2023 CreekWatch Water Quality Monitoring Results

Buffalo Lake Métis Settlement

LICA Citizen Science

03/21/2024

LICA Environmental Stewards

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Background

CreekWatch is a Citizen Science program by the non-profit RiverWatch Institute of Alberta. CreekWatch connects communities with science and stewardship relevant to their local natural areas and streams of interest. Since 2014, CreekWatch has worked with corporate and community volunteers to collect water quality data, improve habitat, and contribute to a meaningful understanding of the management of our local waterways (RiverWatch Institute of Alberta, 2023).

LICA has been a part of the CreekWatch program since 2021. By partnering with different organizations and communities over the last 3 seasons, 8 creeks of interest have been monitored in the LICA Region. Summary reports from previous years can be found on the LICA Website.

On August 2, 2023, LICA partnered with Buffalo Lake Métis Settlement to sample two sites of community interest. Those who participated were trained in CreekWatch safety protocols and proper sampling techniques. As a result, community members gained a greater understanding of local waterways. Located 45 km north of Smoky Lake, Buffalo Lake Métis Settlement is home to 1,236 people and consists of 35,356 hectares of land. This report will cover the processes used in this sampling, in addition to the results of both sites in Buffalo Lake Métis Settlement.

Methods

Data recorded during the 2023 summer sampling program was collected utilizing the CreekWatch Citizen Science water quality monitoring kits. The following parameters were assessed:

Table 1. Water Quality Parameters of Interest

Water Quality Parameters	
Physics	Air Temperature (°C)
	Water Temperature (°C)
	Turbidity (NTU)
Chemistry	Dissolved Oxygen (mg/L)
	Ammonia Nitrogen (mg/L)
	Phosphorous (mg/L)
	pH
	Chloride (mg/L)
Biology	Invertebrates

Each parameter has a sampling protocol and instructions for analysis, with pre-packed chemistry kits. Sample equipment for the CreekWatch program was provided by the Riverwatch Institute of Alberta. For safety practices followed during CreekWatch monitoring, please see Appendix B.

Table 2. The number of sampling events and the total number of volunteer hours for sampling conducted on August 2, 2023.

Item	Amount
Number of Sampling Events at Site 1	1
Number of Sampling Events at Site 2	1
Number of Volunteers	8
Number of Volunteer Hours	24

Sample Site Characteristics

Site 1

Site 1 (54.567736, -112.476747) is located on the north side of Buffalo Lake Métis Settlement, near the Administration Building. This creek flows in a north-east direction before reaching an unnamed waterbody. The surrounding land use is made up of primarily natural land, with some infrastructure (roads) and residences. Located along a portion of the of the Amisk River system, the results of riparian health assessments completed by Fiera Biological Consulting (2021), found this creek to have high riparian intactness and be of high conservation priority.

Figure 1. Volunteers sampling at Site 1.

Site 2

Site 2 (54.543859, -112.469403) is located on the north side of Buffalo Lake Métis Settlement, upstream of site 1. This is the outflow of Buffalo Lake, flowing north to connect with another tributary, before reaching the location of site 1. Sample site 2 was located at a bridge that is regularly used by vehicles and had evidence of recreational angling activity. This portion of the Amisk River system is surrounded in natural land with infrastructure (roads) and residences. Similarly with site 1, as this site too, is located along a portion of the Amisk River system, the results of riparian health assessments completed by Fiera Biological Consulting (2021), found this creek to have high riparian intactness and be of high conservation priority.

Figure 2. Sample site 2, facing downstream.

