51907	7.7	67.9	84.5	14.7	0.53		10	21	DO was taken with Hach Dissolve Oxygen Winkler Method
2024/05/24 09:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.2	21.7	33.9	6.2	2.25	108	13.34	15	high water
2024/06/22 09:05	Goat River (10th Ave S)	49.0782992	-116.5143657	7.3	28.2	40	9.5	1.02	114.7	13.13	21	
2024/07/31 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.59	61.8	71.2	18.1	0.79		9	31	DO from CHEMets Dissolved Oxygen kit
2024/08/30 13:05	Goat River (10th Ave S)	49.0782992	-116.5143657	7.53	63.7	77.1	15.8	0.36		10	25	DO from CHEMets Dissolved Oxygen kit
2024/09/26 13:00	Goat River (10th Ave S)	49.0782992	-116.5143657	7.68	68.3	84.2	15.1	1.28		11	22	DO from CHEMets Dissolved Oxygen kit
2024/10/25 13:10	Goat River (10th Ave S)	49.0782992	-116.5143657	7.21	49.3	79.3	5.2	0.37		11	14	DO from CHEMets Dissolved Oxygen kit
2024-05-24 09:50	Goat River 3.5km	49.1917843	-116.3443565	7.31	20.9	33.7	5.1	1.96	104.3	12.96	14.5	high water
2024-06-22 10:05	Goat River 3.5km	49.1917843	-116.3443565	7.6	25.6	38.4	7.6	1.84	107.6	12.66	19	
2024-07-31 14:00	Goat River 3.5km	49.1917843	-116.3443565	7.61	53.6	66.4	15	0.27		9	26	DO from CHEMets Dissolved Oxygen kit
2024-08-30 13:45	Goat River 3.5km	49.1917843	-116.3443565	7.75	55.1	69	14.5	0.95		11	26	DO from CHEMets Dissolved Oxygen kit
2024-09-26 14:00	Goat River 3.5km	49.1917843	-116.3443565	7.81	57.8	73	14.1	0.72		10	22.5	DO from CHEMets Dissolved Oxygen kit
2024-10-25 14:10	Goat River 3.5km	49.1917843	-116.3443565	7.53	42.8	70.1	4.6	0.42		11	13	DO from CHEMets Dissolved Oxygen kit

Lab Results Appendix

CARO lab results 2022 (11 pages)

CARO lab results 2023 (9 pages)

ALS lab results 2024 (3 pages)

CERTIFICATE OF ANALYSIS

REPORTED TO Wildsight (Creston)
PO Box 1001
Creston, BC V0B 1G0

ATTENTION Melissa Flint

PO NUMBER

PROJECT WCVB Goat River

PROJECT INFO

WORK ORDER 2211097

RECEIVED / TEMP 2022-09-07 14:30 / 5.8°C
REPORTED 2022-10-13 08:41

COC NUMBER B122634

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

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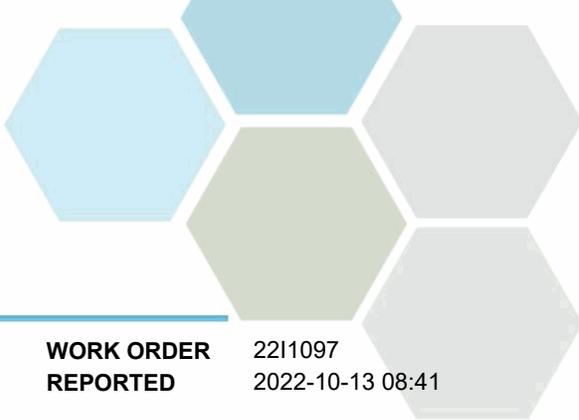
If you have any questions or concerns, please contact me at TeamCaro@caro.ca

Authorized By:

Team CARO
Client Service Representative

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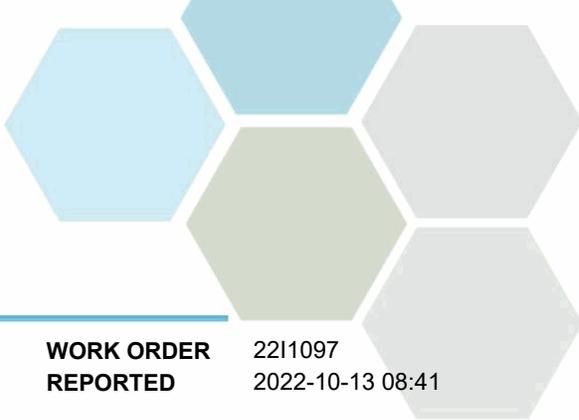


TEST RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
GOA01 (2211097-01) Matrix: Water Sampled: 2022-09-05 11:30					
Anions					
Nitrate (as N)	< 0.010	3	0.010 mg/L	2022-09-13	HT1
Nitrite (as N)	< 0.010	0.02	0.010 mg/L	2022-09-13	HT1
Phosphate (as P)	< 0.0100	N/A	0.0050 mg/L	2022-09-13	HT1
Calculated Parameters					
Hardness, Total (as CaCO3)	35.7	N/A	0.500 mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100 mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500 mg/L	N/A	
General Parameters					
Alkalinity, Total (as CaCO3)	46.2	10	1.0 mg/L	2022-09-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2022-09-11	
Alkalinity, Bicarbonate (as CaCO3)	46.2	N/A	1.0 mg/L	2022-09-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2022-09-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2022-09-11	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2022-09-13	
Phosphorus, Total (as P)	< 0.0050	0.005	0.0050 mg/L	2022-09-12	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050 mg/L	2022-09-12	
Solids, Total Suspended	< 2.0	N/A	2.0 mg/L	2022-09-13	HT1
Total Metals					
Aluminum, total	0.0096	N/A	0.0050 mg/L	2022-09-11	
Antimony, total	< 0.00020	0.009	0.00020 mg/L	2022-09-11	
Arsenic, total	< 0.00050	0.005	0.00050 mg/L	2022-09-11	
Barium, total	0.0127	1	0.0050 mg/L	2022-09-11	
Beryllium, total	< 0.00010	0.00013	0.00010 mg/L	2022-09-11	
Bismuth, total	< 0.00010	N/A	0.00010 mg/L	2022-09-11	
Boron, total	< 0.0500	1.2	0.0500 mg/L	2022-09-11	
Cadmium, total	< 0.000010	N/A	0.000010 mg/L	2022-09-11	
Calcium, total	9.44	N/A	0.20 mg/L	2022-09-11	
Chromium, total	< 0.00050	N/A	0.00050 mg/L	2022-09-11	
Cobalt, total	< 0.00010	0.004	0.00010 mg/L	2022-09-11	
Copper, total	< 0.00040	0.002	0.00040 mg/L	2022-09-11	
Iron, total	0.027	1	0.010 mg/L	2022-09-11	
Lead, total	< 0.00020	0.003	0.00020 mg/L	2022-09-11	
Lithium, total	0.00045	N/A	0.00010 mg/L	2022-09-11	
Magnesium, total	2.94	N/A	0.010 mg/L	2022-09-11	
Manganese, total	0.00233	0.61	0.00020 mg/L	2022-09-11	
Molybdenum, total	0.00044	1	0.00010 mg/L	2022-09-11	
Nickel, total	< 0.00040	0.025	0.00040 mg/L	2022-09-11	
Phosphorus, total	< 0.050	N/A	0.050 mg/L	2022-09-11	
Potassium, total	0.47	N/A	0.10 mg/L	2022-09-11	
Selenium, total	< 0.00050	0.001	0.00050 mg/L	2022-09-11	
Silicon, total	4.3	N/A	1.0 mg/L	2022-09-11	



