# Real-Time Water Quality Annual Report

## Outflow of the Steady below FireFly Metals' Nugget Pond Facility

**May 29 to**
**November 6, 2025**

Newfoundland Labrador

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

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## Introduction

- The Real-Time Water Quality (RTWQ) Monitoring station at Outflow of the Steady is funded by FireFly Metals Ltd. The program is a partnership between FireFly Metals Ltd. and the Newfoundland & Labrador Department of Environment, Conservation and Climate Change (ECC).
- The real-time water quality monitoring station at Outflow of the Steady was initially installed in July 2019 by ECC staff.
- This station measures the following water parameters: temperature, pH, specific conductivity, dissolved oxygen, turbidity and water quantity (stage). Parameters are recorded on an hourly basis during the deployment period and are available in real-time online: https://www.mae.gov.nl.ca/wrmd/ADRS/v6/Template_Station.asp?station=NLENHM0002

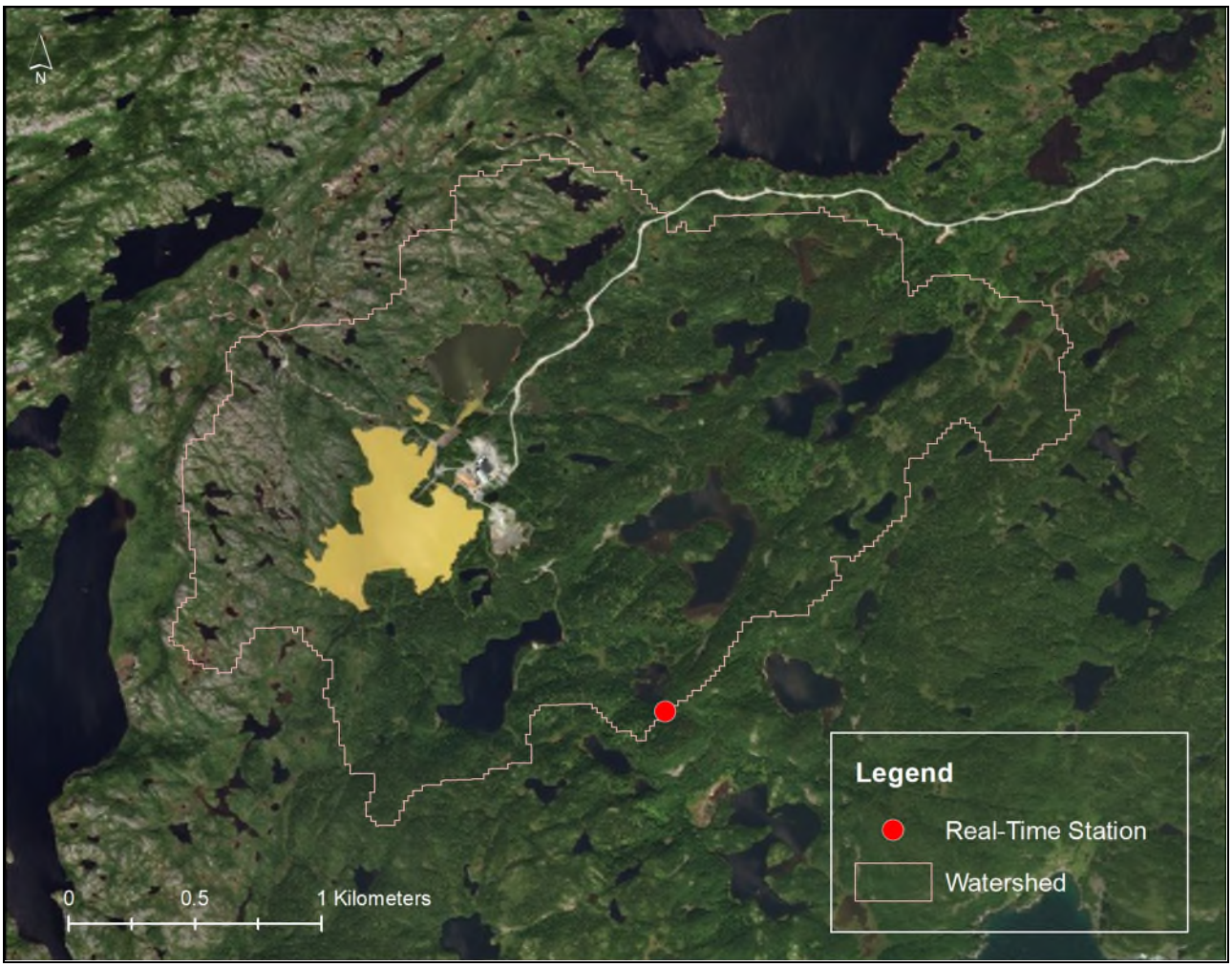


**Figure 1: Map of FireFly Metals Ltd.'s Nugget Pond Mill tailings management facility area and the RTWQ station**

- The purpose of this network is to monitor, process, and distribute water quality/quantity data to FireFly Metals Ltd. and ECC for assessment and management of water resources, as well as to provide an early warning for any potential or emerging water issues, allowing mitigative measures to be implemented in a timely manner.
- ECC provides FireFly Metals Ltd. with monthly and annual deployment reports. Data is available in near real-time on the ECC website.
- Gaps in the water quality data are the result of transmission loss by the station or the removal of inaccurate data due to ongoing station maintenance during that time period.
- The initial deployment for the 2025 season was on May 29th. The instrument was removed for the winter season on November 6th. The following report depicts and discusses water quality events throughout this time period. For more in-depth analysis, please refer to the individual deployment reports.

