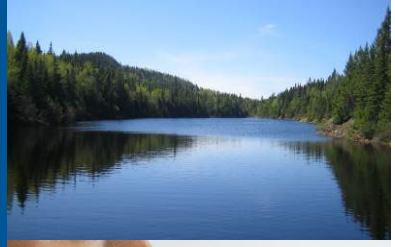
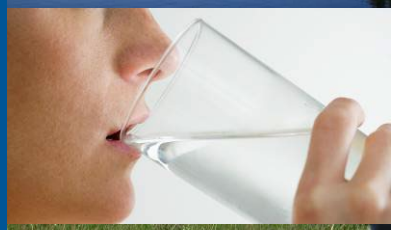



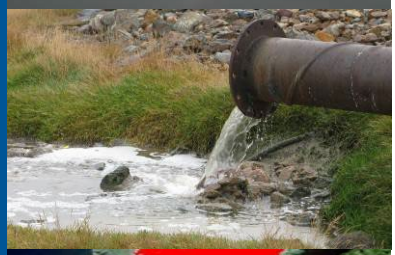


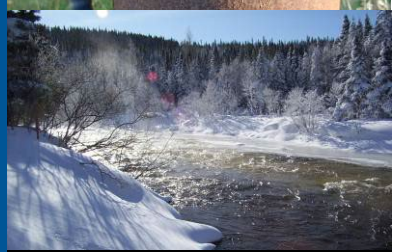

Real Time Water Quality Report

Tata Steel Minerals Canada

Elross Lake/Joan Brook Network

Deployment Period
2021-06-30 to 2021-07-16

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment & Climate Change
Water Resources Management Division

Prepared by:

Department of Environment & Climate Change
Water Resources Management Division

General

- The Water Resources Management Division (WRMD), in partnership with Tata Steel Minerals Canada Limited (TSMC) and Environment and Climate Change Canada (ECCC), maintains two real-time water quality and water quantity stations in close proximity to the Elross Lake Iron Ore Mine in western Labrador, near Schefferville, QC.
- The official name of each station is ELROSS CREEK BELOW PINETTE LAKE INFLOW and JOAN BROOK BELOW OUTLET OF JOAN LAKE, hereafter referred to as the *Elross Creek Station* and the *Joan Brook Station,* respectively.
- A third station, previously known as GOODREAM CREEK 2KM NORTHWEST OF TIMMINS 6, was removed in 2018 for relocation further downstream near Triangle Lake. In 2021, the station was still awaiting relocation by TSMC.
- Station sites were selected to monitor all surface water outflows from the Elross Lake and the DSO4 Project 2B mining sites. The Elross Creek Station is situated downstream of the Timmins 1 pit, and downstream of Pinette Lake. The original Goodream Creek Station served to monitor potential impacts from groundwater flowing from Timmins 6 pit into the surface water of Goodream Creek. The new Goodream Station will monitor impacts from the development of the Howse deposit. The Joan Brook station is downstream of the five pits (Kivivic 1, 2, 3N, 4 and 5) which are included in the DSO4 Project 2B mining operation.
- The Water Resources Management Division will inform Tata Steel Minerals Canada Limited of any significant water quality events by email notification and by monthly deployment reports.
- This monthly deployment report presents water quality and water quantity data recorded at the Elross Creek and Joan Brook stations from June 30th to July 16th, 2021, which was the second deployment period for the 2021 field season.
- Due to site access limitations due to the Covid-19 pandemic, instruments were shipped to TSMC via charter flight and installed at the stations by TSMC staff. Limited shipping options prevented collection of proper QA/QC grab samples.

Quality Assurance / Quality Control

- Water quality instrument performance is tested at the beginning and end of its deployment period. The process is outlined in Appendix A.
- Instruments are assigned a performance ranking (i.e., poor, marginal, fair, good or excellent) for each water quality parameter measured.
- Table 1 shows the performance rankings of five water quality parameters (i.e., temperature, pH, specific conductivity, dissolved oxygen and turbidity) measured by instruments deployed at the water monitoring stations.

- With the exception of water quantity data (stage height), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Table 1: Water quality instrument performance at the beginning and end of deployment

	Elross Creek		Joan Brook	
Stage of deployment	Beginning	End	Beginning	End
Date	2021-6-30	2021-7-16	2021-6-30	2021-7-15
Temperature	NA	NA	Poor*	NA
pH	Good#	NA	Good#	NA
Specific Conductivity	Excellent#	NA	Excellent#	NA
Dissolved Oxygen	NA	NA	NA	NA
Turbidity	Fair#	NA	Excellent#	NA

**QA/QC comparison to instrument owned by TSMC*

#QA/QC comparison to grab sample

- Sensor performance rankings were not obtained for the majority of parameters as a full QA/QC instrument was not available. Grab sample results were included in Table 1 to provide more information on the condition of the field sensors upon deployment.

Deployment Notes

- Water quality monitoring for this deployment period started on June 30th, 2021, at both Joan Brook and Elross Creek.
- Both stations experienced significant transmission and power loss, resulting in data gaps. Where possible, data was supplemented using internally logged data from the real-time instrumentation. However, when logged data was used, stage data was still unavailable.

Data Interpretation

- Data records were interpreted for each station during the deployment period for the following six parameters:

  (i.) Stage (m)
  (ii.) Temperature (°C)
  (iii.) pH
  (iv.) Specific conductivity (µS/cm)
  (v.) Dissolved oxygen (mg/l)
  (vi.) Turbidity (NTU)

Stage

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- Limited stage data is available for Elross Creek during this deployment due to transmission and equipment issues from animal damage (Figure 1). Stage data is available for July 8th to 13th, before equipment was again damaged.
- During the deployment period, stage values ranged from 1.16m to 1.21m at Elross Creek (limited data – Figure 1) and from 1.63mt o 1.69m at Joan Brook (Figure 2). Both showed a downward trend in stage which is normal as spring meltwaters begin to decrease into summer.