TEST RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
GOA01 (2211097-01) Matrix: Water Sampled: 2022-09-05 11:30, Continued						
<i>Total Metals, Continued</i>						
Silver, total	< 0.000050	0.00005	0.000050	mg/L	2022-09-11	
Sodium, total	1.90	N/A	0.10	mg/L	2022-09-11	
Strontium, total	0.0340	N/A	0.0010	mg/L	2022-09-11	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2022-09-11	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2022-09-11	
Thallium, total	< 0.000020	0.008	0.000020	mg/L	2022-09-11	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2022-09-11	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2022-09-11	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2022-09-11	
Tungsten, total	< 0.0002	N/A	0.0002	mg/L	2022-09-11	
Uranium, total	0.000375	0.0085	0.000020	mg/L	2022-09-11	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2022-09-11	
Zinc, total	< 0.0040	0.0075	0.0040	mg/L	2022-09-11	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2022-09-11	

GOA01 A (2211097-02) | Matrix: Water | Sampled: 2022-09-05 11:30

General Parameters

Alkalinity, Total (as CaCO3)	< 1.0	10	1.0	mg/L	2022-09-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	

GOA02 (2211097-03) | Matrix: Water | Sampled: 2022-09-05 14:30

Anions

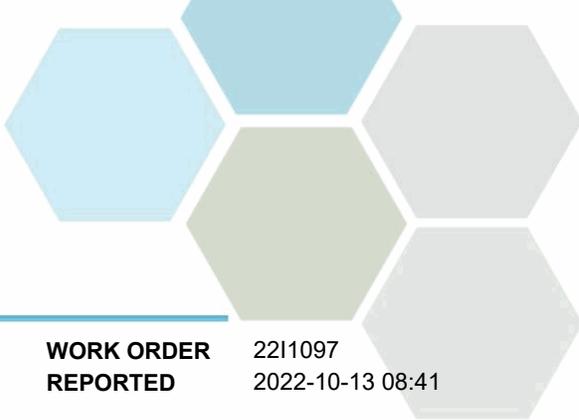
Nitrate (as N)	< 0.010	3	0.010	mg/L	2022-09-13	HT1
Nitrite (as N)	< 0.010	0.02	0.010	mg/L	2022-09-13	HT1
Phosphate (as P)	< 0.0100	N/A	0.0050	mg/L	2022-09-13	HT1

Calculated Parameters

Hardness, Total (as CaCO3)	33.3	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500	mg/L	N/A	

General Parameters

Alkalinity, Total (as CaCO3)	41.6	10	1.0	mg/L	2022-09-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Bicarbonate (as CaCO3)	41.6	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2022-09-11	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2022-09-13	



TEST RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
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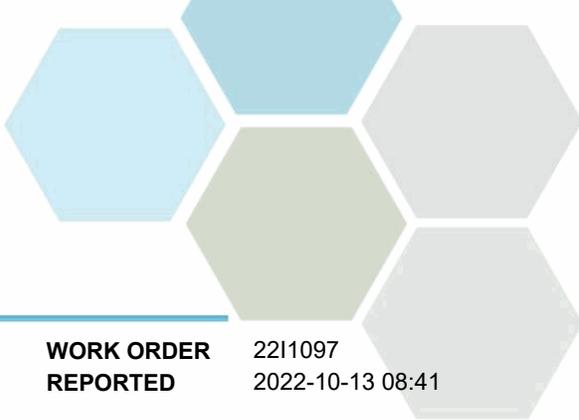
GOA02 (2211097-03) | Matrix: Water | Sampled: 2022-09-05 14:30, Continued

General Parameters, Continued

Phosphorus, Total (as P)	< 0.0050	0.005	0.0050	mg/L	2022-09-12	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2022-09-12	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2022-09-13	HT1

Total Metals

Aluminum, total	0.0100	N/A	0.0050	mg/L	2022-09-11	
Antimony, total	< 0.00020	0.009	0.00020	mg/L	2022-09-11	
Arsenic, total	< 0.00050	0.005	0.00050	mg/L	2022-09-11	
Barium, total	0.0136	1	0.0050	mg/L	2022-09-11	
Beryllium, total	< 0.00010	0.00013	0.00010	mg/L	2022-09-11	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2022-09-11	
Boron, total	< 0.0500	1.2	0.0500	mg/L	2022-09-11	
Cadmium, total	< 0.000010	N/A	0.000010	mg/L	2022-09-11	
Calcium, total	8.61	N/A	0.20	mg/L	2022-09-11	
Chromium, total	< 0.00050	N/A	0.00050	mg/L	2022-09-11	
Cobalt, total	< 0.00010	0.004	0.00010	mg/L	2022-09-11	
Copper, total	< 0.00040	0.002	0.00040	mg/L	2022-09-11	
Iron, total	< 0.010	1	0.010	mg/L	2022-09-11	
Lead, total	< 0.00020	0.003	0.00020	mg/L	2022-09-11	
Lithium, total	0.00049	N/A	0.00010	mg/L	2022-09-11	
Magnesium, total	2.86	N/A	0.010	mg/L	2022-09-11	
Manganese, total	0.00054	0.61	0.00020	mg/L	2022-09-11	
Molybdenum, total	0.00055	1	0.00010	mg/L	2022-09-11	
Nickel, total	< 0.00040	0.025	0.00040	mg/L	2022-09-11	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2022-09-11	
Potassium, total	0.37	N/A	0.10	mg/L	2022-09-11	
Selenium, total	< 0.00050	0.001	0.00050	mg/L	2022-09-11	
Silicon, total	3.9	N/A	1.0	mg/L	2022-09-11	
Silver, total	< 0.000050	0.00005	0.000050	mg/L	2022-09-11	
Sodium, total	1.31	N/A	0.10	mg/L	2022-09-11	
Strontium, total	0.0318	N/A	0.0010	mg/L	2022-09-11	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2022-09-11	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2022-09-11	
Thallium, total	< 0.000020	0.008	0.000020	mg/L	2022-09-11	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2022-09-11	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2022-09-11	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2022-09-11	
Tungsten, total	< 0.0002	N/A	0.0002	mg/L	2022-09-11	
Uranium, total	0.000375	0.0085	0.000020	mg/L	2022-09-11	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2022-09-11	
Zinc, total	< 0.0040	0.0075	0.0040	mg/L	2022-09-11	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2022-09-11	



