



# Real-Time Water Quality Report

## Waterford River at Kilbride

Deployment Period  
December 1, 2020 to January 6, 2021



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

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## General

The Water Resources Management Division (WRMD), in partnership with Water Survey of Canada -Environment and Climate Change Canada (WSC-ECCC), maintain a real-time water quality and water quantity monitoring station on Waterford River at Kilbride.

The purpose of the real-time water quality station is to monitor, process and publish real-time water quality data. This deployment report discusses water quality related events occurring at this station from instrument deployment on January 1, 2021 until removal on August 3, 2021.



Figure 1: Waterford River at Kilbride Real-Time Water Quality and Quantity Station.

## 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 the deployment period. The procedure is based on the approach used by the United States Geological Survey (Table 1).

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 the parameters on the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 2).

WRMD staff at the Department of Environment & Climate Change (ECC) are responsible maintaining and calibrating the water quality instrument, as well as grooming, analyzing and reporting on water quality data recorded at the station.

WSC staff are responsible for the data logging/communication aspect of the network and maintenance of the water quantity monitoring equipment. WSC-ECCC staff visit the site regularly to ensure the data logging and data transmitting equipment are working properly, and are responsible for handling stage and streamflow data issues. The water quantity data is transmitted via satellite and published online with the water quality data on the WRMD website. Water quantity data has not been corrected or groomed when published online or used in the monthly reports for the stations. WSC is responsible for QA/QC of water quantity data. Corrected stage and streamflow data can be obtained upon request to WSC.

**Table 1: Instrument Performance Ranking classifications for deployment and removal**

Parameter	Rank				
	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 divided into subgroups of: temperature dependant, temperature compensated and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is recorded too early it may not accurately portray the water body.



**Table 2: Instrument performance rankings for Waterford River at Kilbride**

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Waterford	January 6	Deployment	Excellent	Fair	Excellent	Excellent	Excellent
	August 3	Removal	Good	Good	Excellent	Excellent	Excellent

Upon deployment, all sensors ranked ‘Excellent’ with the exception of pH which ranked ‘Fair’. This is likely due to the instrument being slow to acclimate in the very cold water this time of year and the values recorded before the instrument had stabilized. The field sonde rose from 6.28 to 6.90 slowly over the first six hours, indicating this is likely the case. The grab sample value was 7.30.

At removal of the instrument, all parameters ranked ‘Good’ or ‘Excellent’ against the QAQC sonde, despite the long deployment period of 207 days.

### **Deployment Note**

At 207 days, this deployment period was longer than normal due to COVID-19 restrictions and issues with removing the instrument from its casing.

## Waterford River at Kilbride

### Water Temperature

Water temperature ranged from -0.14 °C to 22.56 °C during this deployment period (Figure 2).

Over the duration of the deployment period, the water temperature increased as air temperatures changed into and throughout summer. Water temperatures dip during the higher stage events, likely the result of cool rainfall.

Water temperature display a natural diurnal pattern with temperatures increasing during the day and temperatures decreasing overnight. All brooks and ambient waterways have natural diurnal patterns.

Please note the stage data is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