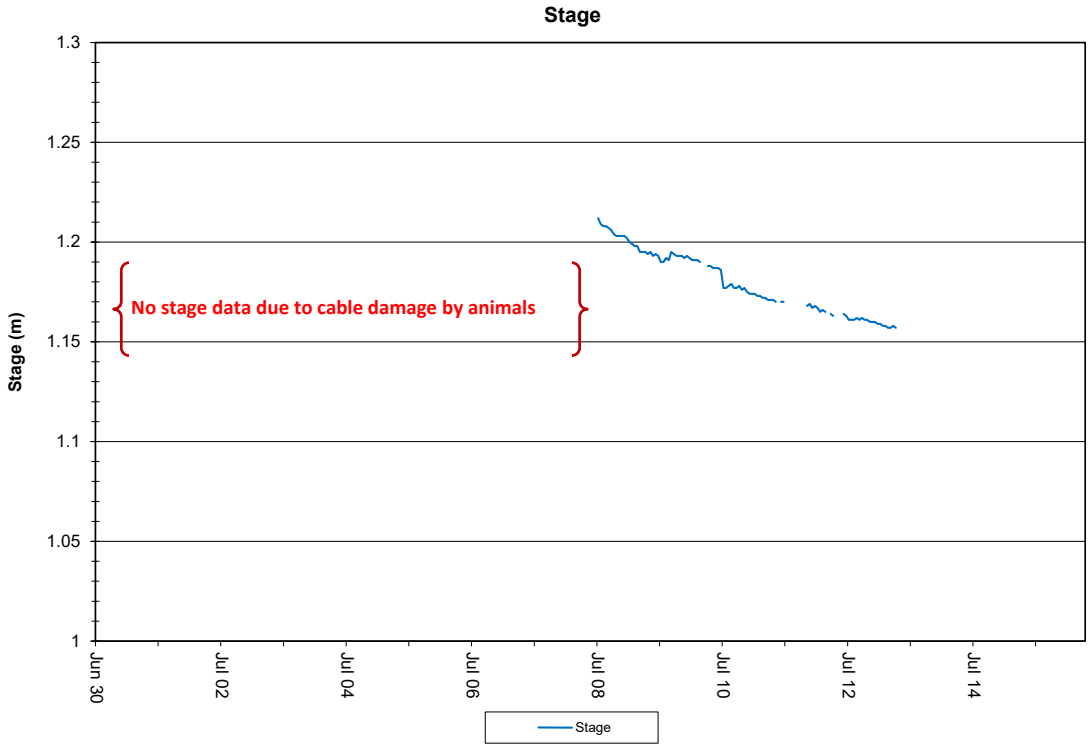

Figure 1: Stage & Flow at Elross Creek

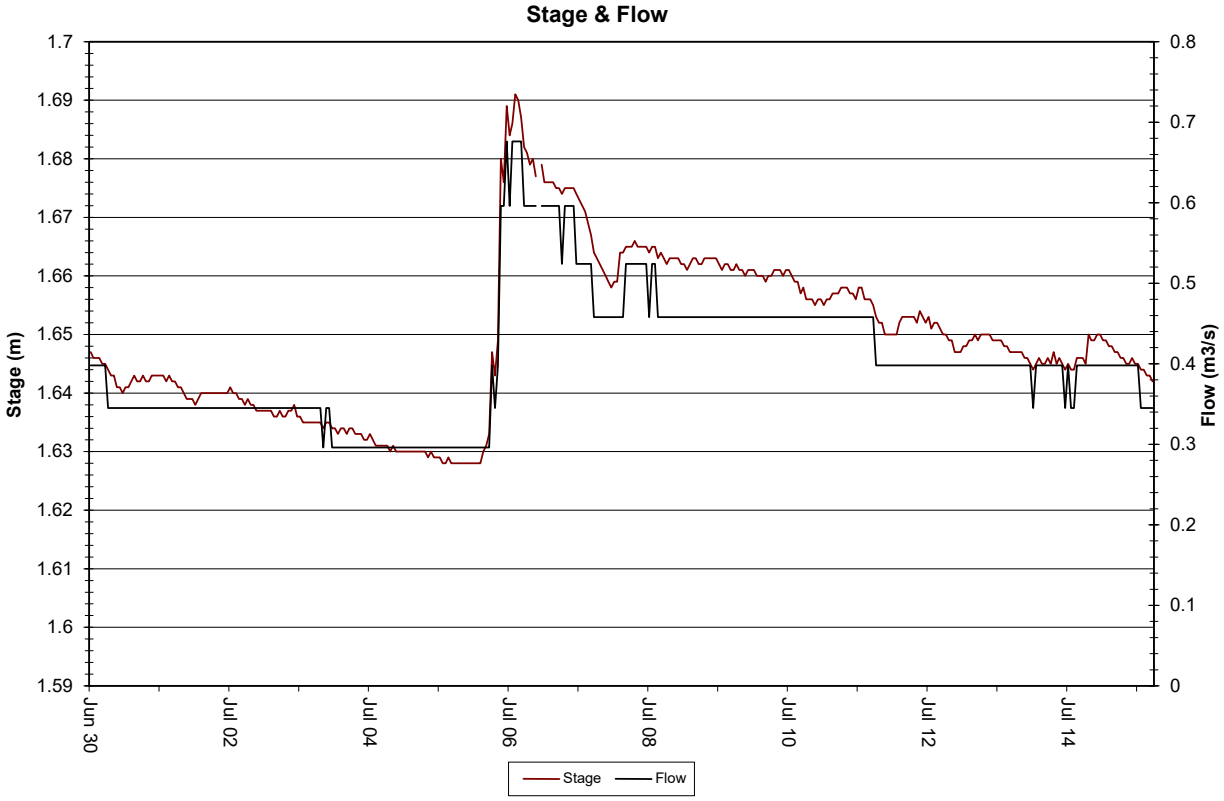

Figure 2: Stage & Flow at Joan Brook

Temperature

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- During the deployment period covered by this report, water temperature ranged from 7.70˚C to 15.84˚C at Elross Creek and from 6.20˚C to 15.40˚C at Joan Brook (Figures 3-4).
- Both stations display noticeable diurnal variations, typical of shallow water streams and ponds that are highly influenced by diurnal variations in ambient air temperatures.
- Both station's temperature values showed an increasing trend over the first portion of the deployment which is typical of the transition from spring into summer. An influx of precipitation (visible as a stage increase) reduced the water temperature for a short period before it began to climb again.