TEST RESULTS

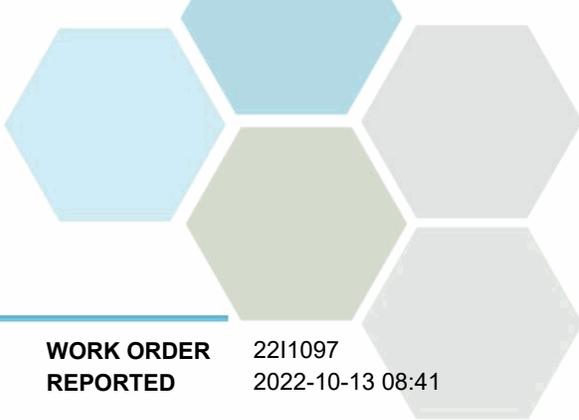
REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
GOA02 A (2211097-04) Matrix: Water Sampled: 2022-09-05 14:30						
General Parameters						
Alkalinity, Total (as CaCO ₃)	39.5	10		1.0 mg/L	2022-09-11	
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	N/A		1.0 mg/L	2022-09-11	
Alkalinity, Bicarbonate (as CaCO ₃)	39.5	N/A		1.0 mg/L	2022-09-11	
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	N/A		1.0 mg/L	2022-09-11	
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	N/A		1.0 mg/L	2022-09-11	

Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.



APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2017)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

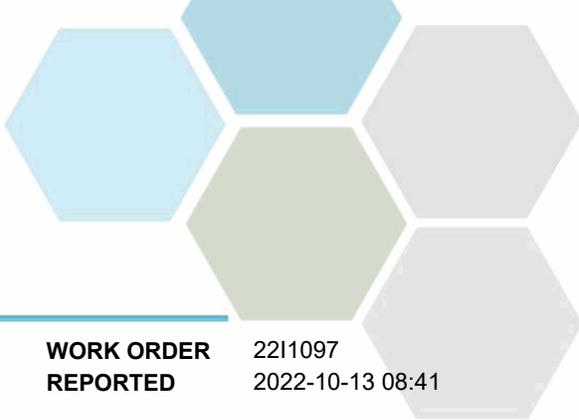
Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
Long-term Average	
mg/L	Milligrams per litre
Short-term Maximum Working Guideline	
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

[BC Water Quality Guidelines - Freshwater Aquatic Life](#)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Wildsight (Creston)
PROJECT WCVB Goat River

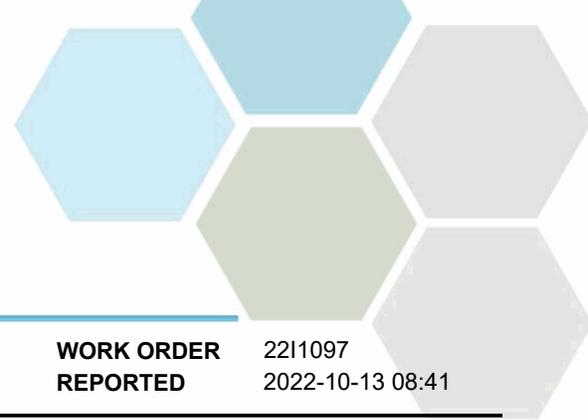
WORK ORDER 2211097
REPORTED 2022-10-13 08:41

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: TeamCaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

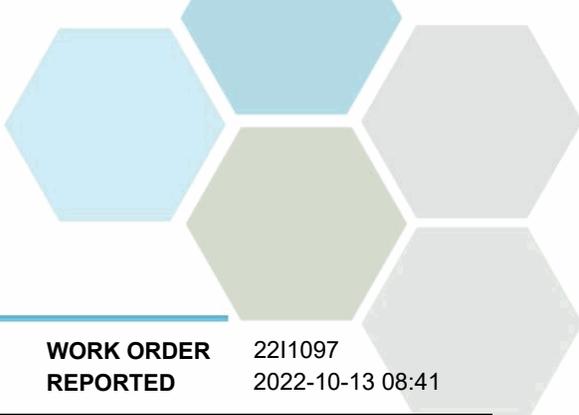
WORK ORDER REPORTED 2211097
2022-10-13 08:41

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B211027									
Blank (B211027-BLK1)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	< 0.005	0.005 mg/L							
Nitrite (as N)	< 0.005	0.005 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B211027-BLK2)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	< 0.005	0.005 mg/L							
Nitrite (as N)	< 0.005	0.005 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B211027-BLK3)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	< 0.005	0.005 mg/L							
Nitrite (as N)	< 0.005	0.005 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B211027-BLK4)			Prepared: 2022-09-14, Analyzed: 2022-09-14						
Nitrate (as N)	< 0.005	0.005 mg/L							
Nitrite (as N)	< 0.005	0.005 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B211027-BLK5)			Prepared: 2022-09-14, Analyzed: 2022-09-14						
Nitrate (as N)	< 0.005	0.005 mg/L							
Nitrite (as N)	< 0.005	0.005 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
LCS (B211027-BS1)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	3.79	0.005 mg/L	4.00		95	90-110			
Nitrite (as N)	2.08	0.005 mg/L	2.00		104	85-115			
Phosphate (as P)	0.848	0.0050 mg/L	1.00		85	80-120			
LCS (B211027-BS2)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	3.99	0.005 mg/L	4.00		100	90-110			
Nitrite (as N)	2.19	0.005 mg/L	2.00		110	85-115			
Phosphate (as P)	0.852	0.0050 mg/L	1.00		85	80-120			
LCS (B211027-BS3)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Nitrate (as N)	3.79	0.005 mg/L	4.00		95	90-110			
Nitrite (as N)	1.94	0.005 mg/L	2.00		97	85-115			