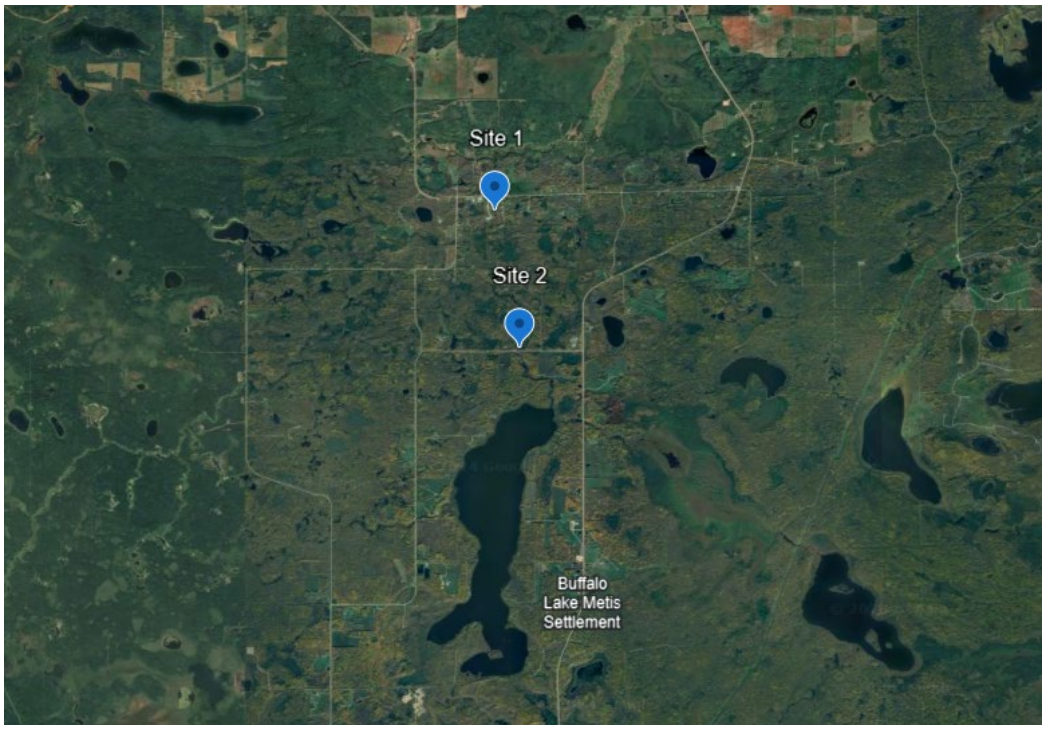

Figure 3. Spatial distribution of sample sites.

Site Results

Dissolved Oxygen

Dissolved Oxygen (DO) concentrations were measured using a Hach Kit with a drop-by-drop titration to show a change in water colour until totally clear. The red line in the graph below indicates the Environmental Quality Guidelines for Alberta Surface Waters (2018) for exceedance is minimum 5 mg/L for instantaneous value as the short-term allowance for the protection of freshwater aquatic life.
DO was found to be higher at Site 2 in comparison to Site 1, being 4 mg/L and 7 mg/L, respectively. Sample site 1 results indicate that DO levels are below the allowable limit to support freshwater aquatic life.
At the time of sampling, a small-bodied fish, invertebrates, and a Crayfish were observed at Site 1. Further monitoring is recommended to determine if DO levels collected during this sample event reflect actual in-stream conditions.

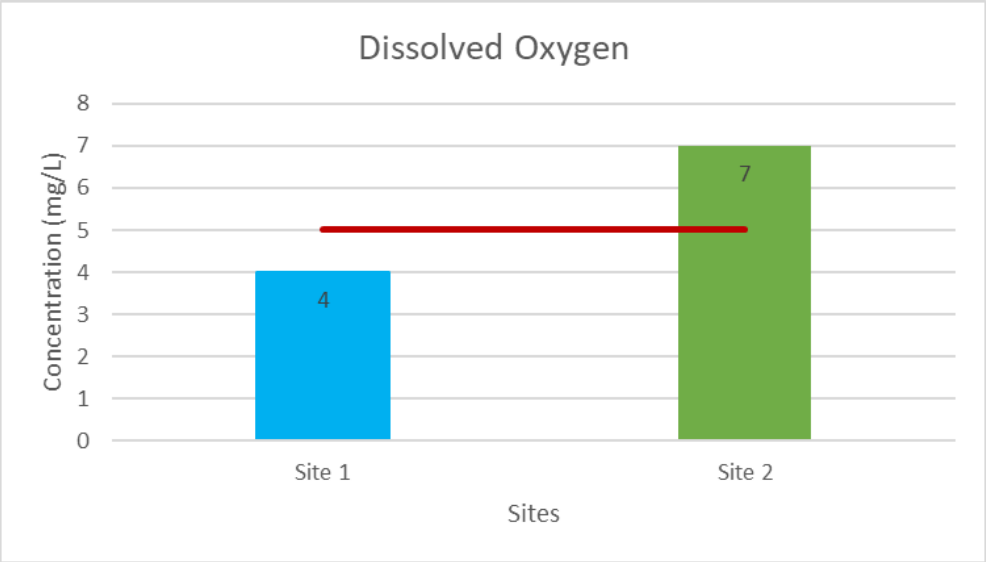

Figure 4. Dissolved Oxygen concentrations measured at the sample sites on August 2, 2023.