## Maintenance and Calibration

- To ensure accurate data collection, maintenance and calibration of the water quality instrumentation is performed approximately every 45 days.
- Maintenance includes a thorough cleaning of the instrument and replacement of any small sensor parts that are damaged or unsuitable for reuse. Once the instrument is cleaned, ECC staff carefully calibrate each sensor attachment for pH, specific conductivity, dissolved oxygen and turbidity to ensure accurate data collection.
- Installation and removal dates for the 2025 season are summarized in the table below.

**Table 1: Water quality instrument deployment start and end dates for 2025**

| Installation | Removal | Deployment duration (days) |
|---|---|---|
| May 29 | July 23 | 55 |
| July 23 | September 03 | 48 |
| September 03 | October 16 | 43 |
| October 16 | November 06 | 20 |

## Quality Assurance and Quality Control

- As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of each deployment period. The procedure is based on the approach used by the United States Geological Survey.
- At deployment and removal, a QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between parameters recorded by the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 2).

**Table 2: Ranking classifications for deployment and removal**

| | Rank | | | | |
|---|---|---|---|---|---|
| **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 |

- It should be noted that the temperature sensor on any sonde is the most important. All other parameters can be broken down into three groups: temperature dependent, temperature compensated and temperature independent. Since the temperature sensor is not isolated from the rest of the sonde the entire sonde must be at the same temperature before the sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.
- Deployment and removal comparison rankings for the Outflow of the Steady water quality station for the three deployment periods from May 29$^{th}$ to November 6$^{th}$, 2025, are summarized in Table 3.
- For additional information and explanations of rankings, please refer to the 2025 monthly deployment reports.

**Table 3: QA/QC comparison rankings for Outflow of the Steady May 29 – November 06, 2025**

| | Date | | Instrument # | Temperature | pH | Specific Conductivity | Dissolved Oxygen | Turbidity |
|---|---|---|---|---|---|---|---|---|
| Outflow of the Steady | 29-May-25 | Deployment | 17M102371 | Excellent | Excellent | Excellent | Excellent | Excellent |
| | 23-Jul-25 | Removal | 17M102371 | Good | Excellent | Excellent | Excellent | Excellent |
| | 23-Jul-25 | Deployment | 19E100335 | Excellent | Excellent | Excellent | Excellent | Excellent |
| | 03-Sep-25 | Removal | 19E100335 | Excellent | Good | Excellent | Good | Excellent |
| | 03-Sep-25 | Deployment | 17M102371 | Excellent | Excellent | Excellent | Excellent | Excellent |
| | 16-Oct-25 | Removal | 17M102371 | Excellent | Good | Excellent | Excellent | Excellent |
| | 16-Oct-25 | Deployment | 17M102371 | Excellent | Good | Excellent | Excellent | Excellent |
| | 06-Nov-25 | Removal | 17M102371 | Excellent | Excellent | Excellent | Excellent | Excellent |

## Data Interpretation

- The following graphs and discussion illustrate water quality-related events from May 29th, 2025 to November 6th, 2025 at Outflow of the Steady.
- With the exception of water quantity data (stage), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Corrected data can be obtained upon request.

**Outflow of the Steady below Nugget Pond Mill**

- Water temperature ranged from 4.58 to 27.99ºC during the 2025 deployment season. The median value was 15.53ºC (Figure 2).
- Water temperature increases at the beginning of the deployment and decreases during the later portion of the season. This is expected as ambient air temperature warms the water in the summer and cools water into the fall in a seasonal pattern.