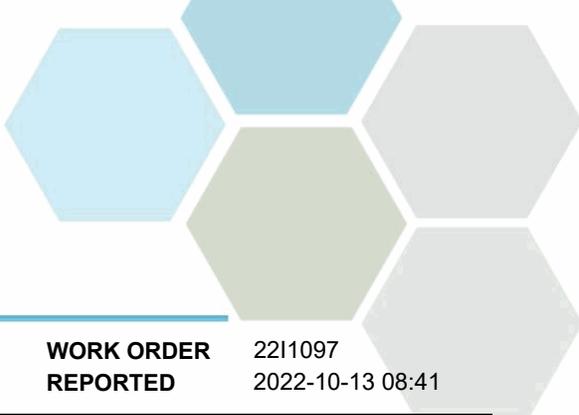


APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B211027, Continued									
LCS (B211027-BS3), Continued					Prepared: 2022-09-13, Analyzed: 2022-09-13				
Phosphate (as P)	0.944	0.0050 mg/L	1.00		94	80-120			
LCS (B211027-BS4)					Prepared: 2022-09-14, Analyzed: 2022-09-14				
Nitrate (as N)	3.98	0.005 mg/L	4.00		100	90-110			
Nitrite (as N)	2.03	0.005 mg/L	2.00		102	85-115			
Phosphate (as P)	0.968	0.0050 mg/L	1.00		97	80-120			
LCS (B211027-BS5)					Prepared: 2022-09-14, Analyzed: 2022-09-14				
Nitrate (as N)	3.88	0.005 mg/L	4.00		97	90-110			
Nitrite (as N)	1.83	0.005 mg/L	2.00		91	85-115			
Phosphate (as P)	0.914	0.0050 mg/L	1.00		91	80-120			
General Parameters, Batch B211082									
Blank (B211082-BLK1)					Prepared: 2022-09-11, Analyzed: 2022-09-11				
Alkalinity, Total (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0 mg/L							
Blank (B211082-BLK2)					Prepared: 2022-09-11, Analyzed: 2022-09-11				
Alkalinity, Total (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0 mg/L							
LCS (B211082-BS1)					Prepared: 2022-09-11, Analyzed: 2022-09-11				
Alkalinity, Total (as CaCO ₃)	112	1.0 mg/L	100		112	80-120			
LCS (B211082-BS2)					Prepared: 2022-09-11, Analyzed: 2022-09-11				
Alkalinity, Total (as CaCO ₃)	107	1.0 mg/L	100		107	80-120			
General Parameters, Batch B211094									
Blank (B211094-BLK1)					Prepared: 2022-09-11, Analyzed: 2022-09-13				
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
Blank (B211094-BLK2)					Prepared: 2022-09-11, Analyzed: 2022-09-13				
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
LCS (B211094-BS1)					Prepared: 2022-09-11, Analyzed: 2022-09-13				
Nitrogen, Total Kjeldahl	1.02	0.050 mg/L	1.00		102	85-115			
LCS (B211094-BS2)					Prepared: 2022-09-11, Analyzed: 2022-09-13				
Nitrogen, Total Kjeldahl	1.02	0.050 mg/L	1.00		102	85-115			
General Parameters, Batch B211136									
Blank (B211136-BLK1)					Prepared: 2022-09-12, Analyzed: 2022-09-12				
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							
Blank (B211136-BLK2)					Prepared: 2022-09-12, Analyzed: 2022-09-12				
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT	Wildsight (Creston) WCVB Goat River	WORK ORDER REPORTED	2211097 2022-10-13 08:41
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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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General Parameters, Batch B211136, Continued

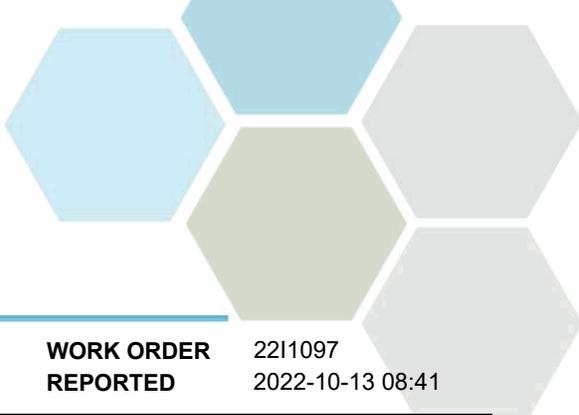
Blank (B211136-BLK3)			Prepared: 2022-09-12, Analyzed: 2022-09-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							
LCS (B211136-BS1)			Prepared: 2022-09-12, Analyzed: 2022-09-12						
Phosphorus, Total Dissolved	0.108	0.0050 mg/L	0.100		108	85-115			
LCS (B211136-BS2)			Prepared: 2022-09-12, Analyzed: 2022-09-12						
Phosphorus, Total (as P)	0.110	0.0050 mg/L	0.100		110	85-115			
LCS (B211136-BS3)			Prepared: 2022-09-12, Analyzed: 2022-09-12						
Phosphorus, Total (as P)	0.110	0.0050 mg/L	0.100		110	85-115			
Phosphorus, Total Dissolved	0.110	0.0050 mg/L	0.100		110	85-115			
Duplicate (B211136-DUP3)			Source: 2211097-01		Prepared: 2022-09-12, Analyzed: 2022-09-12				
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L		< 0.0050					15
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L		< 0.0050					15
Matrix Spike (B211136-MS3)			Source: 2211097-01		Prepared: 2022-09-12, Analyzed: 2022-09-12				
Phosphorus, Total (as P)	0.107	0.0050 mg/L	0.102	< 0.0050	100	70-125			
Phosphorus, Total Dissolved	0.111	0.0050 mg/L	0.102	< 0.0050	105	70-125			

General Parameters, Batch B211296

Blank (B211296-BLK1)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Solids, Total Suspended	< 2.0	2.0 mg/L							
LCS (B211296-BS1)			Prepared: 2022-09-13, Analyzed: 2022-09-13						
Solids, Total Suspended	90.0	10.0 mg/L	100		90	85-115			

Total Metals, Batch B211085

Blank (B211085-BLK1)			Prepared: 2022-09-11, Analyzed: 2022-09-11						
Aluminum, total	< 0.0050	0.0050 mg/L							
Antimony, total	< 0.00020	0.00020 mg/L							
Arsenic, total	< 0.00050	0.00050 mg/L							
Barium, total	< 0.0050	0.0050 mg/L							
Beryllium, total	< 0.00010	0.00010 mg/L							
Bismuth, total	< 0.00010	0.00010 mg/L							
Boron, total	< 0.0500	0.0500 mg/L							
Cadmium, total	< 0.000010	0.000010 mg/L							
Calcium, total	< 0.20	0.20 mg/L							
Chromium, total	< 0.00050	0.00050 mg/L							
Cobalt, total	< 0.00010	0.00010 mg/L							
Copper, total	< 0.00040	0.00040 mg/L							
Iron, total	< 0.010	0.010 mg/L							
Lead, total	< 0.00020	0.00020 mg/L							
Lithium, total	< 0.00010	0.00010 mg/L							
Magnesium, total	< 0.010	0.010 mg/L							
Manganese, total	< 0.00020	0.00020 mg/L							
Molybdenum, total	< 0.00010	0.00010 mg/L							
Nickel, total	< 0.00040	0.00040 mg/L							
Phosphorus, total	< 0.050	0.050 mg/L							
Potassium, total	< 0.10	0.10 mg/L							
Selenium, total	< 0.00050	0.00050 mg/L							
Silicon, total	< 1.0	1.0 mg/L							
Silver, total	< 0.000050	0.000050 mg/L							



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 2211097
2022-10-13 08:41

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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Total Metals, Batch B211085, Continued

Blank (B211085-BLK1), Continued

Prepared: 2022-09-11, Analyzed: 2022-09-11

Sodium, total	< 0.10	0.10 mg/L							
Strontium, total	< 0.0010	0.0010 mg/L							
Sulfur, total	< 3.0	3.0 mg/L							
Tellurium, total	< 0.00050	0.00050 mg/L							
Thallium, total	< 0.000020	0.000020 mg/L							
Thorium, total	< 0.00010	0.00010 mg/L							
Tin, total	< 0.00020	0.00020 mg/L							
Titanium, total	< 0.0050	0.0050 mg/L							
Tungsten, total	< 0.0002	0.0002 mg/L							
Uranium, total	< 0.000020	0.000020 mg/L							
Vanadium, total	< 0.0050	0.0050 mg/L							
Zinc, total	< 0.0040	0.0040 mg/L							
Zirconium, total	< 0.00010	0.00010 mg/L							

LCS (B211085-BS1)