Ammonia Nitrogen

Ammonia Nitrogen concentrations were measured by dipping Hach test trips into the water and noting the colour change.

The red line in the graph below indicates the Environmental Quality Guidelines for Alberta Surface Waters (2018), for exceedance is maximum 1.0 mg/L at pH 8.0, 10°C. Both Site 1 and Site 2 levels for Ammonia Nitrogen were recorded at 0.25 mg/L. Results of these sites were within the allowable limit for healthy freshwater aquatic systems.

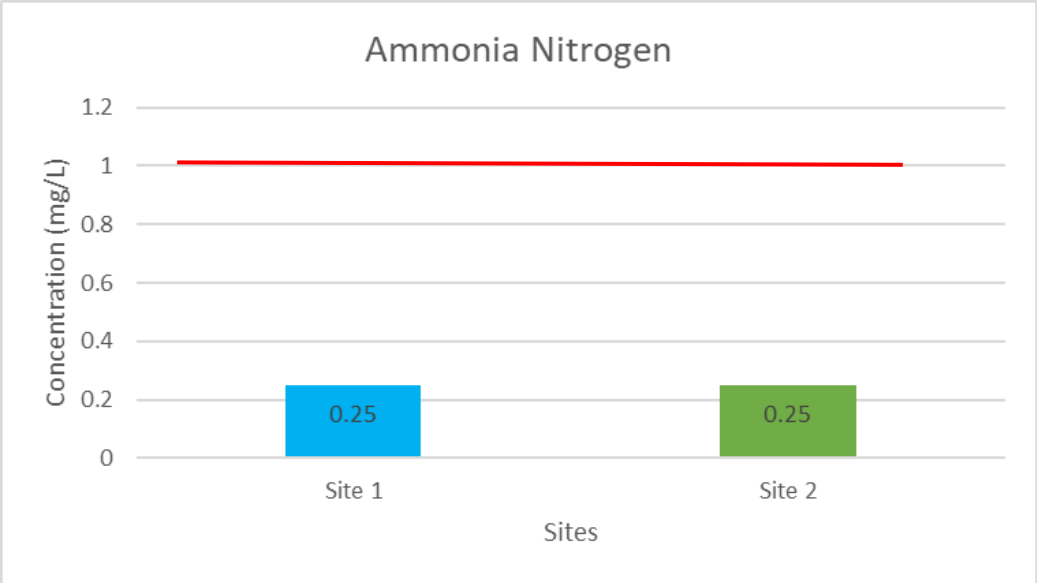

Figure 5. Ammonia Nitrogen concentrations measured at the sample sites on August 2, 2023.

Phosphorus

Phosphorus concentrations are measured using a Hach kit that compare a change in water colour.
Living organisms require phosphorus to survive and obtain it in the form of phosphates (PO_4^{-3}) when combined with oxygen. Phosphorus is typically dissolved in such low concentrations that it becomes a limiting nutrient for the growth of aquatic plants. However, even the slightest increase in phosphorus can increase plant and algae growth.
The Phosphorous concentrations at site 1 were much lower than site 2. Results indicate that 0.08 mg/L and 4 mg/L of phosphorous were measured at site 1 and site 2, respectively.
See Figure 6 for comparative results.