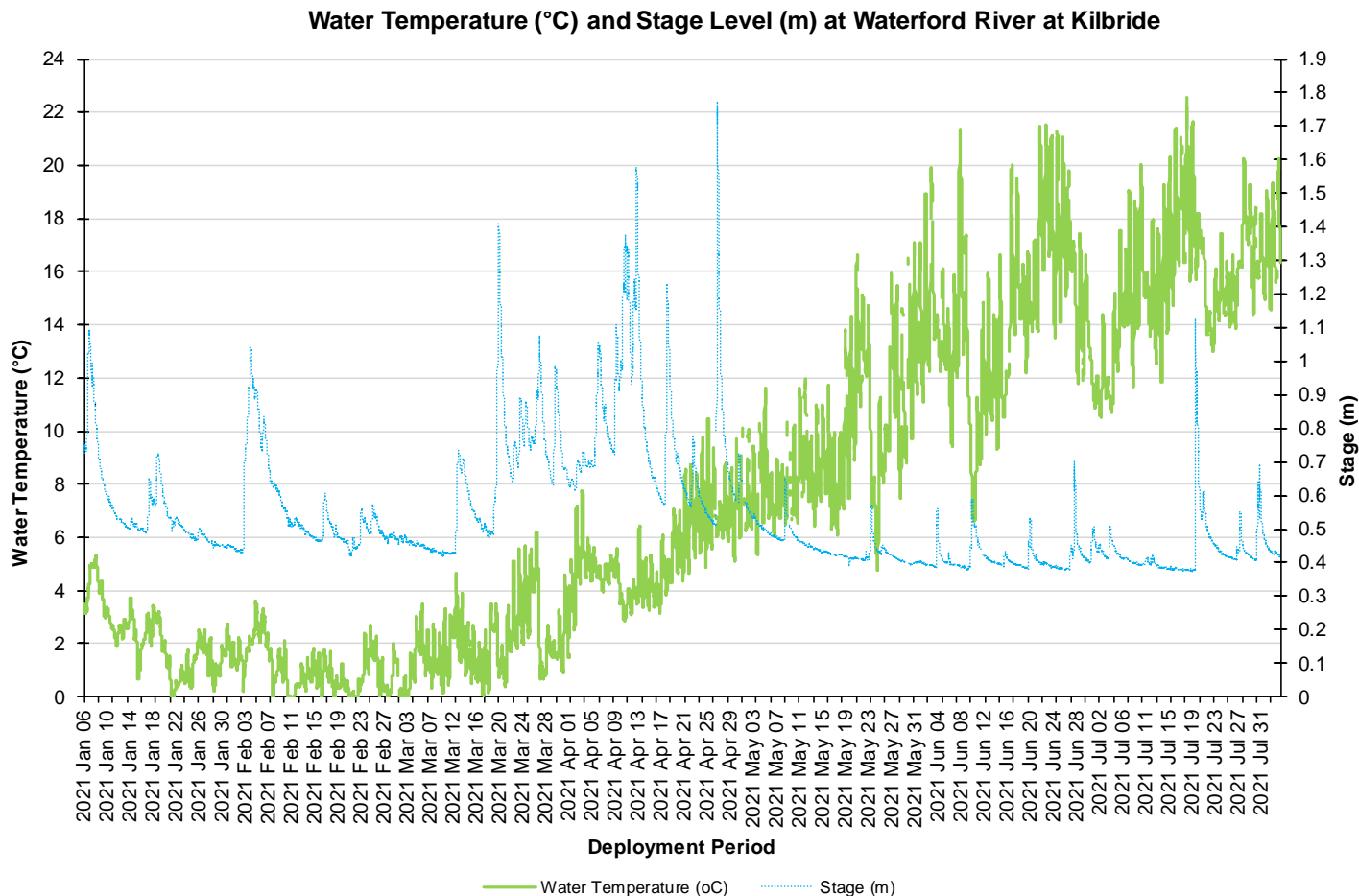


Figure 2: Water temperature (°C) and Stage (m) values at Waterford River at Kilbride