Prepared: 2022-09-11, Analyzed: 2022-09-11

Aluminum, total	4.07	0.0050 mg/L	4.00		102	80-120			
Antimony, total	0.0386	0.00020 mg/L	0.0400		97	80-120			
Arsenic, total	0.0401	0.00050 mg/L	0.0400		100	80-120			
Barium, total	0.0382	0.0050 mg/L	0.0400		95	80-120			
Beryllium, total	0.0406	0.00010 mg/L	0.0400		102	80-120			
Bismuth, total	0.0389	0.00010 mg/L	0.0400		97	80-120			
Boron, total	< 0.0500	0.0500 mg/L	0.0400		104	80-120			
Cadmium, total	0.0392	0.000010 mg/L	0.0400		98	80-120			
Calcium, total	3.93	0.20 mg/L	4.00		98	80-120			
Chromium, total	0.0408	0.00050 mg/L	0.0400		102	80-120			
Cobalt, total	0.0403	0.00010 mg/L	0.0400		101	80-120			
Copper, total	0.0404	0.00040 mg/L	0.0400		101	80-120			
Iron, total	4.01	0.010 mg/L	4.00		100	80-120			
Lead, total	0.0391	0.00020 mg/L	0.0400		98	80-120			
Lithium, total	0.0408	0.00010 mg/L	0.0400		102	80-120			
Magnesium, total	4.12	0.010 mg/L	4.00		103	80-120			
Manganese, total	0.0404	0.00020 mg/L	0.0400		101	80-120			
Molybdenum, total	0.0392	0.00010 mg/L	0.0400		98	80-120			
Nickel, total	0.0395	0.00040 mg/L	0.0400		99	80-120			
Phosphorus, total	4.00	0.050 mg/L	4.00		100	80-120			
Potassium, total	3.95	0.10 mg/L	4.00		99	80-120			
Selenium, total	0.0396	0.00050 mg/L	0.0400		99	80-120			
Silicon, total	4.3	1.0 mg/L	4.00		107	80-120			
Silver, total	0.0400	0.000050 mg/L	0.0400		100	80-120			
Sodium, total	4.12	0.10 mg/L	4.00		103	80-120			
Strontium, total	0.0396	0.0010 mg/L	0.0400		99	80-120			
Sulfur, total	41.5	3.0 mg/L	40.0		104	80-120			
Tellurium, total	0.0385	0.00050 mg/L	0.0400		96	80-120			
Thallium, total	0.0382	0.000020 mg/L	0.0400		95	80-120			
Thorium, total	0.0387	0.00010 mg/L	0.0400		97	80-120			
Tin, total	0.0395	0.00020 mg/L	0.0400		99	80-120			
Titanium, total	0.0409	0.0050 mg/L	0.0400		102	80-120			
Tungsten, total	0.0400	0.0002 mg/L	0.0400		100	80-120			
Uranium, total	0.0386	0.000020 mg/L	0.0400		97	80-120			
Vanadium, total	0.0397	0.0050 mg/L	0.0400		99	80-120			
Zinc, total	0.0379	0.0040 mg/L	0.0400		95	80-120			
Zirconium, total	0.0393	0.00010 mg/L	0.0400		98	80-120			

CERTIFICATE OF ANALYSIS

REPORTED TO Wildsight (Creston)
PO Box 1001
Creston, BC V0B 1G0

ATTENTION Melissa Flint

PO NUMBER

PROJECT WCVB Goat River

PROJECT INFO

WORK ORDER 23J0845

RECEIVED / TEMP 2023-10-06 16:00 / 16.4°C

REPORTED 2023-10-16 10:44

COC NUMBER B134819

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

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If you have any questions or concerns, please contact me at TeamCaro@caro.ca

Authorized By:

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TEST RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
GOA01 (23J0845-01) Matrix: Water Sampled: 2023-10-02 14:15					
Anions					
Nitrate (as N)	< 0.010	3	0.010 mg/L	2023-10-09	HT1
Nitrite (as N)	< 0.010	0.02	0.010 mg/L	2023-10-09	HT1
Phosphate (as P)	0.0085	N/A	0.0050 mg/L	2023-10-09	HT1
Calculated Parameters					
Hardness, Total (as CaCO3)	36.6	N/A	0.500 mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100 mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500 mg/L	N/A	
General Parameters					
Alkalinity, Total (as CaCO3)	36.5	10	1.0 mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	36.5	N/A	1.0 mg/L	2023-10-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2023-10-11	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2023-10-14	
Phosphorus, Total (as P)	< 0.0050	0.005	0.0050 mg/L	2023-10-12	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050 mg/L	2023-10-12	
Solids, Total Suspended	< 10.0	N/A	2.0 mg/L	2023-10-14	HT1, RS2
Total Metals					
Aluminum, total	< 0.0050	N/A	0.0050 mg/L	2023-10-12	
Antimony, total	< 0.00020	0.009	0.00020 mg/L	2023-10-12	
Arsenic, total	< 0.00050	0.005	0.00050 mg/L	2023-10-12	
Barium, total	0.0118	1	0.0050 mg/L	2023-10-12	
Beryllium, total	< 0.00010	0.00013	0.00010 mg/L	2023-10-12	
Bismuth, total	< 0.00010	N/A	0.00010 mg/L	2023-10-12	
Boron, total	< 0.0500	1.2	0.0500 mg/L	2023-10-12	
Cadmium, total	< 0.000010	N/A	0.000010 mg/L	2023-10-12	
Calcium, total	9.66	N/A	0.20 mg/L	2023-10-12	
Chromium, total	< 0.00050	N/A	0.00050 mg/L	2023-10-12	
Cobalt, total	< 0.00010	0.004	0.00010 mg/L	2023-10-12	
Copper, total	< 0.00040	0.002	0.00040 mg/L	2023-10-12	
Iron, total	0.021	1	0.010 mg/L	2023-10-12	
Lead, total	< 0.00020	0.003	0.00020 mg/L	2023-10-12	
Lithium, total	0.00037	N/A	0.00010 mg/L	2023-10-12	
Magnesium, total	3.02	N/A	0.010 mg/L	2023-10-12	
Manganese, total	0.00151	0.61	0.00020 mg/L	2023-10-12	
Molybdenum, total	0.00047	1	0.00010 mg/L	2023-10-12	
Nickel, total	< 0.00040	0.025	0.00040 mg/L	2023-10-12	
Phosphorus, total	< 0.050	N/A	0.050 mg/L	2023-10-12	
Potassium, total	0.46	N/A	0.10 mg/L	2023-10-12	
Selenium, total	< 0.00050	0.001	0.00050 mg/L	2023-10-12	
Silicon, total	3.9	N/A	1.0 mg/L	2023-10-12	



TEST RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
GOA01 (23J0845-01) Matrix: Water Sampled: 2023-10-02 14:15, Continued						
<i>Total Metals, Continued</i>						
Silver, total	< 0.000050	0.00005	0.000050	mg/L	2023-10-12	
Sodium, total	2.08	N/A	0.10	mg/L	2023-10-12	
Strontium, total	0.0356	N/A	0.0010	mg/L	2023-10-12	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-12	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Thallium, total	< 0.000020	0.008	0.000020	mg/L	2023-10-12	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-12	
Uranium, total	0.000410	0.0085	0.000020	mg/L	2023-10-12	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Zinc, total	< 0.0040	0.0075	0.0040	mg/L	2023-10-12	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	