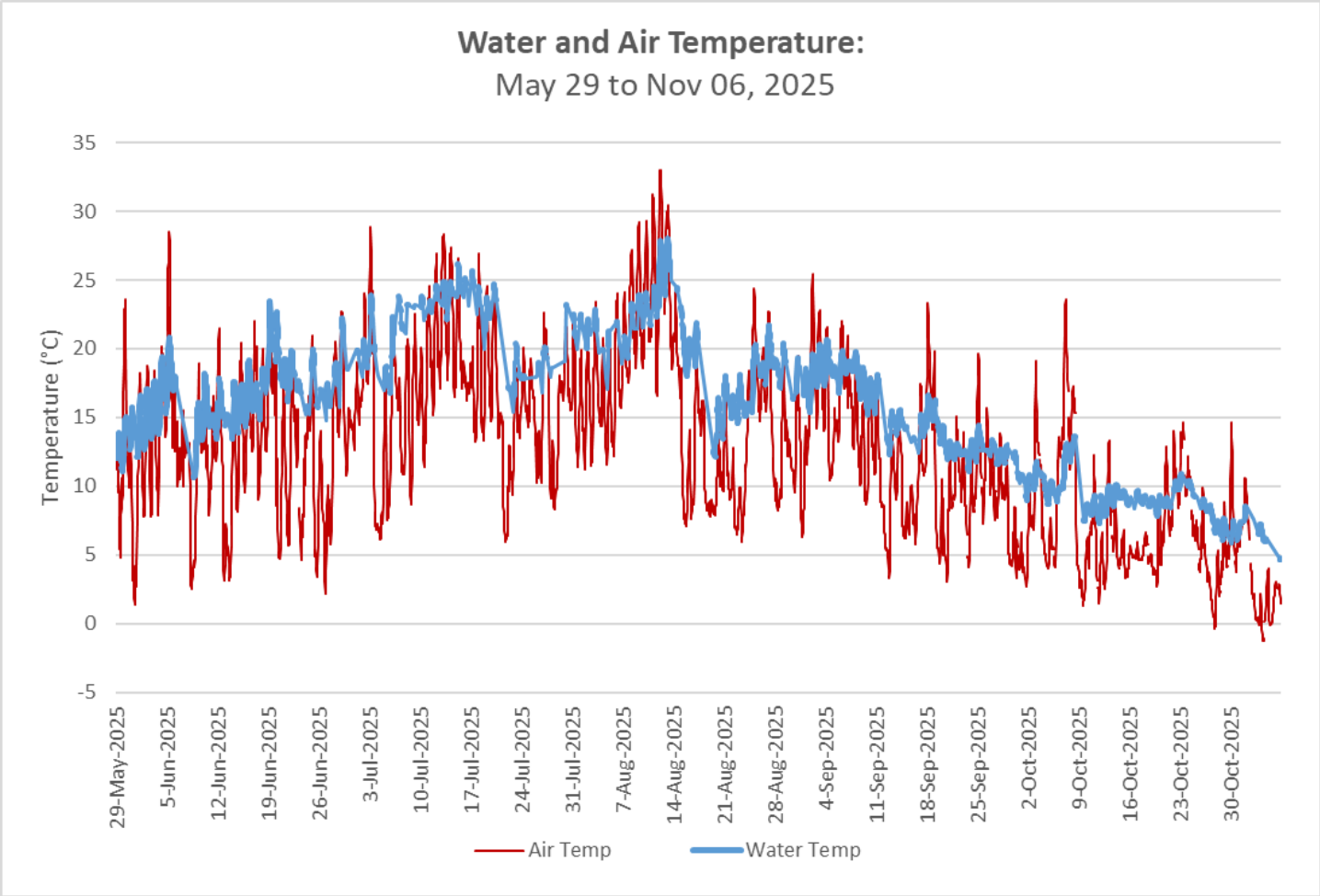


**Figure 2: Water and Air Temperature – Outflow of the Steady**
**(Weather data from ECCC climate at La Scie)**

- pH ranged from 6.69 to 7.36 pH units at Outflow of the Steady during the 2025 deployment season (Figure 3). The median pH was 7.04.
- pH fluctuates daily. All values during the deployment are within the CCME Water Quality Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units).
- pH remained relatively stable throughout the deployment season of 2025.