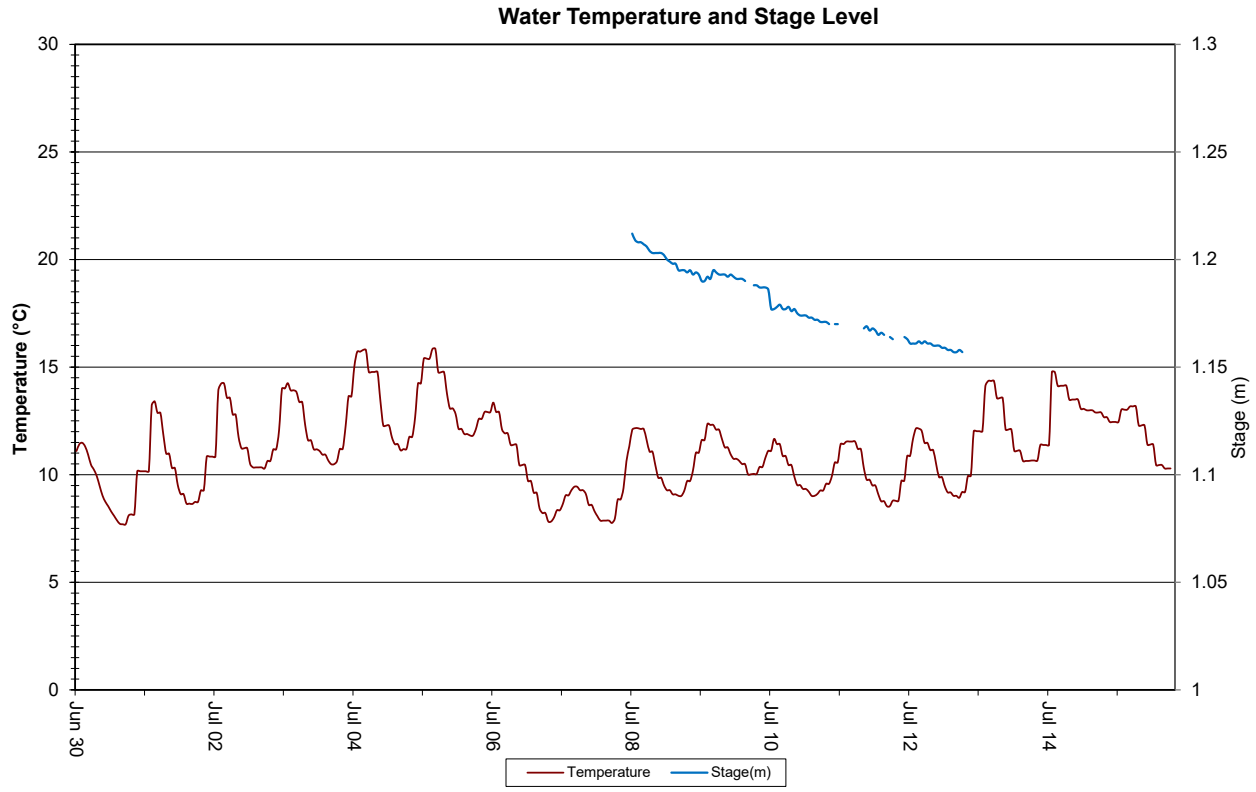

Figure 3: Water Temperature & Stage at Elross Creek

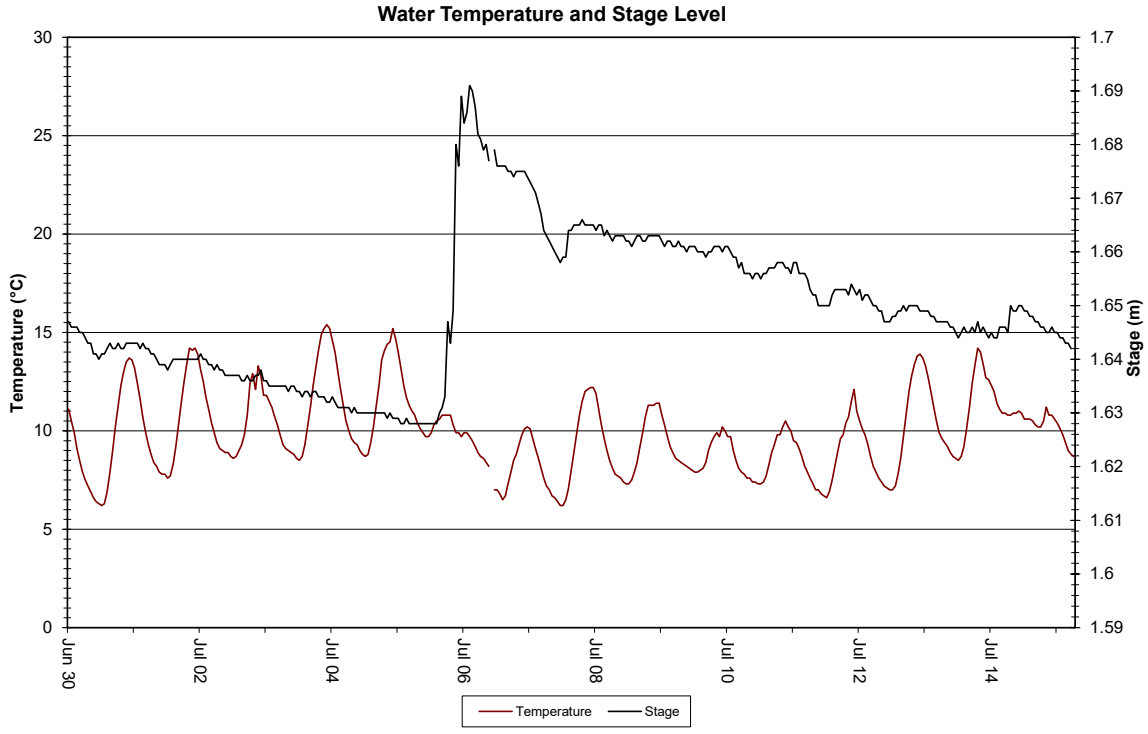

Figure 4: Water Temperature & Stage at Joan Brook

pH

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- During the deployment period, pH values ranged from 6.48 units to 6.95 units at Elross Creek and from 6.25 units to 6.81 units at Joan Brook (Figures 5-6).
- pH tends to show a diurnal trend which is related to the diurnal temperature trend. This diurnal trend is visible at both stations.
- pH appears to be relatively stable at both stations during this deployment period. A slight drop in pH at Elross Creek may be the result of precipitation as stage rose at Joan Brook at this time.
- Almost all pH values at both stations are within the guidelines set for the protection of aquatic life (i.e., 6.5 – 9.0 units), as defined by the Canadian Council of Ministers of the Environment (CCME) (2007). It should be noted that acidic waters are quite common in Canada, particularly in boreal and northern ecoregions, and pH is often naturally below the 6.5 unit guideline.