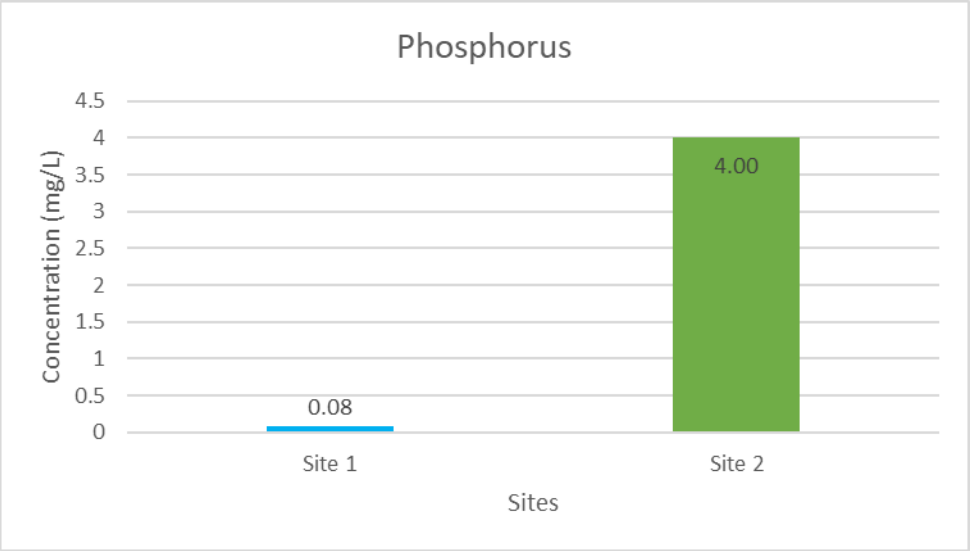

Figure 6. Phosphorous concentrations measured at the sample sites on August 2, 2023.

pH

pH was measured using a Hach kit that compares the change in water colour to determine the water pH value.
The pH scale ranges from 0 - 14, where a pH of 0 is the most acidic, becoming less acidic when moving towards a pH of 7. A pH of 7 is considered a neutral solution, neither acidic nor basic. Solutions with a pH greater than 7 are considered basic, with solutions becoming increasingly basic as they approach a pH of 14.
The Environmental Quality Guidelines for Alberta Surface Waters (2018) for exceedance is a pH value outside the range of 6.5 - 9. Results from Site 1 and 2 fall within the allowable range. See Figure 7 for comparative results.

Figure 7. pH values measured at the sample sites on August 2, 2023.

Chloride

Chloride concentrations were measured using Hach Kits with a drop-by-drop titration to show a change in water colour from yellow to orange. The Environmental Quality Guidelines for Alberta Surface Waters (2018) is a maximum concentration of 120 mg/L.

Site 1 presented a greater concentration in comparison to Site 2, with results being 20 mg/L and 15 mg/L, respectively. Data collected at both sites fall within the allowable guideline limits. See Figure 8 for comparative results.

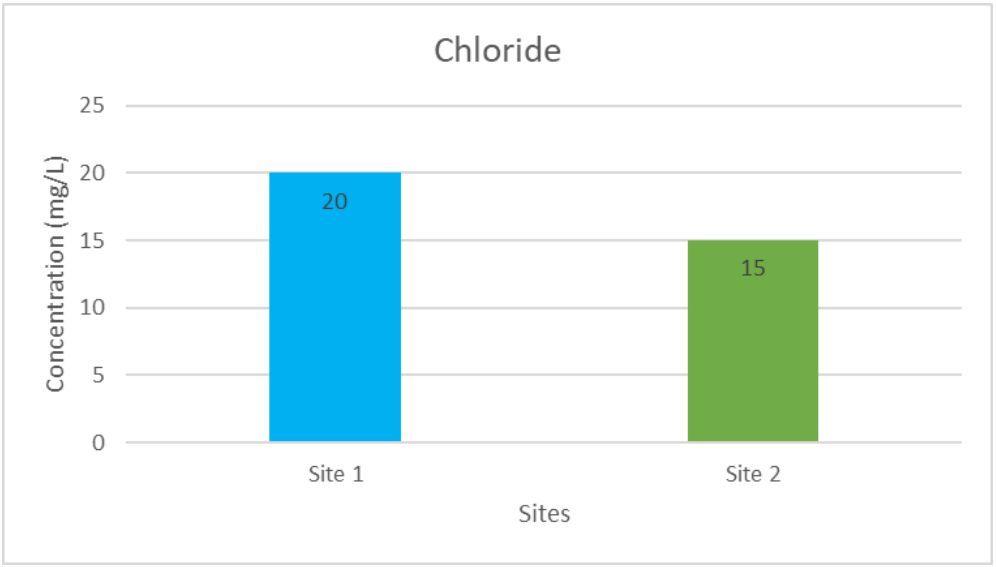

Figure 8. Chloride concentrations measured at the sample sites on August 2, 2023.

Turbidity

Turbidity was measured by slowly pouring water into a type of graduated cylinder marked with a 'Nephelometric Turbidity Units' or NTU's. It is used to determine the level of suspended matter within a water column. Suspended sediment levels in a waterway can be influenced by several factors, including high rainfall or snow runoff, as well as urbanization and development along shorelines.
Both sites had a measure of 0 NTU, which indicates minimal levels of suspended matter. A comparative graph was not included due to results of 0.