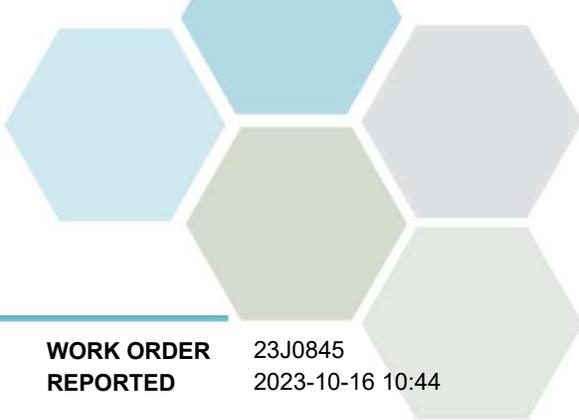
GOA02 (23J0845-02) | Matrix: Water | Sampled: 2023-10-02 15:00

<i>Anions</i>						
Nitrate (as N)	< 0.010	3	0.010	mg/L	2023-10-09	HT1
Nitrite (as N)	< 0.010	0.02	0.010	mg/L	2023-10-09	HT1
Phosphate (as P)	0.0055	N/A	0.0050	mg/L	2023-10-09	HT1

<i>Calculated Parameters</i>						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500	mg/L	N/A	

<i>General Parameters</i>						
Alkalinity, Total (as CaCO3)	39.5	10	1.0	mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	39.5	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2023-10-14	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Solids, Total Suspended	< 10.0	N/A	2.0	mg/L	2023-10-14	HT1, RS2

Sample Qualifiers:	
HT1	The sample was prepared and/or analyzed past the recommended holding time.
RS2	The Reporting Limits for this sample have been raised due to limited sample volume.



APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Hardness in Water	SM 2340 B* (2021)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

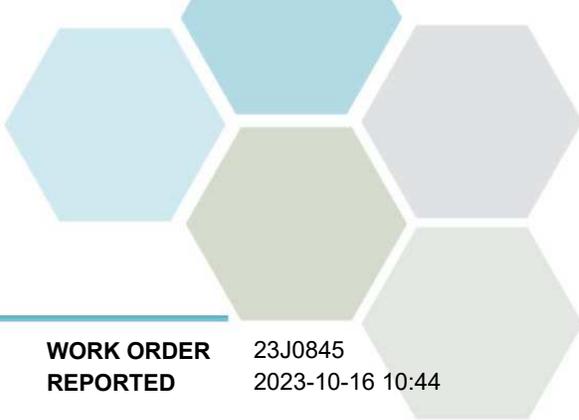
Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
Long-term Average	
mg/L	Milligrams per litre
Short-term Maximum Working Guideline	
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

[BC Water Quality Guidelines - Freshwater Aquatic Life](#)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO Wildsight (Creston)
PROJECT WCVB Goat River

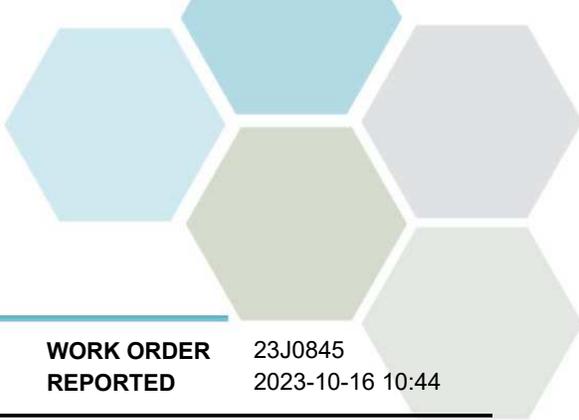
WORK ORDER 23J0845
REPORTED 2023-10-16 10:44

General Comments:

The results in this report apply to the received samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: TeamCaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3J0723									
Blank (B3J0723-BLK1)			Prepared: 2023-10-09, Analyzed: 2023-10-09						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B3J0723-BLK2)			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B3J0723-BLK3)			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
LCS (B3J0723-BS1)			Prepared: 2023-10-09, Analyzed: 2023-10-09						
Nitrate (as N)	4.00	0.010 mg/L	4.00		100	90-110			
Nitrite (as N)	1.96	0.010 mg/L	2.00		98	85-115			
Phosphate (as P)	0.846	0.0050 mg/L	1.00		85	80-120			
LCS (B3J0723-BS2)			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Nitrate (as N)	3.96	0.010 mg/L	4.00		99	90-110			
Nitrite (as N)	1.96	0.010 mg/L	2.00		98	85-115			
Phosphate (as P)	0.919	0.0050 mg/L	1.00		92	80-120			
LCS (B3J0723-BS3)			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Nitrate (as N)	4.09	0.010 mg/L	4.00		102	90-110			
Nitrite (as N)	1.96	0.010 mg/L	2.00		98	85-115			
Phosphate (as P)	1.07	0.0050 mg/L	1.00		107	80-120			

General Parameters, Batch B3J0967

Blank (B3J0967-BLK1)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L							



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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General Parameters, Batch B3J0967, Continued

Blank (B3J0967-BLK1), Continued			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L							
Blank (B3J0967-BLK2)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L							
Blank (B3J0967-BLK3)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L							
LCS (B3J0967-BS1)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	109	1.0 mg/L	100		109	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	50.5	1.0 mg/L	50.0		101	0-200			
LCS (B3J0967-BS2)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	110	1.0 mg/L	100		110	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	42.6	1.0 mg/L	50.0		85	0-200			
LCS (B3J0967-BS3)			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	109	1.0 mg/L	100		109	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	37.7	1.0 mg/L	50.0		75	0-200			

General Parameters, Batch B3J0991

Blank (B3J0991-BLK1)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Blank (B3J0991-BLK2)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Blank (B3J0991-BLK3)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Blank (B3J0991-BLK4)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							
Blank (B3J0991-BLK5)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							
LCS (B3J0991-BS1)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050 mg/L	0.100		101	85-115			
LCS (B3J0991-BS2)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050 mg/L	0.100		101	85-115			
LCS (B3J0991-BS3)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.103	0.0050 mg/L	0.100		103	85-115			



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT	Wildsight (Creston) WCVB Goat River	WORK ORDER REPORTED	23J0845 2023-10-16 10:44
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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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General Parameters, Batch B3J0991, Continued

LCS (B3J0991-BS4)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.102	0.0050 mg/L	0.100		102	85-115			
Phosphorus, Total Dissolved	0.102	0.0050 mg/L	0.100		102	85-115			
LCS (B3J0991-BS5)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.104	0.0050 mg/L	0.100		104	85-115			
Phosphorus, Total Dissolved	0.103	0.0050 mg/L	0.100		103	85-115			

General Parameters, Batch B3J1200

Blank (B3J1200-BLK2)			Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
LCS (B3J1200-BS2)			Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	0.986	0.050 mg/L	1.00		99	85-115			