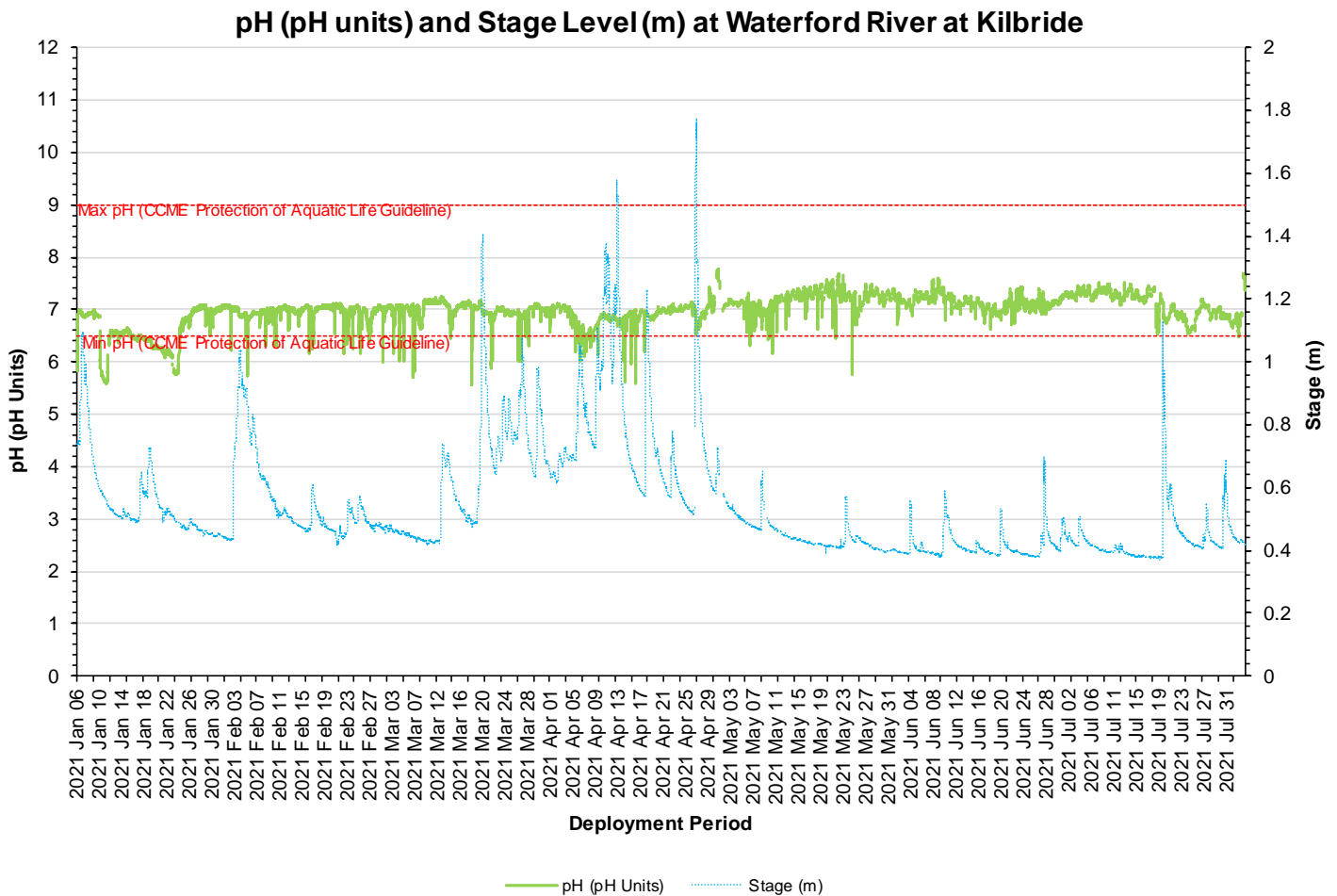
## pH

Throughout the deployment period, pH values ranged between 5.55 pH units and 7.77 pH units (Figure 3).

The CCME guideline provide a basis by which to judge the overall health of the brook. Waterford River pH values remained within the guidelines for the majority of the long deployment, dropping below periodically during high stage events. The median pH level was 7.02 pH units.

During the higher stage events the pH values dip for the duration of the peak in stage. However, the pH values return to background levels as the stage settles out again. Urban brooks such as Waterford River are influenced by the environment around the brook, and water parameters can change quickly in these brooks.

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**Figure 3: pH (pH units) and stage level (m) values at Waterford River at Kilbride**

### Specific Conductivity & Total Dissolved Solids

The conductivity levels were within 163  $\mu\text{S}/\text{cm}$  and 3473  $\mu\text{S}/\text{cm}$  during this deployment period. TDS (a calculated value) ranged from 0.1060 g/L to 2.2580 g/L (Figure 4).

Due to the wide coverage of several different climatic seasons, the data captured the differences of specific conductivity during the winter, spring and into summer conditions. At the beginning of the deployment, conductivity increased during higher stage events. This was likely a result of road salting during the winter and the salt leeching into the brook.

During the month of March, weather conditions warmed and there was a reduction in road salting. Around this time, conductivity levels at Waterford began to decrease during high stage events. This is likely a result of the minerals and dissolved material present in the brook being diluted and flushed for a short period of time before returning to background levels.