Temperature

Water temperature was measured using a non-mercury glass thermometer, placed in flowing, shallower water near the shore.
Temperature can play a significant role in the rate of chemical reactions that affect physical characteristics, such as the solubility of dissolved oxygen and the growth and development of organisms such as bacteria, algae, and fish. Water temperature was consistent between sites 1 and 2.

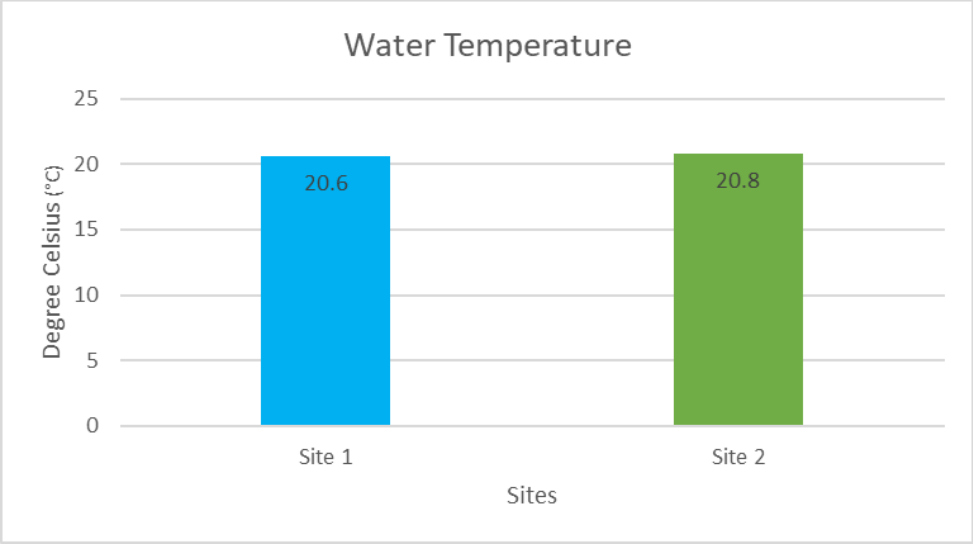

Figure 9. Water Temperature recorded at the sample sites on August 2, 2023.

Benthic Macroinvertebrates

The term “benthic” refers to species underwater living and feeding from the bottom of streambeds rocks, plants, or sediment. Aquatic invertebrates are animals without backbones that live in waterways, they play a critical role in the functioning of ecosystems. Aquatic invertebrates live at least part of their life in freshwater ponds, lakes, streams, or rivers. Macroinvertebrates are species large enough to be seen without using a microscope but are generally less than 2 cm long.

These species play an essential role in monitoring, as they can be highly sensitive to changes in water quality and can be used to indicate areas of decreased water quality leading to the identification of environmental stressors that may be impacting an ecosystem.

Different species have adapted to specific ecosystem conditions and have varying levels of tolerance to environmental stressors, being pollution-sensitive or pollutant tolerant. When monitoring, the invertebrates that are found will suggest a healthy or unhealthy system. Please see Table 3 for species identified during the sampling event.

For additional information see the “Invertebrate Identification Guide” in Appendix C.

Table 3. Invertebrate species identified.

Species	Site 1 Count	Site 2 Count
Mayfly Nymph [1]	5	0
Water Mite	5	3
Northern Crayfish [2]	1	0
Amphipod	0	4
Unidentified Worm	0	3

[1] Pollutant sensitive.

[2] Alberta Aquatic Invasive Species of Concern (2018)

Figure 11. Janessa Desjarlais completing benthic invertebrate identification.

Figure 10. Nolan Cardinal completing benthic invertebrate identification.

Conclusion

A variety of factors may have influenced the accuracy of the water quality data collected. These factors are, but are not limited to; sampler experience, unforeseen variance in sampling protocol, field testing (not conducted in a controlled laboratory), weather, etc. CreekWatch is a Citizen Science program where all tests are conducted in the field, by volunteers. Analysis was not completed at a laboratory.

The results of tests conclude that all parameters are within allowable limits, with the exception of Dissolved Oxygen at sample site 1.