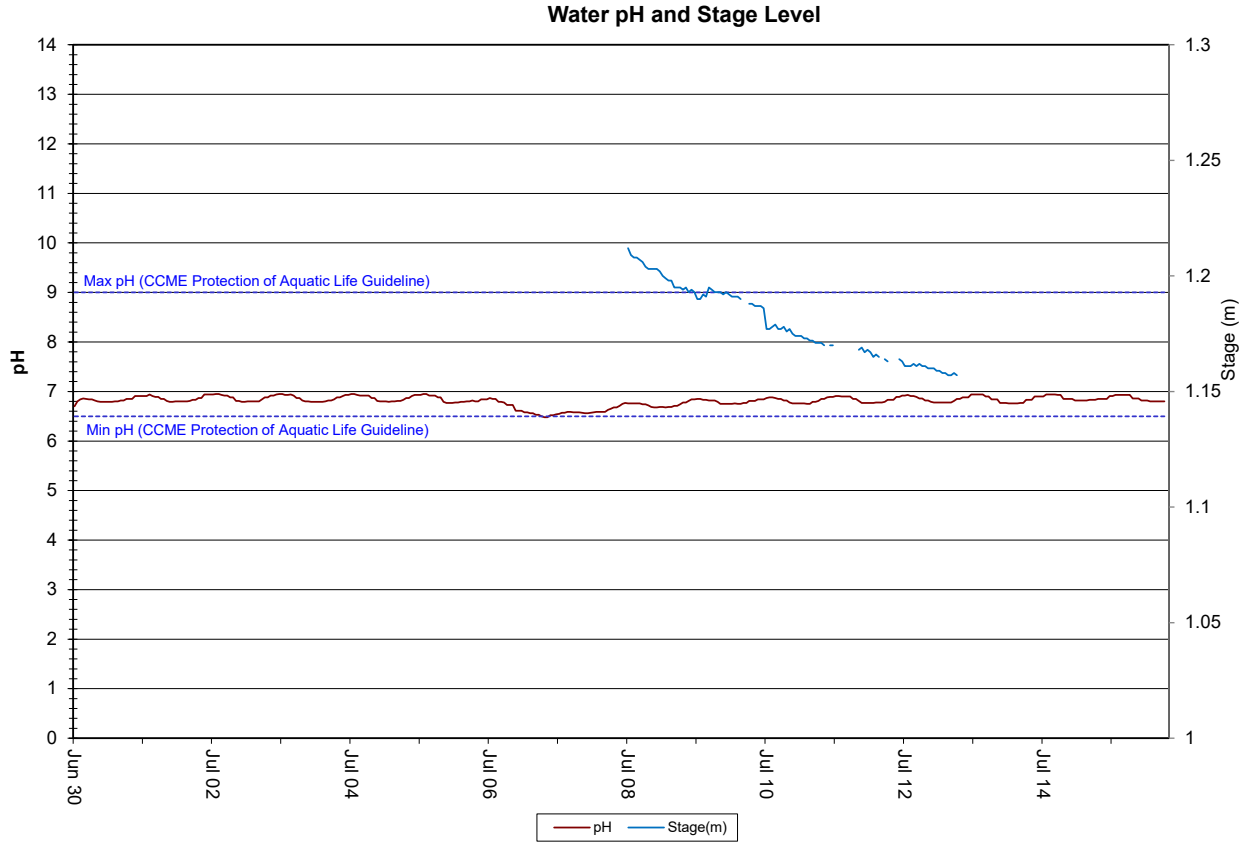

Figure 5: pH & Stage at Elross Creek

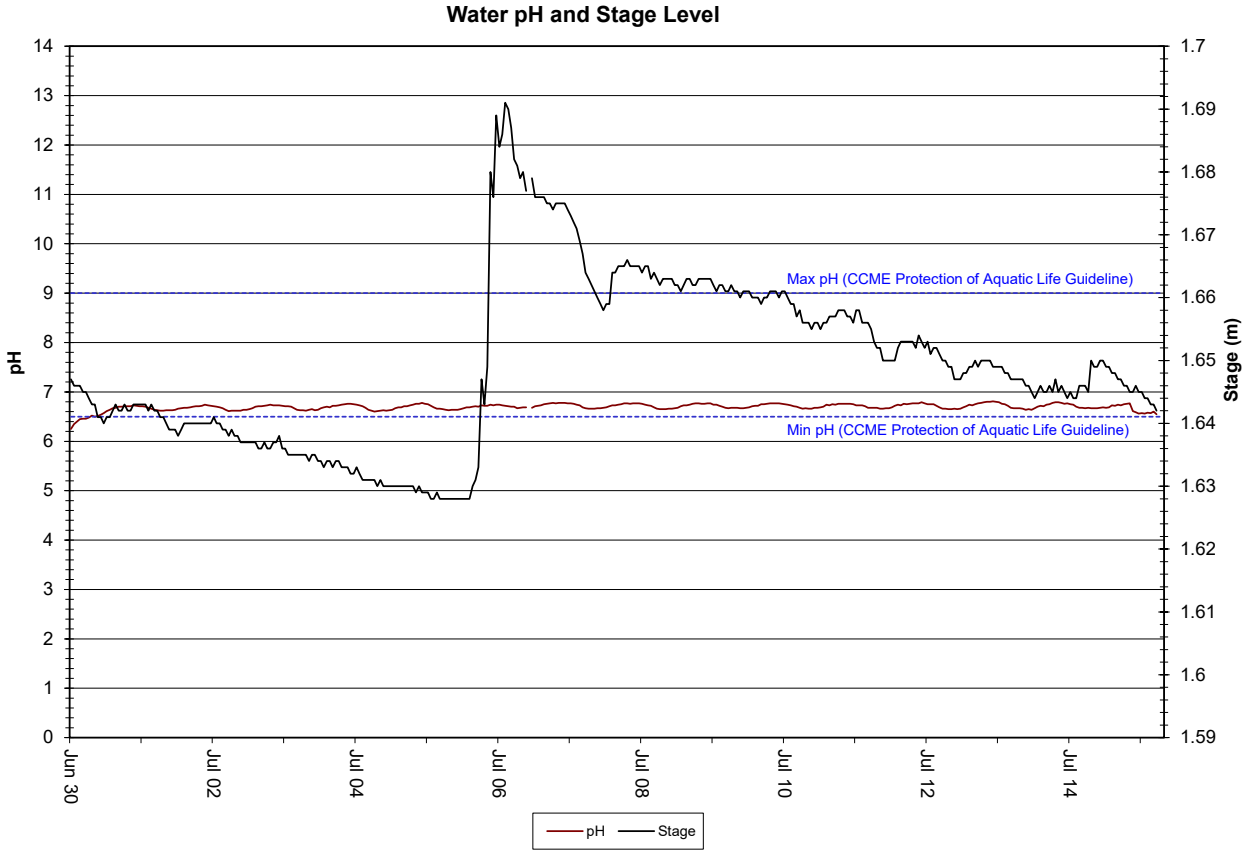

Figure 6: pH & Stage at Joan Brook

Specific Conductivity

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- During the deployment period, specific conductivity ranged from 15.0 µs/cm to 24.6 µs/cm at Elross Creek and from 7.2 µs/cm to 9.1 µs/cm at Joan Brook (Figures 7-8).
- Elross Creek exhibited a gradual increasing trend over the deployment while Joan Lake was relatively stable.
- Both stations exhibit the natural relationship between conductivity and stage values: as stage levels go up and more water is added to the system, conductivity decreases due to dilution and vice versa. Both stations were influenced by high stage levels from precipitation on July 6th, resulting in decreased conductivity for a short time (Figures 7-8).