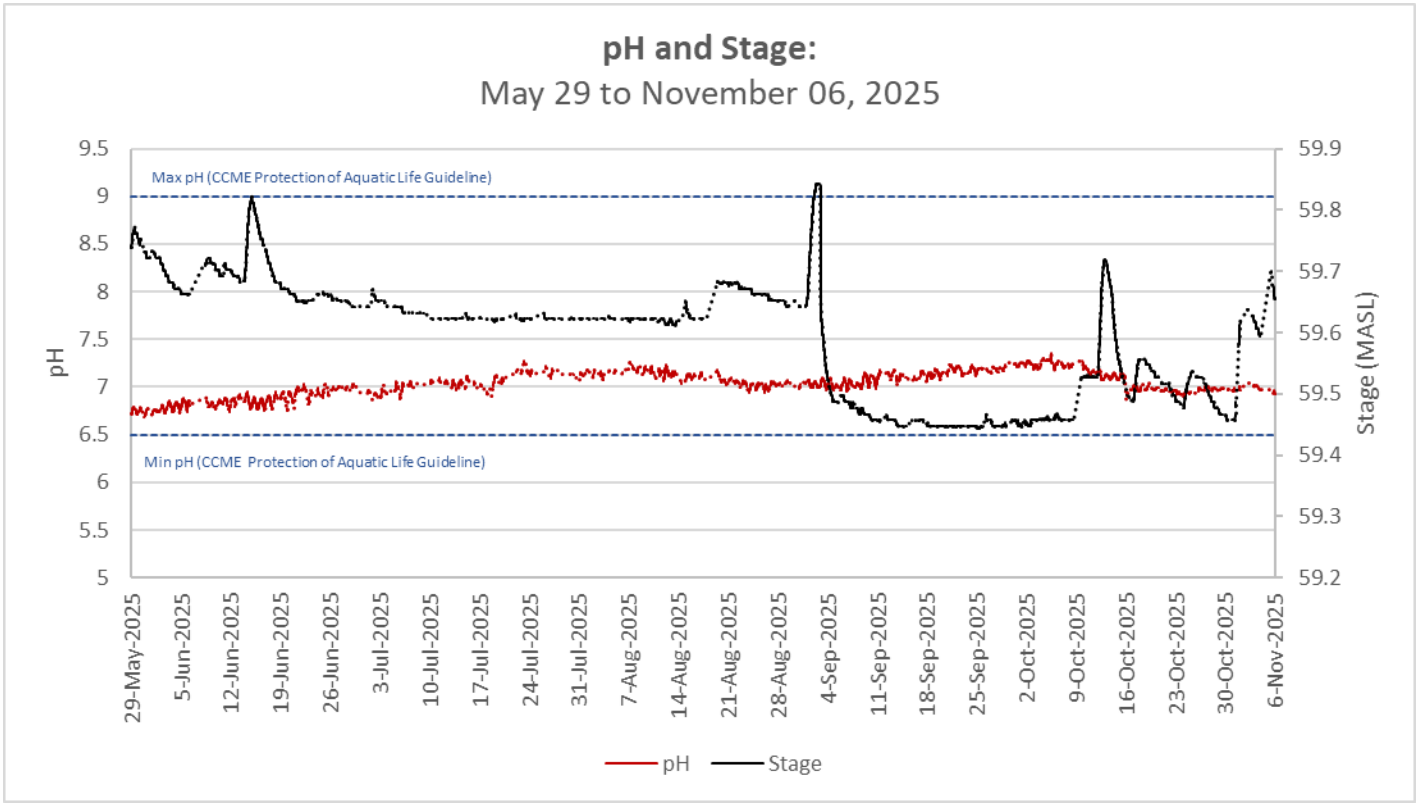


**Figure 3: pH and Stage – Outflow of the Steady**

- Throughout the 2025 deployment season, specific conductivity ranged from 73.6 to 104.03 µs/cm at Outflow of the Steady (Figure 4).
- Conductivity demonstrated an overall slight increasing trend throughout the deployment. Increases were evident and coincided with decreases in stage. Precipitation events add water to the system, increasing stage, which dilutes the water and decreases the specific conductivity for a short time.