General Parameters, Batch B3J1287

Blank (B3J1287-BLK1)			Prepared: 2023-10-14, Analyzed: 2023-10-14						
Solids, Total Suspended	< 2.0	2.0 mg/L							
LCS (B3J1287-BS1)			Prepared: 2023-10-14, Analyzed: 2023-10-14						
Solids, Total Suspended	115	10.0 mg/L	100		115	85-115			

Total Metals, Batch B3J0950

Blank (B3J0950-BLK1)			Prepared: 2023-10-11, Analyzed: 2023-10-12						
Aluminum, total	< 0.0050	0.0050 mg/L							
Antimony, total	< 0.00020	0.00020 mg/L							
Arsenic, total	< 0.00050	0.00050 mg/L							
Barium, total	< 0.0050	0.0050 mg/L							
Beryllium, total	< 0.00010	0.00010 mg/L							
Bismuth, total	< 0.00010	0.00010 mg/L							
Boron, total	< 0.0500	0.0500 mg/L							
Cadmium, total	< 0.000010	0.000010 mg/L							
Calcium, total	< 0.20	0.20 mg/L							
Chromium, total	< 0.00050	0.00050 mg/L							
Cobalt, total	< 0.00010	0.00010 mg/L							
Copper, total	< 0.00040	0.00040 mg/L							
Iron, total	< 0.010	0.010 mg/L							
Lead, total	< 0.00020	0.00020 mg/L							
Lithium, total	< 0.00010	0.00010 mg/L							
Magnesium, total	< 0.010	0.010 mg/L							
Manganese, total	< 0.00020	0.00020 mg/L							
Molybdenum, total	< 0.00010	0.00010 mg/L							
Nickel, total	< 0.00040	0.00040 mg/L							
Phosphorus, total	< 0.050	0.050 mg/L							
Potassium, total	< 0.10	0.10 mg/L							
Selenium, total	< 0.00050	0.00050 mg/L							
Silicon, total	< 1.0	1.0 mg/L							
Silver, total	< 0.000050	0.000050 mg/L							
Sodium, total	< 0.10	0.10 mg/L							
Strontium, total	< 0.0010	0.0010 mg/L							
Sulfur, total	< 3.0	3.0 mg/L							
Tellurium, total	< 0.00050	0.00050 mg/L							
Thallium, total	< 0.000020	0.000020 mg/L							



APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Wildsight (Creston)
WCVB Goat River

WORK ORDER REPORTED 23J0845
2023-10-16 10:44

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0950, Continued									
Blank (B3J0950-BLK1), Continued					Prepared: 2023-10-11, Analyzed: 2023-10-12				
Thorium, total	< 0.00010	0.00010 mg/L							
Tin, total	< 0.00020	0.00020 mg/L							
Titanium, total	< 0.0050	0.0050 mg/L							
Tungsten, total	< 0.0010	0.0010 mg/L							
Uranium, total	< 0.000020	0.000020 mg/L							
Vanadium, total	< 0.0050	0.0050 mg/L							
Zinc, total	< 0.0040	0.0040 mg/L							
Zirconium, total	< 0.00010	0.00010 mg/L							
LCS (B3J0950-BS1)					Prepared: 2023-10-11, Analyzed: 2023-10-12				
Aluminum, total	3.94	0.0050 mg/L	4.00		98	80-120			
Antimony, total	0.0392	0.00020 mg/L	0.0400		98	80-120			
Arsenic, total	0.400	0.00050 mg/L	0.400		100	80-120			
Barium, total	0.0391	0.0050 mg/L	0.0400		98	80-120			
Beryllium, total	0.0379	0.00010 mg/L	0.0400		95	80-120			
Bismuth, total	0.0387	0.00010 mg/L	0.0400		97	80-120			
Boron, total	0.390	0.0500 mg/L	0.400		97	80-120			
Cadmium, total	0.0391	0.000010 mg/L	0.0400		98	80-120			
Calcium, total	3.91	0.20 mg/L	4.00		98	80-120			
Chromium, total	0.0410	0.00050 mg/L	0.0400		102	80-120			
Cobalt, total	0.0406	0.00010 mg/L	0.0400		102	80-120			
Copper, total	0.0410	0.00040 mg/L	0.0400		102	80-120			
Iron, total	4.08	0.010 mg/L	4.00		102	80-120			
Lead, total	0.0389	0.00020 mg/L	0.0400		97	80-120			
Lithium, total	0.0370	0.00010 mg/L	0.0400		93	80-120			
Magnesium, total	3.91	0.010 mg/L	4.00		98	80-120			
Manganese, total	0.0406	0.00020 mg/L	0.0400		102	80-120			
Molybdenum, total	0.0384	0.00010 mg/L	0.0400		96	80-120			
Nickel, total	0.0413	0.00040 mg/L	0.0400		103	80-120			
Phosphorus, total	3.92	0.050 mg/L	4.00		98	80-120			
Potassium, total	3.89	0.10 mg/L	4.00		97	80-120			
Selenium, total	0.398	0.00050 mg/L	0.400		99	80-120			
Silicon, total	4.0	1.0 mg/L	4.00		101	80-120			
Silver, total	0.0388	0.000050 mg/L	0.0400		97	80-120			
Sodium, total	4.03	0.10 mg/L	4.00		101	80-120			
Strontium, total	0.0397	0.0010 mg/L	0.0400		99	80-120			
Sulfur, total	38.7	3.0 mg/L	40.0		97	80-120			
Tellurium, total	0.0363	0.00050 mg/L	0.0400		91	80-120			
Thallium, total	0.0395	0.000020 mg/L	0.0400		99	80-120			
Thorium, total	0.0399	0.00010 mg/L	0.0400		100	80-120			
Tin, total	0.0393	0.00020 mg/L	0.0400		98	80-120			
Titanium, total	0.0404	0.0050 mg/L	0.0400		101	80-120			
Tungsten, total	0.0403	0.0010 mg/L	0.0400		101	80-120			
Uranium, total	0.0396	0.000020 mg/L	0.0400		99	80-120			
Vanadium, total	0.0404	0.0050 mg/L	0.0400		101	80-120			
Zinc, total	0.398	0.0040 mg/L	0.400		99	80-120			
Zirconium, total	0.0403	0.00010 mg/L	0.0400		101	80-120			



CERTIFICATE OF ANALYSIS

Work Order	: CG2414382		
Amendment	: 1		
Client	: Cash Clients Canada	Laboratory	: ALS Environmental - Calgary
Contact	: Melissa Flint	Account Manager	: Gulraj Dhanaua
Address	: 2559 29 Street NE Calgary Alberta Canada T1Y 7B5	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: ----	Date Samples Received	: 02-Oct-2024 09:40
PO	: ----	Date Analysis Commenced	: 03-Oct-2024
C-O-C number	: ----	Issue Date	: 03-Dec-2024 09:40
Sampler	: MELISSA FLINT		
Site	: Wildsight Creston Valley Branch Surface Water Monitoring		
Quote number	: VA24-CASH100-048		
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>
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Logan Carroll	Laboratory Analyst	Inorganics, Edmonton, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta



General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key: CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.