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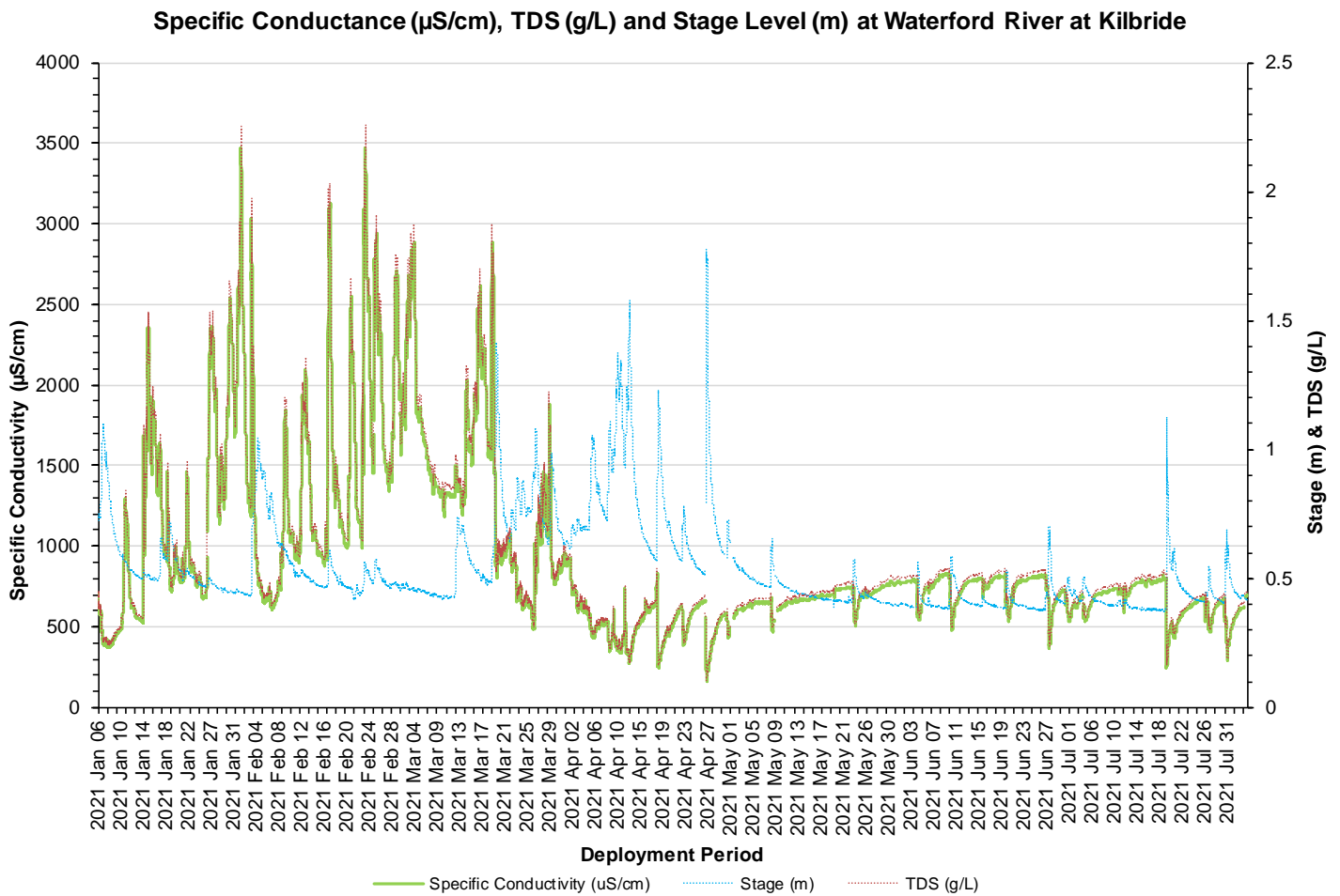


Figure 4: Specific conductivity ( $\mu\text{S}/\text{cm}$ ), TDS (g/L) and stage (m) values at Waterford River at Kilbride.



### Dissolved Oxygen

The water quality instrument measures dissolved oxygen (mg/L) with the dissolved oxygen probe. The instrument then calculates percent saturation (% Sat) taking into account the water temperature.

During the deployment, the dissolved oxygen concentration levels ranged within a minimum of 8.05 mg/L to a maximum of 14.43 mg/L. The percent saturation levels for dissolved oxygen ranged within 87.0 % Saturation to 109.3 % Saturation (Figure 5).

The majority of the dissolved oxygen levels remained above the CCME Guideline for the Protection of Early life stages (9.5mg/L) and other life stages (6.5 mg/L), dropping below in the summer when water temperatures were warmest. The long deployment (Figure 5) allows the seasonal changes and relationship between oxygen and water temperature from winter to summer to be demonstrated.