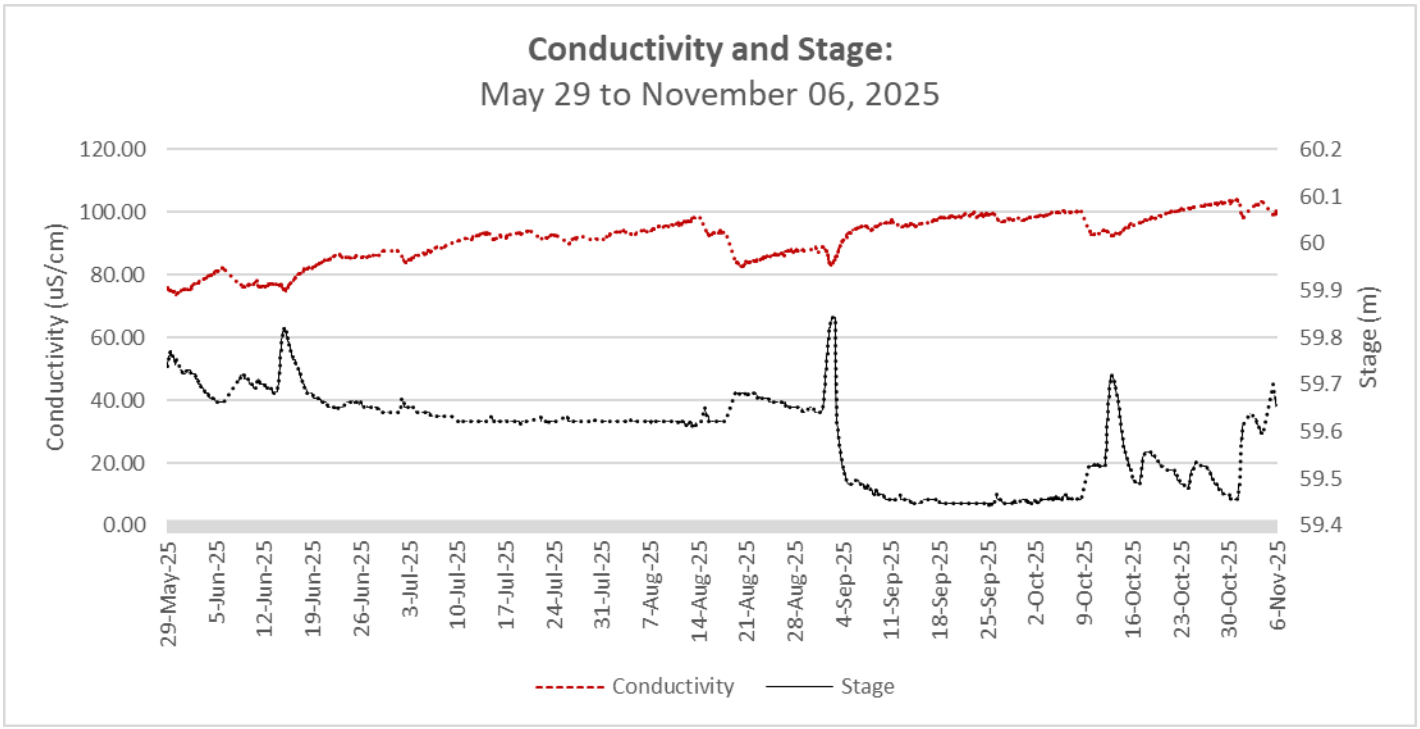


**Figure 4: Specific Conductivity and Stage – Outflow of the Steady**

- The saturation of dissolved oxygen ranged from 86.96% to 110.43%, while the dissolved oxygen content ranged from 7.78 to 12.32 mg/l, with a median value of 9.87 mg/l (Figure 5).
- Dissolved oxygen fluctuated daily with decreases observed at night.
- Dissolved oxygen is lowest during the summer months when water temperature is warmest. It then increases steadily into the fall as water temperatures cool (Figure 5). Cooler water holds more oxygen than warmer water.
- All values were above the CCME Water Quality Guideline for the Protection of Aquatic Life for Cold Water Biota at Other Life Stages of 6.5 mg/l. The majority of values recorded were above the minimum CCME Water Quality Guideline for the Protection of Aquatic Life for Cold Water Biota at Early Life Stages of 9.5 mg/l. The guidelines are indicated in blue on Figure 5.

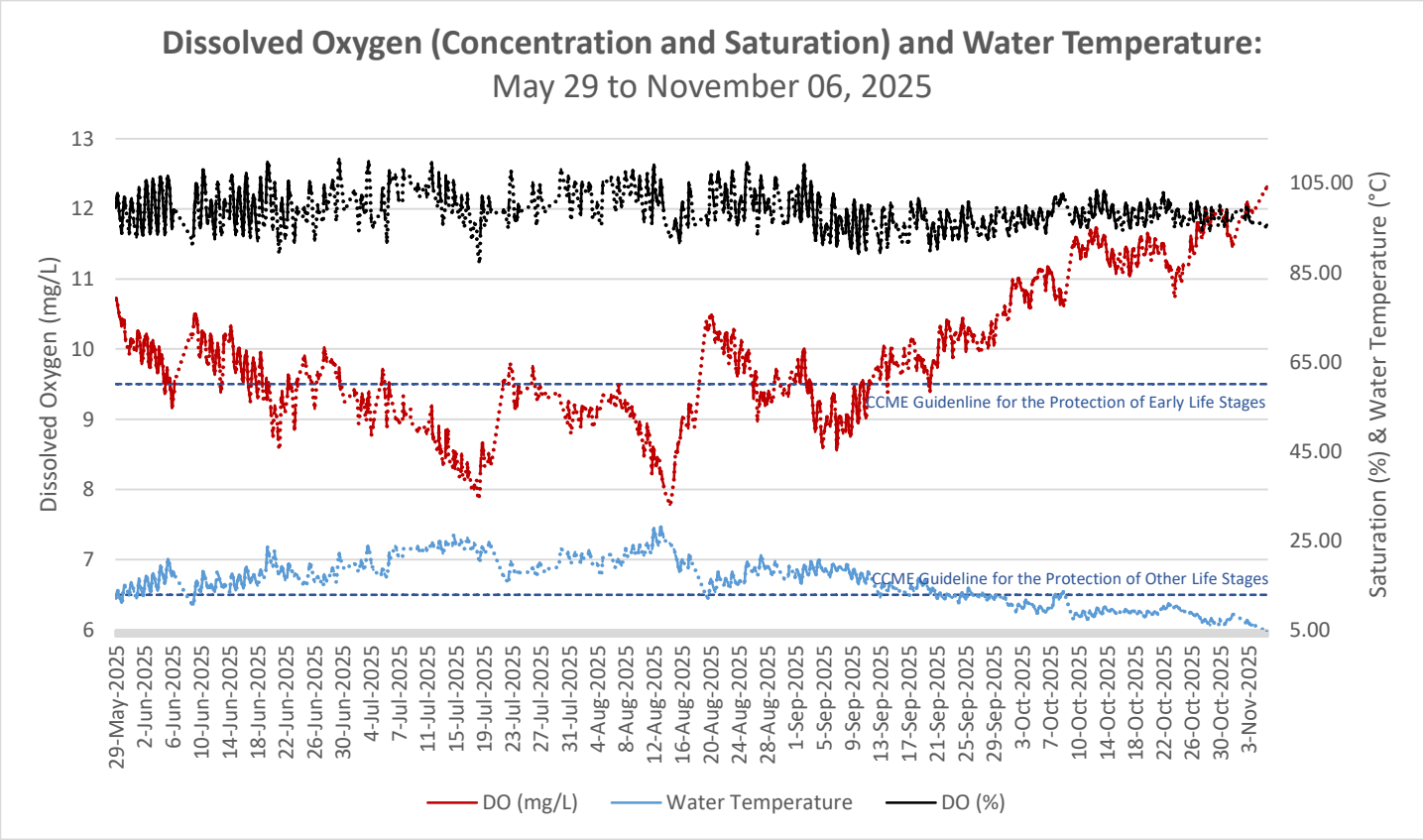


**Figure 5: Dissolved Oxygen Concentration, Saturation and Water Temperature – Outflow of the Steady**

- At the Outflow of the Steady station, turbidity values range from -0.14 to 27.77 NTU with a median value of 0.52 NTU (Figure 6). This indicates very low background turbidity at this location.
- Turbidity remained relatively stable throughout the deployment season with some spikes corresponding to stage increases which suspends sediment and particles into the water column for a short period of time.
- Stage varied from 59.44m to 59.84m, with a range of 0.40m during the year.