These sites were sampled to provide a general understanding of creek health in Buffalo Lake Métis Settlement. It is recommended that this study be used to inform additional water quality monitoring programs that undergo lab analysis.

Thank you, CreekWatch Volunteers!

CreekWatch with LICA is made possible by the amazing volunteers who took time to monitor the water quality of these two sites. Thank you to the RiverWatch Institute of Alberta for providing the sampling equipment to enable LICA to take part in this program! LICA is proud of another great season of volunteer supported water quality data monitoring.

Timothy Patenaude	**Cindy Hamelin**
Janessa Desjarlais	**Vincent Venne**
Nolan Cardinal	**Jennifer Gladue**
Earl Hamelin	**Dililah Bourque**

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Fiera Biological Consulting Ltd. 2021. Upper Beaver Watershed Riparian Area Assessment. Fiera Biological Consulting Report #2132.Prepared for the Lakeland Industry and Community Association, Athabasca, Alberta. Pp. 157.

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Government of Alberta (2018). Status of Northern Crayfish. Alberta Environment and Parks Aquatic Invasive Species Pocket Guide.

The RiverWatch Institute of Alberta (2023). Stewards of our Waterways, CreekWatch. Available from CreekWatch Tributary Stormwater Monitoring: https://creekwatch.ca/#about [accessed August 15, 2023].

Appendix A: 2023 Raw Data Tables

August 2, 2023 CreekWatch Raw Data			
Parameters		Sites	
		Site 1	Site 2
Physics	Air Temperature (°C)	25.00	23.20
	Water Temperature (°C)	20.60	20.80
	Turbidity (NTU)	0.00	0.00
Chemistry	Dissolved Oxygen (mg/L)	4.00	7.00
	Ammonia Nitrogen (mg/L)	0.25	0.25
	Phosphorous (mg/L)	0.08	0.08
	Chloride (mg/L)	20.00	15.00
	pH	7.40	7.40
Biology	Mayfly Nymph	5	0
	Northern Crayfish	1	0
	Amphipod Worm	0	4
	Water Mite	5	3

Appendix B: CreekWatch Safety Practices

Creek Access Best Practices

- Closed toed shoes are the best footwear for sampling.
- While sampling, carry a cell phone when within 911 EMS call areas.
- Avoid sampling alone and especially if young children accompany you.
- Always inform someone where you are sampling and your expected return times.
- Conduct monitoring with at least one other adult, group, or family member.
- Do not stray too far away from the group and keep the other participants within eyesight.
- If sampling with children, always keep them within reach.
- Conduct monitoring in safe public areas and within open view.
- Collect water samples and then retreat further back from the waterway to conduct testing.
- Do not wade into creeks and avoid sampling on the outer bank where it drops off into deep and swift water.
- Traverse uneven ground and creekbanks only if physically able to do so.
- Use common sense to avoid risk in times of inclement weather, or swollen creek flows.
- Modify or reschedule monitoring activities in the event of rain, snow, cold, or wind.
- Consult the CreekWatch Program Manager when increased creek flow rates could temporarily suspend monitoring activities.
- Do NOT sample if conditions are unsafe (higher and swifter water movements than usual, issued extreme weather alerts, lightning, suspicious people or unusual activities in an area, dangerous wildlife reports, and weed spraying)
- Be alert and look both ways before stepping onto paved pathways used by cyclists and skateboarders.
- Notify the CreekWatch program manager of any unsafe conditions or injuries.

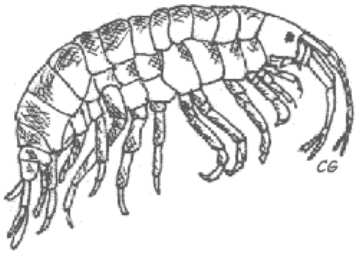
Chemical Use Best Practices

- For each water quality testing kit, follow the procedures, step-by-step.
- Avoid touching your eyes, nose, and mouth during and after handling all chemicals.
- Wear safety glasses while using all wet or dry chemicals.
- Keep in mind the direction of wind when opening dry chemical packets and keep them below eye level.
- Do not eat or drink while conducting water quality testing.
- If dry or wet chemical contact or irritation is a concern, refer to the Workplace Hazardous Materials Information System (WHMIS) Summary Sheets and follow the first aid procedures.
- Please refer to the MSDS overview sheets before handling chemicals, and if feeling unwell.
- Store wastewater in bottles supplied and do not dump it onto the ground or into the waterway.
- Do not use the pH paper strips for testing water pH; these strips are used when emptying wastewater bottles.
- Use the WHMIS warranted content, first-aid kit, insect repellant, emergency response plan, wastewater container, broken glass container, and sharps needle container included in each portable lab.
- Use hand sanitizer when sample testing is completed and wash your hands immediately after each sampling session concludes.