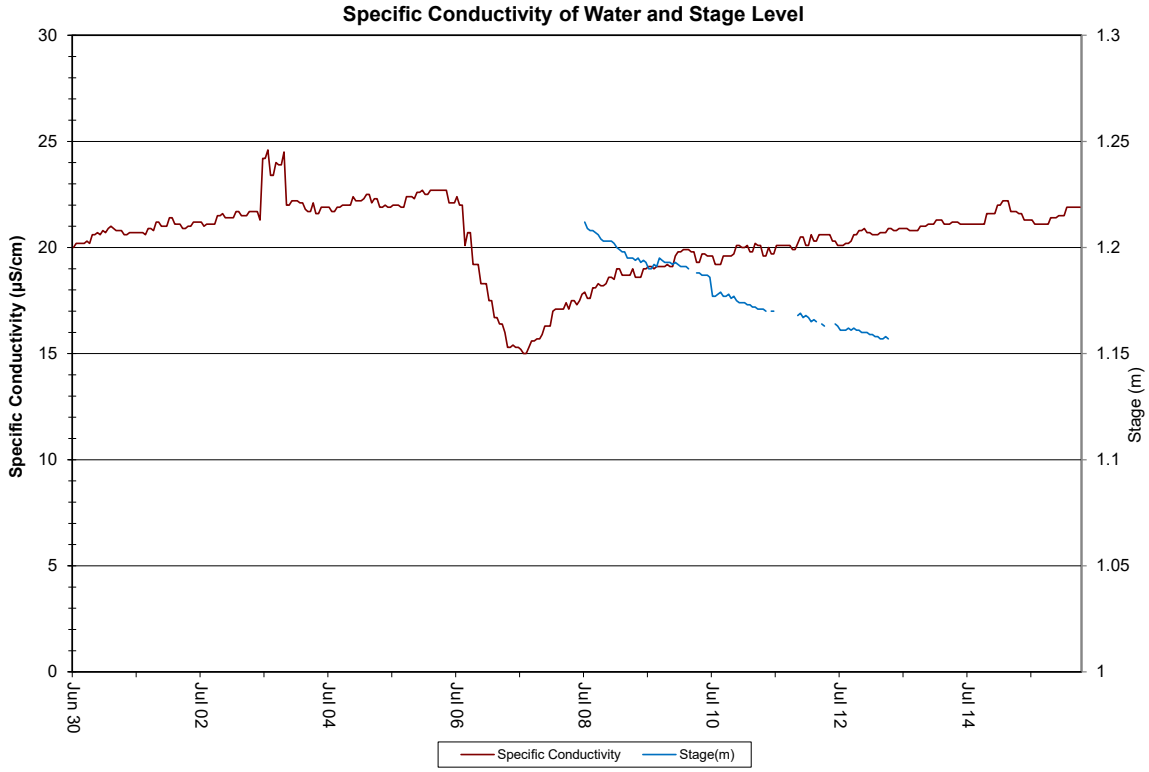

Figure 7: Specific Conductivity & Stage at Elross Creek

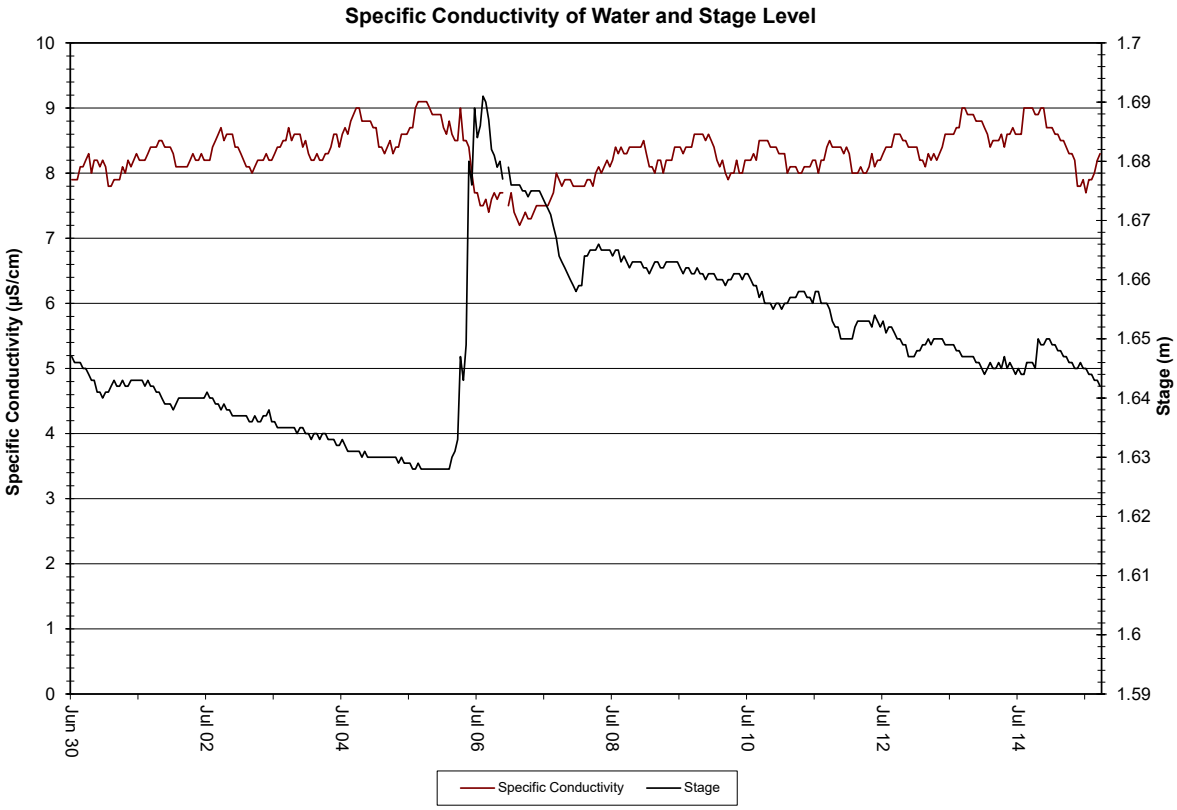

Figure 8: Specific Conductivity & Stage at Joan Brook

Dissolved Oxygen

- During the deployment period, dissolved oxygen (DO) values ranged from 8.08 mg/l (81.3% saturation) to 10.33 mg/l (89.5% saturation) at Elross Creek and from 8.88 mg/l (83.8% saturation) to 10.84 mg/l (90.2% saturation) at Joan Brook (Figures 9-10).
- DO at both stations was relatively stable for this deployment, but did increase slightly at both stations coinciding with a drop in water temperature July 7-18th. This is a natural relationship as cooler water can hold more dissolved oxygen.
- The DO values at Elross Creek and Joan Brook remained above the minimum guideline set for other life stages (6.5 mg/l) but hovered above and below the guideline for early life stages (9.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