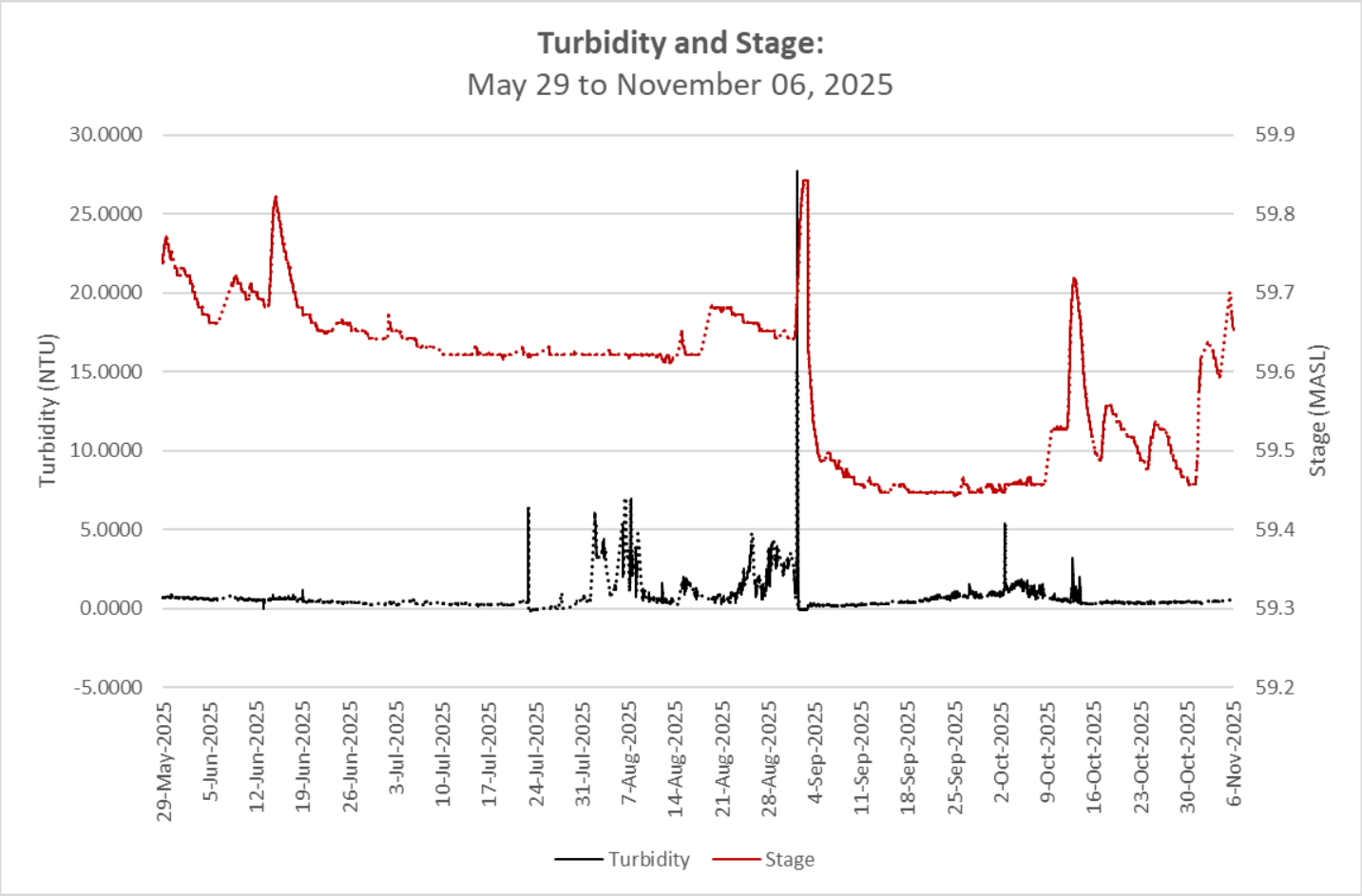


**Figure 6: Turbidity and Stage – Outflow of the Steady**

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Outflow of the Steady (Figure 7).
- Stage levels are generally consistent in the summer months, with an increasing trend into fall. Stage is frequently influenced by precipitation events, but not always. The largest precipitation event occurred July 29th with 13 mm recorded at La Scie.