Analytical Results

Sub-Matrix: Surface Water
 (Matrix: Water)

					Client sample ID		GOA01 (49.0807, -116.051907)	GOA02 (49.1917, -116.3443565)	SUM01 (49.143608, -116.66195)	----	----
					Client sampling date / time		01-Oct-2024 08:15	01-Oct-2024 07:35	01-Oct-2024 08:45	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2414382-001	CG2414382-002	CG2414382-003	----	----	----	----
					Result	Result	Result	----	----	----	----
Physical Tests											
Alkalinity, total (as CaCO3)	----	E290/CG	1.0	mg/L	40.6	34.2	50.5	----	----	----	----
Hardness (as CaCO3), from total Ca/Mg	----	EC100A/CG	0.50	mg/L	37.0	34.7	50.6	----	----	----	----
Solids, total suspended [TSS]	----	E160/CG	3.0	mg/L	<3.0	<3.0	<3.0	----	----	----	----
Anions and Nutrients											
Ammonia, total (as N)	7664-41-7	E298/VA	0.0050	mg/L	<0.0050	<0.0050	0.0072	----	----	----	----
Chloride	16887-00-6	E235.Cl/CG	0.50	mg/L	----	----	1.28	----	----	----	----
Nitrate (as N)	14797-55-8	E235.NO3-L/CG	0.0050	mg/L	<0.0050	<0.0050	<0.0050	----	----	----	----
Nitrite (as N)	14797-65-0	E235.NO2-L/CG	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----	----	----
Nitrogen, total	7727-37-9	E366/VA	0.030	mg/L	0.033	0.031	0.040	----	----	----	----
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U/CG	0.0010	mg/L	0.0027	<0.0010	<0.0010	----	----	----	----
Phosphorus, total	7723-14-0	E372-U/VA	0.0020	mg/L	0.0021	<0.0020	<0.0020	----	----	----	----
Phosphorus, total dissolved	7723-14-0	E375-U/EO	0.0010	mg/L	0.0032	----	<0.0010	----	----	----	----
Nitrate + Nitrite (as N)	----	EC235.N+N/C G	0.0050	mg/L	<0.0051	<0.0051	<0.0051	----	----	----	----
Total Metals											
Aluminum, total	7429-90-5	E420/CG	0.0030	mg/L	0.0055	0.0042	0.0106	----	----	----	----
Antimony, total	7440-36-0	E420/CG	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----	----	----
Arsenic, total	7440-38-2	E420/CG	0.00010	mg/L	0.00035	0.00018	<0.00010	----	----	----	----
Barium, total	7440-39-3	E420/CG	0.00010	mg/L	0.0139	0.0140	0.0300	----	----	----	----
Beryllium, total	7440-41-7	E420/CG	0.000020	mg/L	<0.000020	<0.000020	<0.000020	----	----	----	----
Bismuth, total	7440-69-9	E420/CG	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----	----	----
Boron, total	7440-42-8	E420/CG	0.010	mg/L	<0.010	<0.010	<0.010	----	----	----	----



Analytical Results

Sub-Matrix: Surface Water
 (Matrix: Water)

					Client sample ID	GOA01 (49.0807, -116.051907)	GOA02 (49.1917, -116.3443565)	SUM01 (49.143608, -116.66195)	----	----
					Client sampling date / time	01-Oct-2024 08:15	01-Oct-2024 07:35	01-Oct-2024 08:45	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2414382-001	CG2414382-002	CG2414382-003	----	----	
					Result	Result	Result	----	----	
Total Metals										
Cadmium, total	7440-43-9	E420/CG	0.0000050	mg/L	<0.0000050	<0.0000050	0.0000056	----	----	
Calcium, total	7440-70-2	E420/CG	0.050	mg/L	9.30	8.49	13.8	----	----	
Cesium, total	7440-46-2	E420/CG	0.000010	mg/L	<0.000010	0.000019	0.000038	----	----	
Chromium, total	7440-47-3	E420/CG	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----	
Cobalt, total	7440-48-4	E420/CG	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----	
Copper, total	7440-50-8	E420/CG	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----	
Iron, total	7439-89-6	E420/CG	0.010	mg/L	0.031	<0.010	<0.010	----	----	
Lead, total	7439-92-1	E420/CG	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----	
Lithium, total	7439-93-2	E420/CG	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----	
Magnesium, total	7439-95-4	E420/CG	0.0050	mg/L	3.34	3.28	3.93	----	----	
Manganese, total	7439-96-5	E420/CG	0.00010	mg/L	0.00103	0.00040	0.00050	----	----	
Molybdenum, total	7439-98-7	E420/CG	0.000050	mg/L	0.000415	0.000528	0.000268	----	----	
Nickel, total	7440-02-0	E420/CG	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----	
Phosphorus, total	7723-14-0	E420/CG	0.050	mg/L	<0.050	<0.050	<0.050	----	----	
Potassium, total	7440-09-7	E420/CG	0.050	mg/L	0.499	0.380	1.20	----	----	
Rubidium, total	7440-17-7	E420/CG	0.00020	mg/L	0.00068	0.00062	0.00158	----	----	
Selenium, total	7782-49-2	E420/CG	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----	
Silicon, total	7440-21-3	E420/CG	0.10	mg/L	4.11	3.96	4.59	----	----	
Silver, total	7440-22-4	E420/CG	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----	
Sodium, total	7440-23-5	E420/CG	0.050	mg/L	2.24	1.49	2.42	----	----	
Strontium, total	7440-24-6	E420/CG	0.00020	mg/L	0.0390	0.0357	0.0568	----	----	



Analytical Results

Sub-Matrix: Surface Water
 (Matrix: Water)

					Client sample ID	GOA01 (49.0807, -116.051907)	GOA02 (49.1917, -116.3443565)	SUM01 (49.143608, -116.66195)	----	----
					Client sampling date / time	01-Oct-2024 08:15	01-Oct-2024 07:35	01-Oct-2024 08:45	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2414382-001	CG2414382-002	CG2414382-003	----	----	
					Result	Result	Result	----	----	
Total Metals										
Sulfur, total	7704-34-9	E420/CG	0.50	mg/L	1.18	0.94	2.13	----	----	
Tellurium, total	13494-80-9	E420/CG	0.00020	mg/L	<0.00020	<0.00020	<0.00020	----	----	
Thallium, total	7440-28-0	E420/CG	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----	
Thorium, total	7440-29-1	E420/CG	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----	
Tin, total	7440-31-5	E420/CG	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----	
Titanium, total	7440-32-6	E420/CG	0.00030	mg/L	<0.00030	<0.00030	<0.00030	----	----	
Tungsten, total	7440-33-7	E420/CG	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----	
Uranium, total	7440-61-1	E420/CG	0.000010	mg/L	0.000360	0.000326	0.000300	----	----	
Vanadium, total	7440-62-2	E420/CG	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----	
Zinc, total	7440-66-6	E420/CG	0.0030	mg/L	<0.0030	<0.0030	<0.0030	----	----	
Zirconium, total	7440-67-7	E420/CG	0.00020	mg/L	<0.00020	<0.00020	<0.00020	----	----	

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