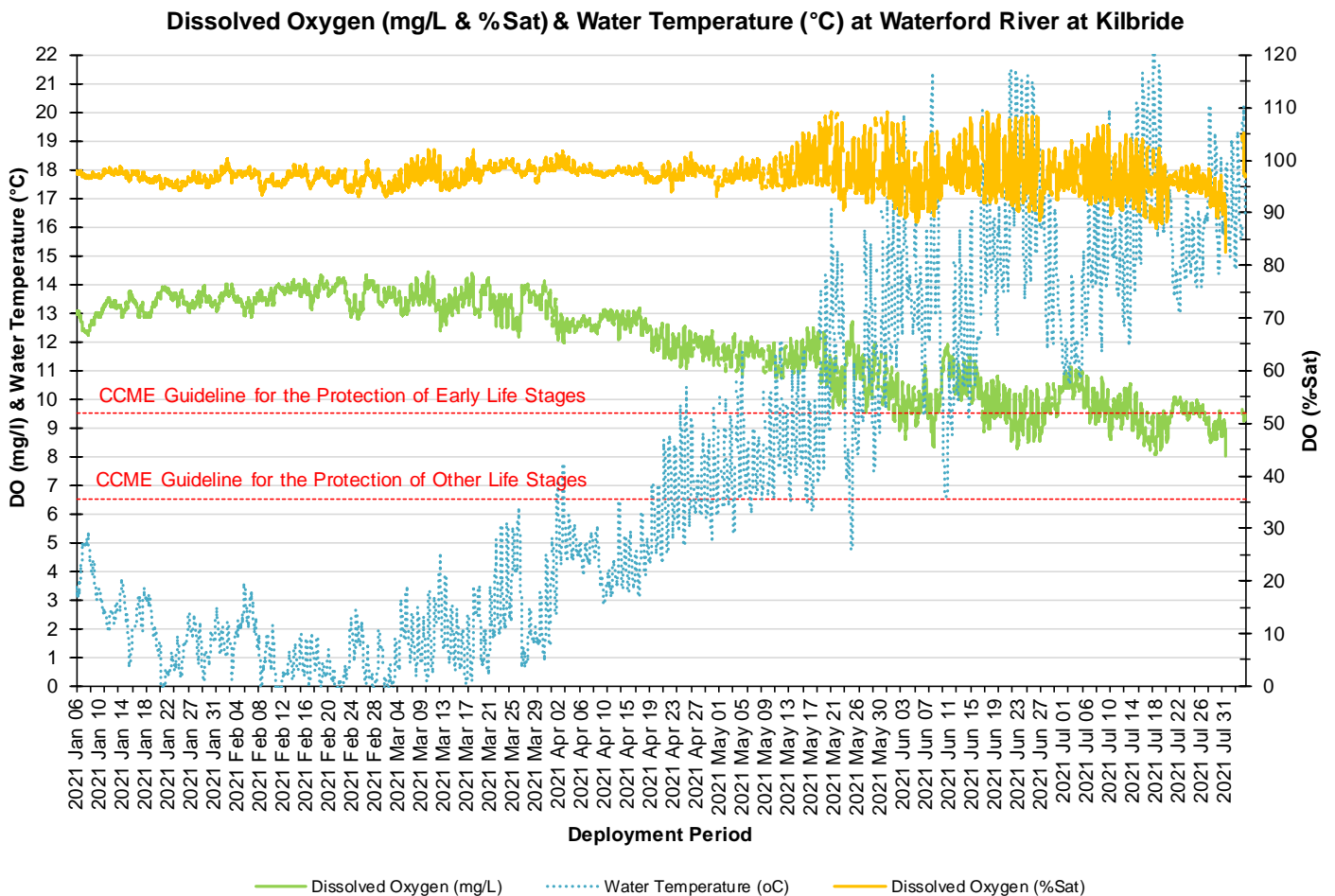


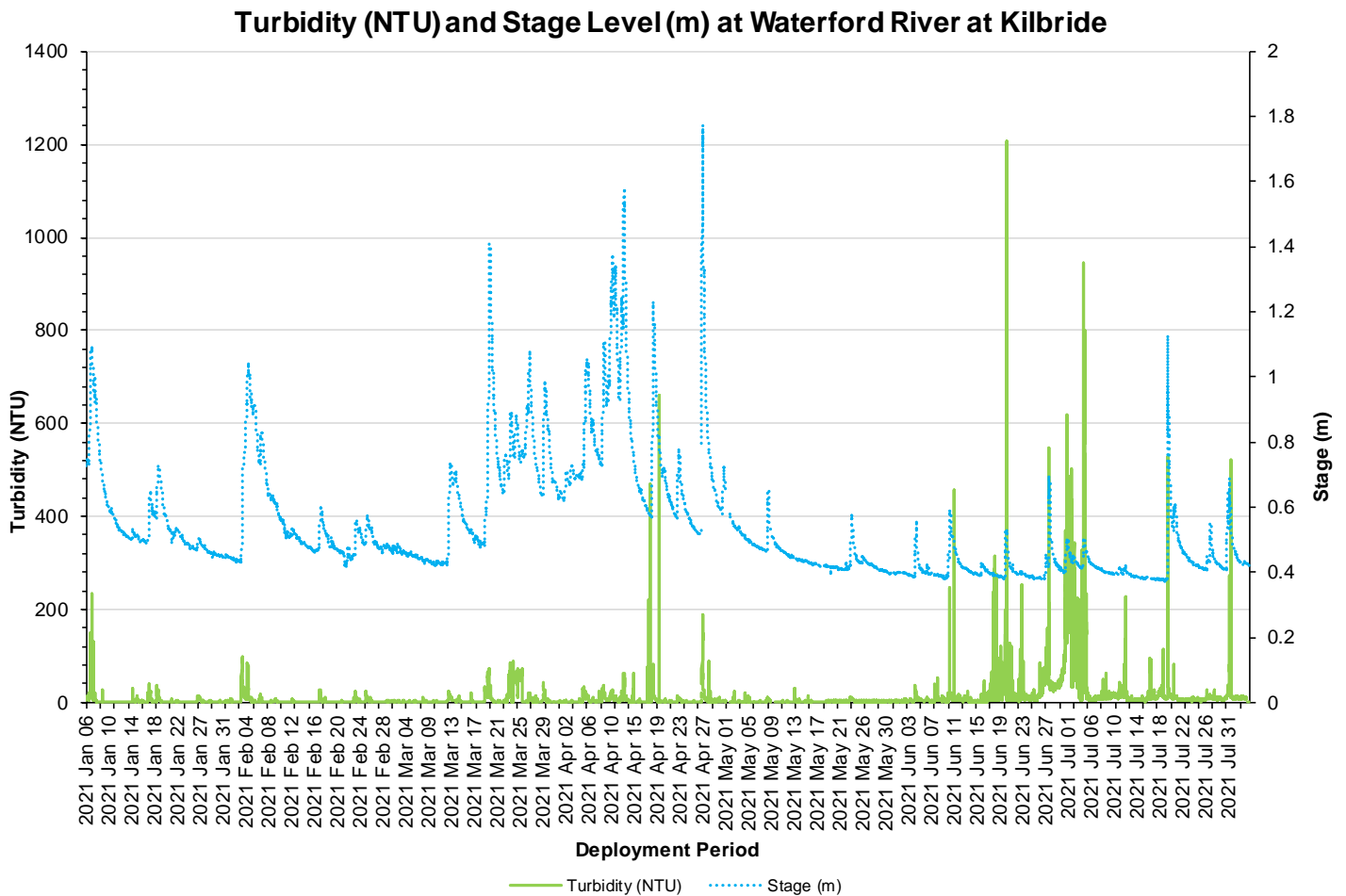
Figure 5: Dissolved Oxygen (mg/L & Percent Saturation) values at Waterford River at Kilbride.

### Turbidity

Turbidity levels during the deployment ranged within 0.0 NTU and 1207.7 NTU (Figure 6).

The higher turbidity events correlate with increases in stage. Rainfall was recorded during all of the high stage increases (see Figure 7). Precipitation can increase the presence of suspended material in water through the movement of soil and sediment from nearby urban areas.

Please note the stage data is raw. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.



**Figure 6: Turbidity (NTU) and stage level (m) values at Waterford River at Kilbride.**

### Stage and Precipitation

Please note the stage data graphed below is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data is available upon request to WSC.

Stage is an estimation of water level at the station and can explain some of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). Stage will increase during rainfall events (Figure 7) and during any surrounding snow or ice melt, as runoff will collect in the brooks. However, direct snowfall will not cause stage to rise significantly.