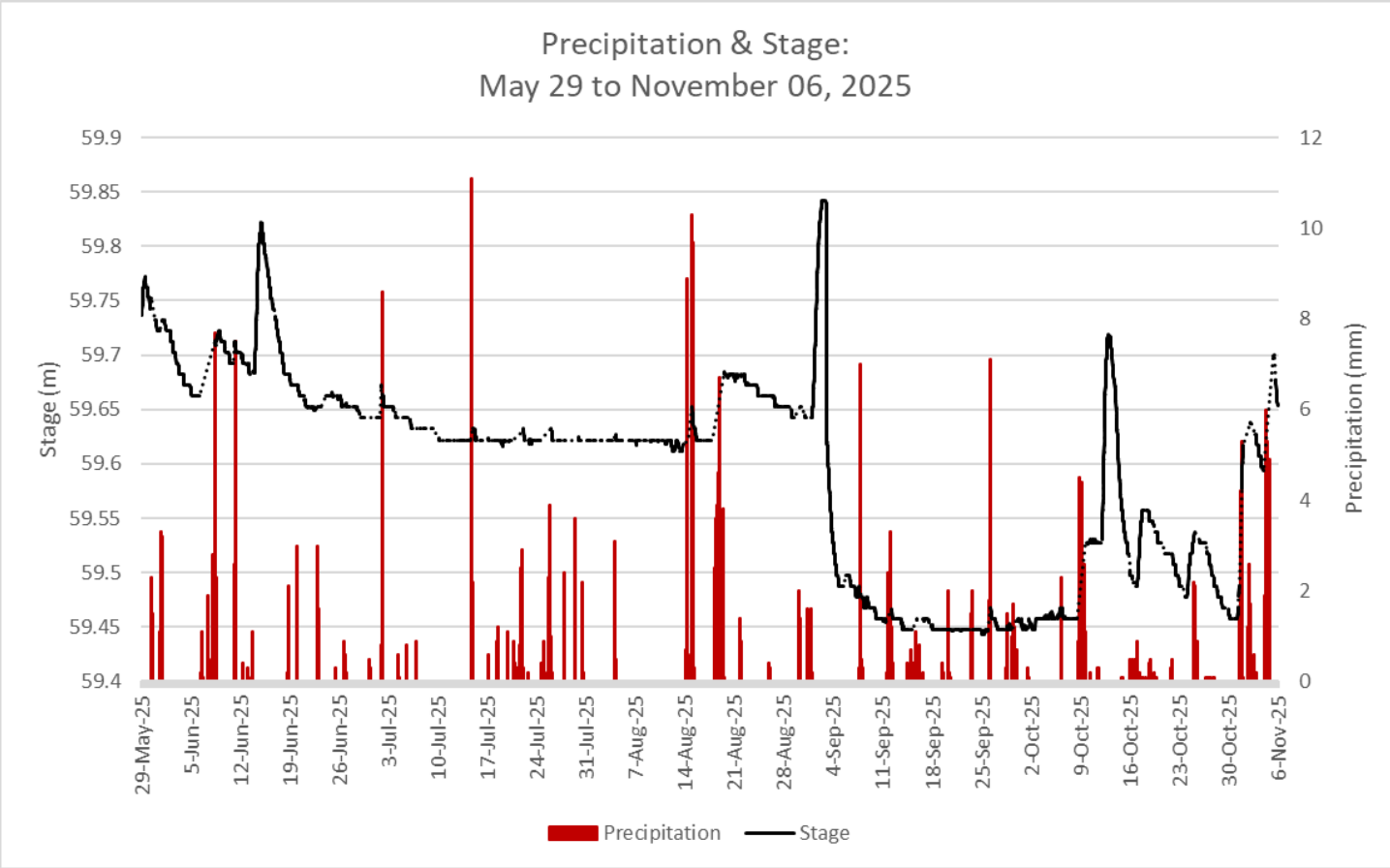


**Figure 7: Stage and Precipitation – Outflow of the Steady**
**(Weather data collected from ECCC climate station at La Scie)**

## Conclusions

- The instrument at the water quality monitoring station Outflow of the Steady was deployed on May 29th, 2025 and removed on November 6$^{th}$, 2025 for the winter season.
- Deployment periods were 55, 48, 43 and 20 days. A typical deployment period would normally be approximately 45 days. Staff monitored the data daily for issues. QA/QC sensor rankings show that the extended deployment had no negative effect on the data collected.
- With the exception of the negative turbidity data, the water quality instrument performed well for the 2025 season with no other issues. Intermittent transmission loss has been an issue at this station and mitigation measures (signal boosting and tree clearing) are scheduled for the 2026 season.
- In most cases, weather related events or increases/decreases in water level explain the data fluctuations.
- Water temperature followed the seasonal trend of increasing during the summer and decreasing into the fall. Water temperature corresponded with air temperature.
- The pH ranged from 6.69 to 7.36. All pH values were within the acceptable range of the CCME Water Quality Guidelines for Protection of Aquatic Life.
- Specific conductivity ranged from 73.6 to 104.03 µs/cm and displayed an overall minimal increase during the 2025 deployments.
- Dissolved oxygen values remained above the minimum CCME Guideline for the Protection of Other Life Stage Cold Water Biota of 6.5 mg/l. The majority of values were above the minimum CCME Guideline for the Protection of Early Life Stage Cold Water Biota value of 9.5 mg/l. The values below this guideline correspond to periods of warmer water temperatures.
- This station has low background turbidity but can be influenced by stage increases which may increase turbidity for a short period of time.