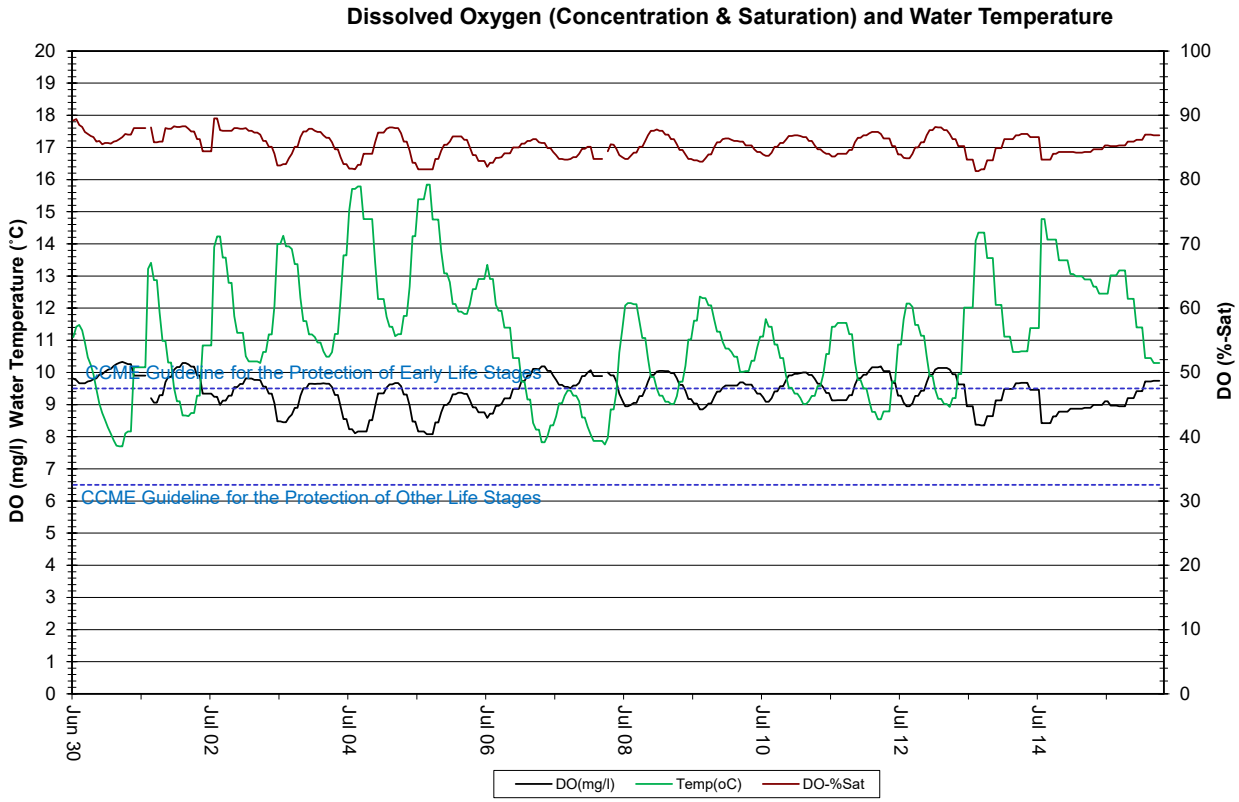

Figure 9: Dissolved Oxygen & Water Temperature at Elross Creek

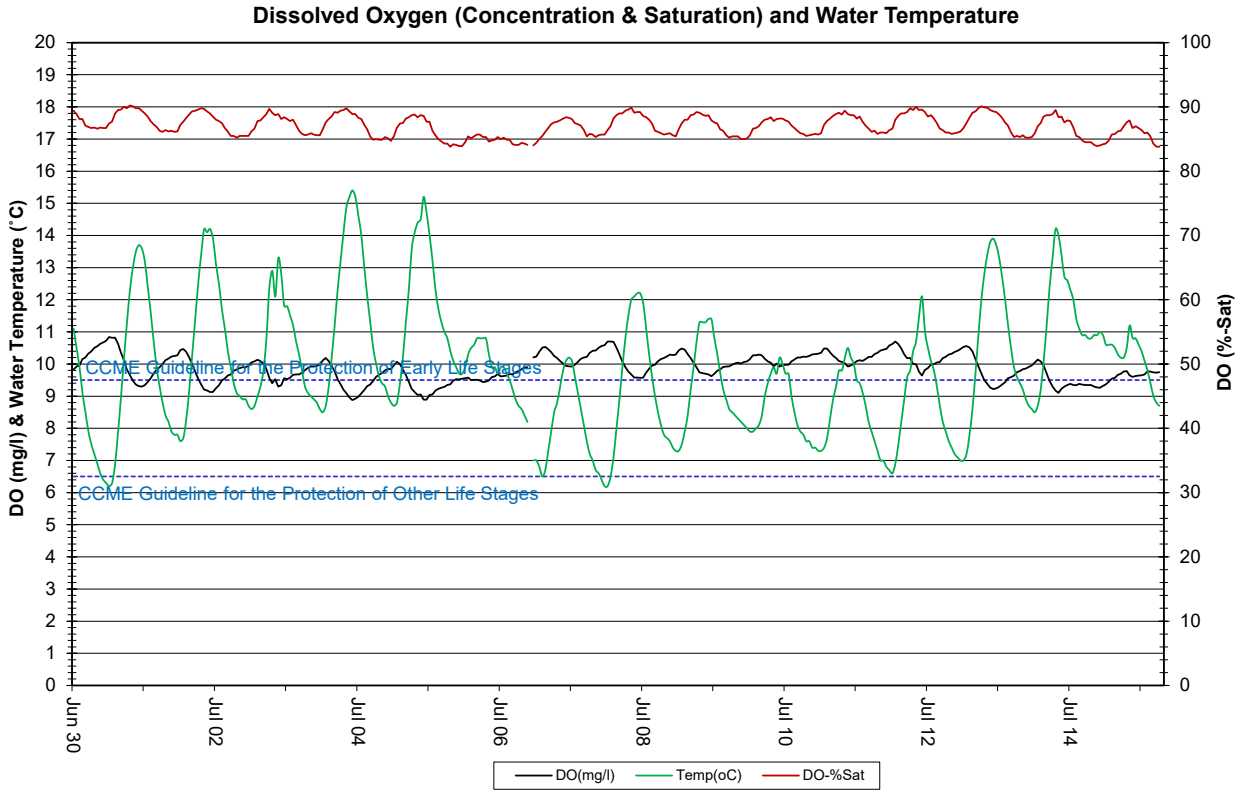

Figure 10: Dissolved Oxygen & Water Temperature at Joan Brook

Turbidity

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. The Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- During the deployment period, turbidity values ranged from 11.6 NTU to 17.7 NTU at Elross Creek and from 0.0 NTU to 1662.0 NTU at Joan Brook (Figures 11-12). However, it should be noted that there is limited turbidity data for Elross Creek due to power issues with internal logging of the instrument.
- Elross Creek was turbid throughout the deployment (median 12.5) but significantly less turbid than the previous deployment (median 37.4 NTU). Joan Brook again recorded minimal turbidity throughout the deployment (median 0.0 NTU).