Appendix C: Invertebrate Identification Guide

The following is available from The RiverWatch Institute of Alberta (2023)

Amphipods



- Crustacean
- Resemble a small shrimp.
- Swims on its side.
- Swims quickly before burrowing into clumps of vegetation.
- Omnivores and scavengers on plant or animal material .
- Requires well-oxygenated water.
- Moderately Tolerant of pollution.
- May indicate fair water quality.

Blackfly Larva

- Insect.
- Complete metamorphosis.
- Blackfly larvae resemble small grubs.
- Dark-coloured head with bottom-end swollen and fatter than the head-end.
- Attaches to the upper smooth surface of rocks using suckers on bottom end.
- Heavily populated rocks have an appearance of a “stubbled beard”.
- Omnivores.
- Filtering collectors.
- May or may not indicate poor water quality.

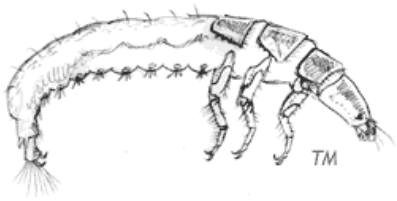
Bristle Worm

- Segmented worm.
- Resemble thin, reddish earthworms.
- Bristles on each segment are not visible to the unaided eye.
- Can tolerate low oxygen levels.
- Pollution tolerant.
- Large populations may indicate poor water quality.
- May indicate organic pollution.

Caddisfly Larva

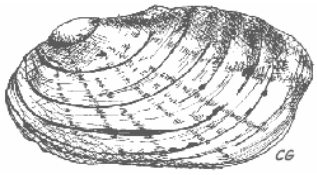
- Insect.
- Undergoes complete metamorphosis.
- Some larvae build tube-like cases using rocks, sticks, and sediments to hide in.

- Resemble caterpillars with skinny legs.
- Mostly herbivorous on algae and plants.
- Some predators eat nymphs, while some collectors build nests.
- Larvae are a favourite food amongst trout.
- Larvae are moderately pollution tolerant to pollution sensitive and inhabit warm waters.
- Large numbers indicate good environmental health.



Clams and Mussels

- Mollusc.
- Found in slow-moving and warm waters.
- Clams are small, round, and symmetrical.
- Mussels are larger, oblong and asymmetrical.
- Filter feeders on plankton and organic debris adrift in the current.
- Can tolerate degraded or polluted environments.
- Moderately pollution tolerant.
- Large numbers may indicate fair water quality.

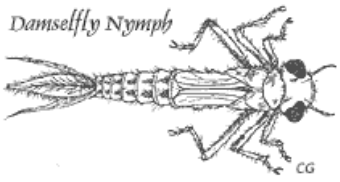


Cranefly Larva

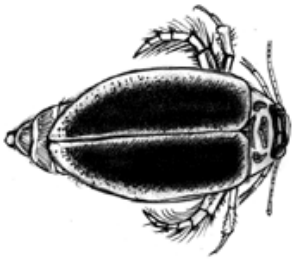
- Insect.
- Complete metamorphosis.
- Cranefly larvae resemble plump caterpillars with a knobby end.
- Larvae are found more often in the fall.
- Herbivorous larvae shed leaf material as shredders.
- Adults do not feed.
- Adults look like “giant mosquitoes,” but do not bite.
- Moderately pollution tolerant.
- Large numbers may indicate fair water quality.

Damselfly Nymph

- Insect.
- Incomplete metamorphosis.
- Nymphs have three paddle-shaped tails.
- Extendable lower lip used to grab prey.
- Predatory on mayfly nymphs, mosquito larvae, worms, and anything else small enough to grab.
- Moderately pollution tolerant.
- Large populations may indicate fair water quality.