## Path Forward

- The field instrument will undergo proficiency testing and evaluation during the winter of 2025-2026. ECC will inform FireFly Metals Ltd. of any instrument performance issues.
- ECC staff will deploy the real time water quality instrument in spring 2026 when ice conditions allow and perform regular site visits throughout the 2026 deployment season for calibration and maintenance of the instrument and water quantity equipment.
- If necessary, deployment techniques will be evaluated and modified, ensuring secure and suitable conditions for RTWQ monitoring.
- ECC will continue to work on its Automatic Data Retrieval System (ADRS), to incorporate new capabilities in data management and data display.
- Open communication lines will continue to be maintained between ECC and FireFly Metals Ltd. to respond to emerging issues on a proactive basis. FireFly Metals Ltd. will receive monthly deployment reports and an annual report, summarizing the events of the deployment season.

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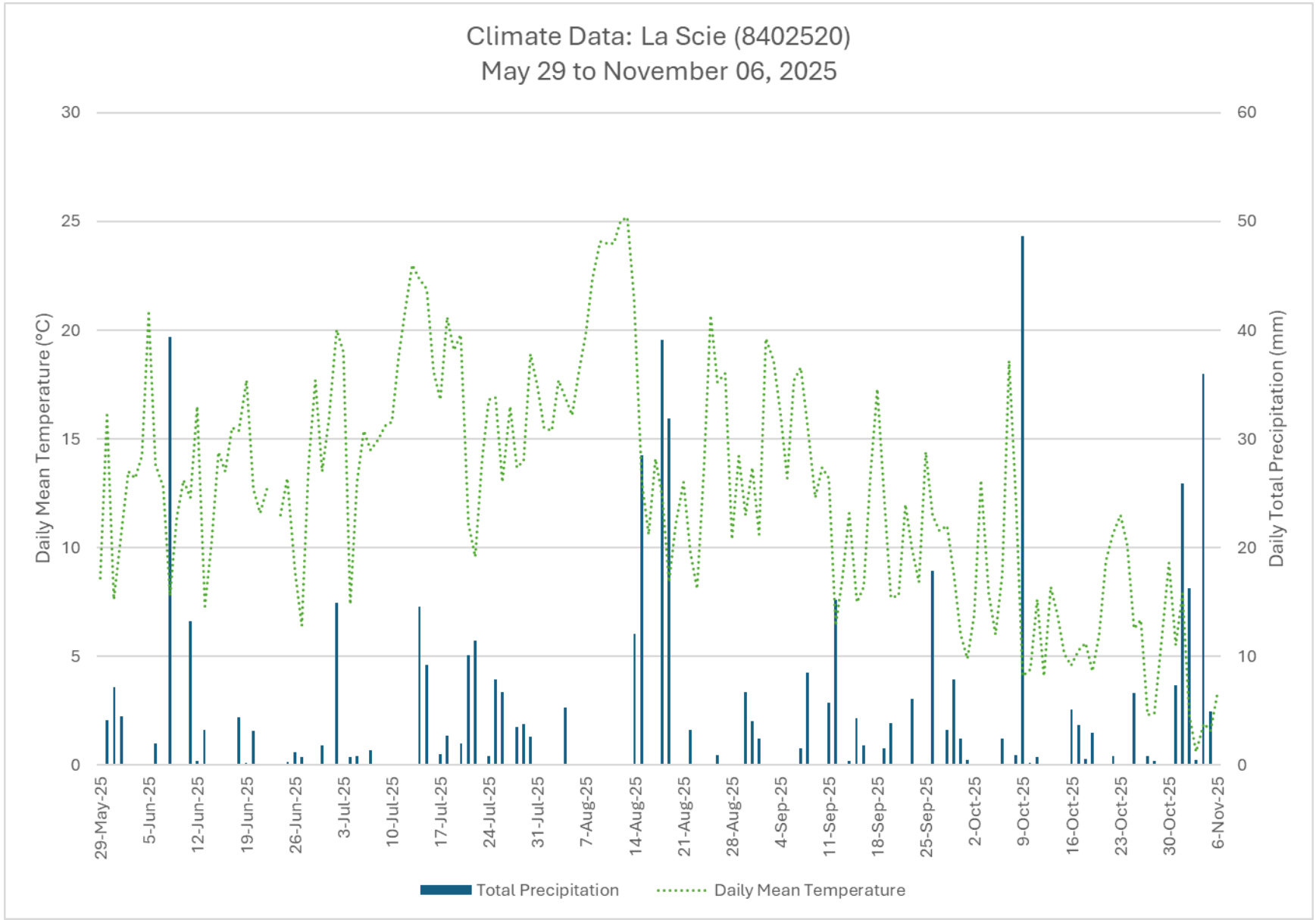
# Appendix 1: Air Temperature and Precipitation



## Appendix 2: RTWQ Monitoring Station Outflow of the Steady