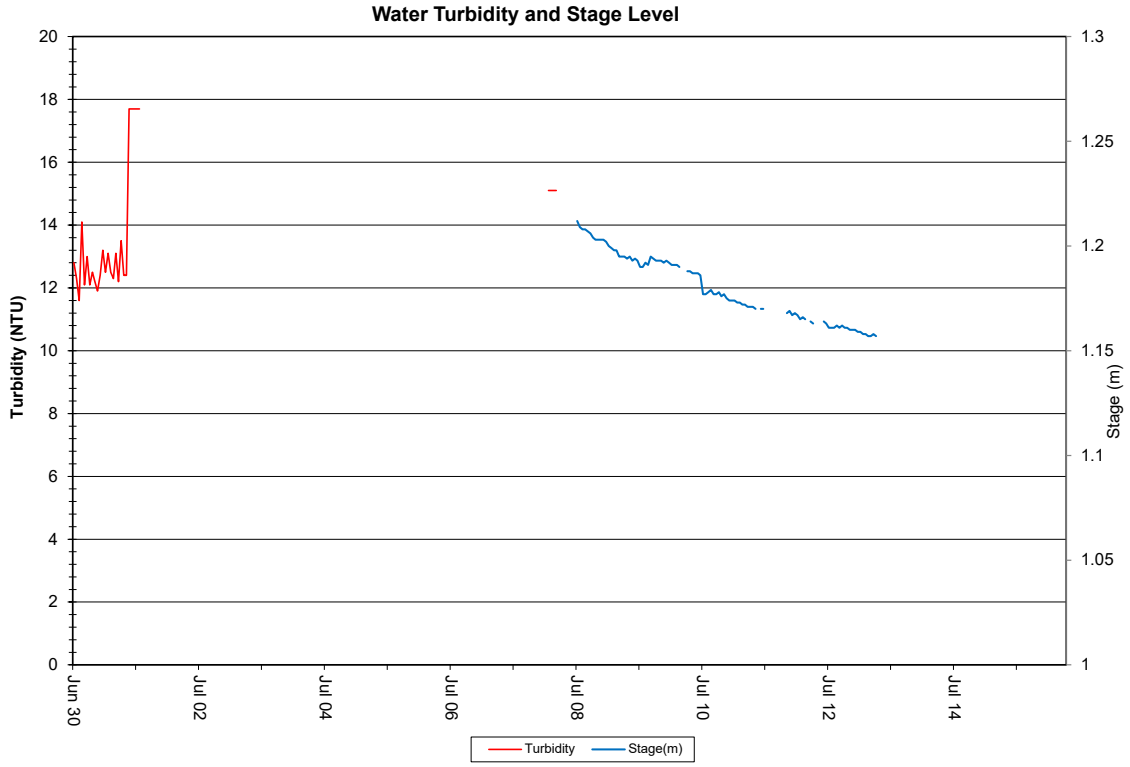

Figure 11: Turbidity & Stage at Elross Creek

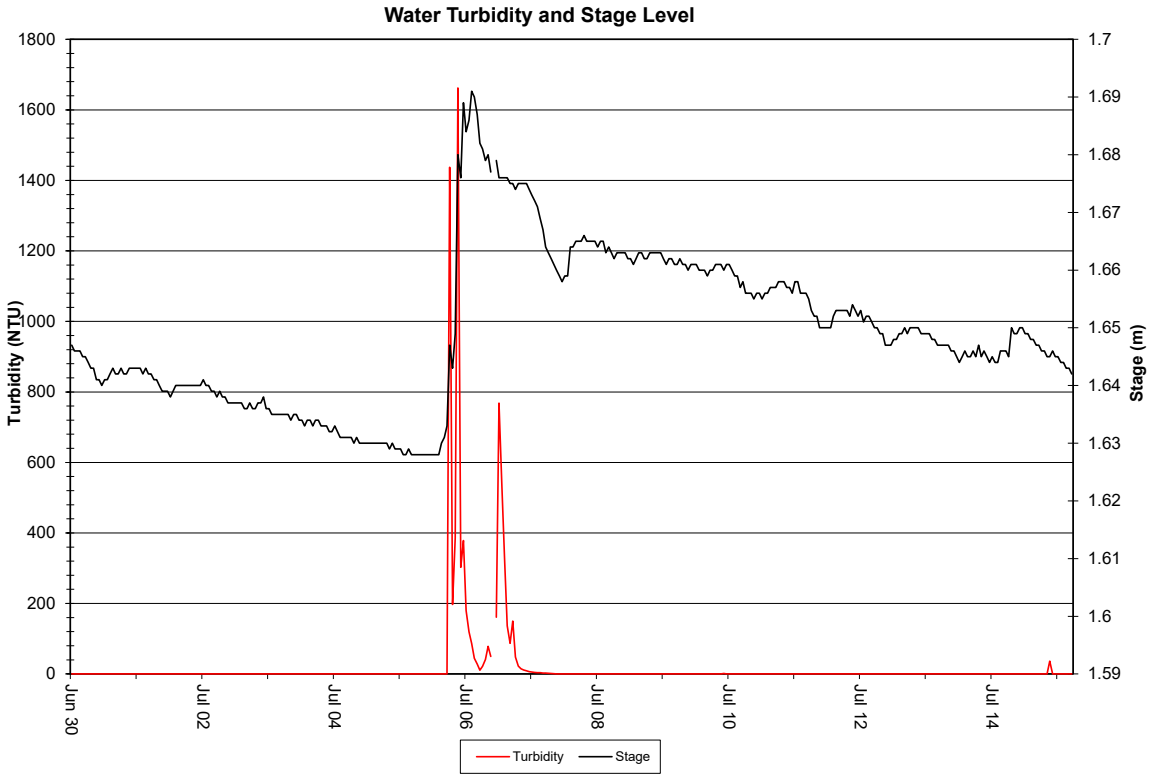

Figure 12: Turbidity & Stage at Joan Brook

Conclusions

- This deployment report presents water quality and water quantity data recorded at the Elross Creek and Joan Brook real time monitoring stations from June 30th to July 16th, 2021. Is it notable that data from Elross Creek was limited due to continued issues with cabling damage at the station by animals.
- Field instruments for both stations performed well over the deployment period despite numerous transmission and power issues caused by animal-damaged cabling.
- Variations in water quality/quantity values recorded at each station are summarized below:
    - At both stations, stage was typical for spring into summer as the last of the spring melt passes through the system, decreasing the overall stage level. This was evident even at Elross Creek were stage data was limited.
    - At both stations, temperature showed a slight increasing trend over the deployment which is typical of the transition into summer. The addition of precipitation caused the water temperature to cool for a period of time.
    - pH values ranged from 6.48 units to 6.98 units at Elross Creek and from 6.25 units to 6.81 units at Joan Brook. pH was relatively stable at both stations, dipping briefly below the recommended guidelines only during the initial acclimation period upon deployment and when reduced by the addition of significant precipitation to the system.
    - Specific conductivity ranged from 15.0 µs/cm to 24.6 µs/cm at Elross Creek and from 7.2 µs/cm to 9.1 µs/cm at Joan Brook. Elross Creek exhibited a gradual increasing trend over the deployment while Joan Lake was relatively stable. Conductance at both stations was influenced by precipitation events.
    - Dissolved oxygen (DO) values ranged values ranged from 8.08 mg/l (81.3% saturation) to 10.33 mg/l (89.5% saturation) at Elross Creek and from 8.88 mg/l (83.8% saturation) to 10.84 mg/l (90.2% saturation) at Joan Brook. Both stations were relatively stable, but were influenced by water temperature and hovered around the CCME guideline for all early life stages (9.5 mg/l).
    - Turbidity values ranged from 11.6 NTU to 17.7 NTU at Elross Creek and from 0.0 NTU to 1662 NTU at Joan Brook. At both locations, stage level increases caused spikes in turbidity.