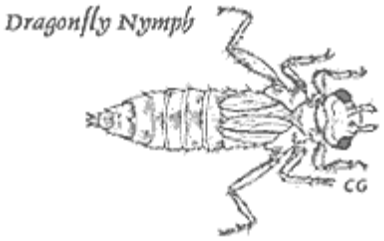


Diving Beetle



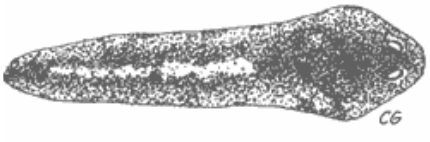
- Insect.
- Complete metamorphosis.
- Can grow quite large.
- Breathes air from an air bubble trapped under their wing covers.
- Found in water both as adults and larvae.
- Very strong swimmers.
- Carnivorous on larvae and small fish.
- Adults are not useful as a bioindicator because they breathe from surface air bubbles.

Dragonfly Nymph



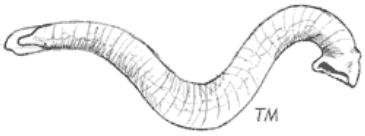
- Insect.
- Incomplete metamorphosis.
- Nymphs are relatively large and ferocious creatures.
- Their back-end pushes water to repel themselves forward.
- Lower jaw is hinged and can extend to catch prey.
- Predatory on larvae, nymphs, tadpoles, and small fish.
- Found in slow-moving or still water.
- Moderately pollution tolerant.
- Large numbers may indicate fair water quality.

Flatworm



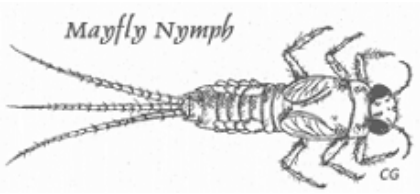
- Small, pale “blobs” found in vegetation or under rocks.
- Omnivorous on living or dead plants and animals.
- Pollution tolerant.
- Large numbers may indicate poor water quality.

Leech



- Segmented worm.
- Leeches can be found swimming or inching along the bottom of the sampling container.
- Parasitic by feeding from the blood of fish and birds.
- Large numbers may indicate poor water quality.

Mayfly Nymph

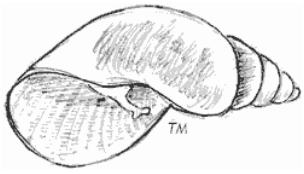


- Insect.
- Incomplete metamorphosis.
- Three long tails.
- Swims similar to a dolphin with up and down undulations.
- Feathery gills are located along the sides of the abdomen.
- Diverse body types that can range from flat, armoured, short, long, and skinny from adaptations for different flow conditions.
- Mainly herbivorous on algae and detritus.
- Nymphs require clean and oxygenated water.
- Pollution sensitive.
- Large numbers indicate good water quality and high oxygen levels.

Midge Larva

- Insect.
- Complete metamorphosis.
- Larvae occur in astronomical numbers and dominate many aquatic samples.
- Some larvae have red blood.
- Resemble a small and short worm.
- "C-shaped" and swim through flexing rapidly appearing to wiggle back and forth vigorously.
- Omnivores feeding on small organisms, decaying matter, and algae.
- Pollution tolerant.
- Large numbers may or may not indicate poor water quality and organic enrichment.

Snail



- Mollusc.
- Herbivores that feed on algae scraped from stones and leaves.
- Detritivores that feed on decaying matter.
- Browse by means of a radula - a ribbon-like tongue embedded with thousands of "teeth" scraping along rocks or leaves.
- Lung-breathing snails have shells coiled like a tuba or spiral shells opening on the left obtaining air from the waters surface therefore not great indicators of water quality.
- Gill-breathing nails have spiral shells opening on the right side with a "door" (operculum) that relies on dissolved oxygen in the water and may be more susceptible to pollution.
- Pollution tolerant.
- Large numbers of lunged snails may indicate poor water quality and organic enrichment.
- Large numbers of gilled snails may indicate good water quality.

Stonefly Nymph

- Insect.
- Incomplete metamorphosis.
- Can be very large in size.
- Most are herbivores feeding on decomposing leaves coated in bacteria and fungus.
- Two long tails and antennae.
- Swim like sharks with side-to-side undulations.
- Nymphs do “push-up” movement to allow water to flow past their gills.
- Typically leave their dry, shredded skins attached to dry rocks.
- Found in deeper and fast-flowing waters.
- Very pollution sensitive.
- Indicate good water quality with high dissolved oxygen levels.