References

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated December, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

APPENDIX A
Quality Assurance / Quality Control Procedures

As part of the Quality Assurance / Quality Control (QA/QC) protocol, the performance of a station's water quality instrument (i.e., Field Sonde) is rated at the beginning and end of its deployment period. The procedure is based on the approach used by the United States Geological Survey (Wagner *et al.* 2006)[1].

At the beginning of the deployment period, a fully cleaned and calibrated QA/QC water quality instrument (i.e., QA/QC Sonde) is placed *in-situ* with the fully cleaned and calibrated Field Sonde. After Sonde readings have stabilized, which may take up to five minutes in some cases, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde. If the readings from both Sondes are in close agreement, the QA/QC Sonde can be removed from the water. If the readings are not in close agreement, there will be attempts to reconcile the problem on site (e.g., removing air bubbles from sensors, etc.). If no fix is made, the Field Sonde may be removed for recalibration.

At the end of the deployment period, a fully cleaned and calibrated QA/QC Sonde is once again deployed *in-situ* with the Field Sonde, which has already been deployment for 30-40 days. After Sonde readings have stabilized, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde.

Performance ratings are based on differences listed in the table below.

[1] Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 10, 2006, at *http://pubs.water.usgs.gov/tm1d3*

	Rating				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (°C)	≤ ±0.2	> ±0.2 to 0.5	> ±0.5 to 0.8	> ±0.8 to 1	> ±1
pH (unit)	≤ ±0.2	> ±0.2 to 0.5	> ±0.5 to 0.8	> ±0.8 to 1	> ±1
Sp. Conductance (µS/cm)	≤ ±3	> ±3 to 10	> ±10 to 15	> ±15 to 20	> ±20
Sp. Conductance > 35 µS/cm (%)	≤ ±3	> ±3 to 10	> ±10 to 15	> ±15 to 20	> ±20
Dissolved Oxygen (mg/l) (% Sat)	≤ ±0.3	> ±0.3 to 0.5	> ±0.5 to 0.8	> ±0.8 to 1	> ±1
Turbidity <40 NTU (NTU)	≤ ±2	> ±2 to 5	> ±5 to 8	> ±8 to 10	> ±10
Turbidity > 40 NTU (%)	≤ ±5	> ±5 to 10	> ±10 to 15	> ±15 to 20	> ±20

APPENDIX B
Environment Canada Weather Data – Schefferville (July 2021)

Weather data from the Schefferville station is not available for this time period