During the deployment period, the stage values ranged from 0.37m to 1.78m. The larger peaks in stage correspond with substantial rainfall events as noted on Figure 7. Precipitation data was collected by Environment Canada's St. John's International Airport weather station. Daily Total Precipitation ranges for the deployment period were a minimum of 0.0 mm and a maximum of 42.8 mm on April 10, 2021.

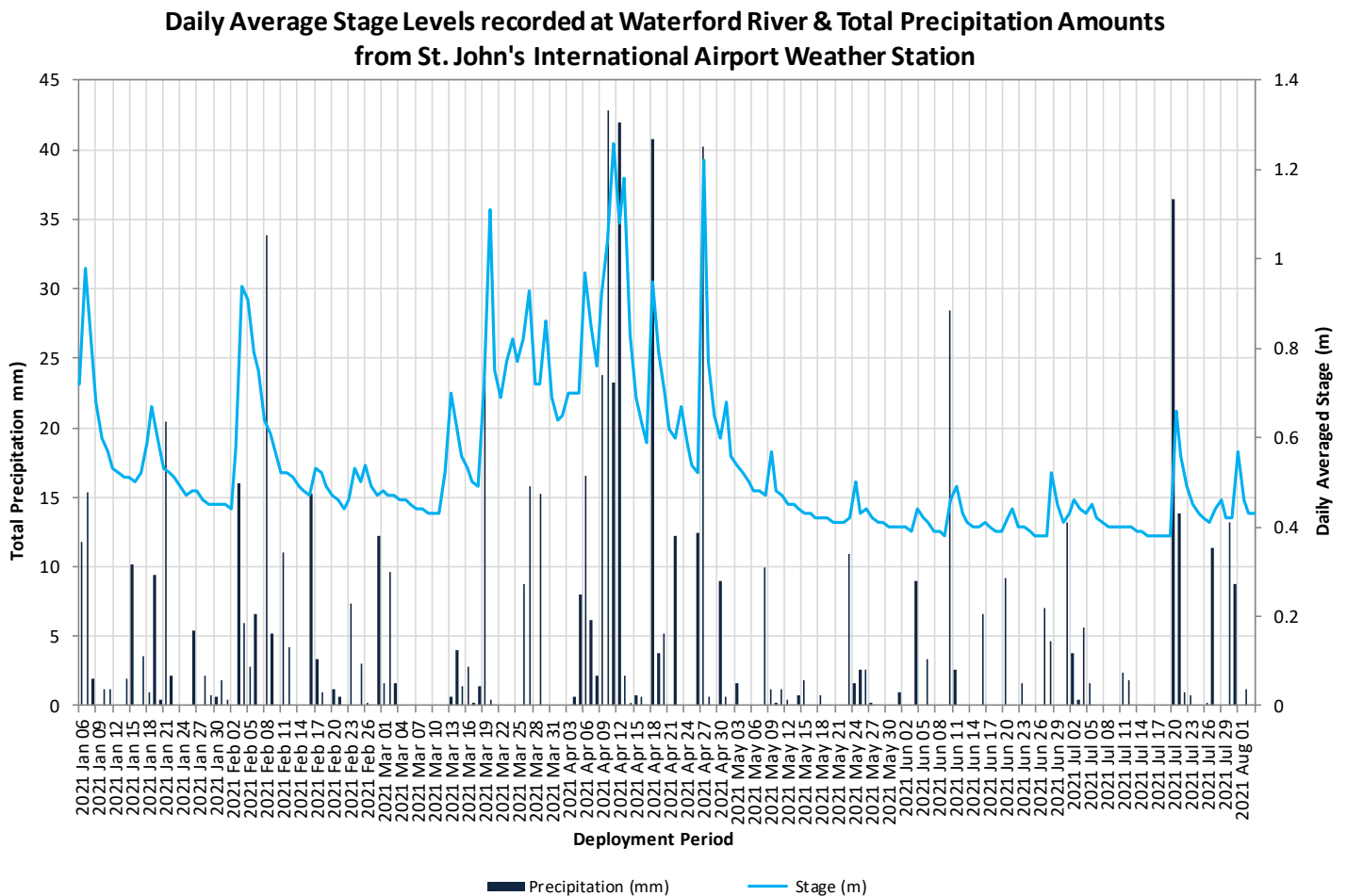


Figure 7: Stage values recorded at Waterford River at Kilbride and daily total precipitation from St. John's Airport Weather Station.

Appendix A

Daily Averaged Water Temperatures (oC) recorded at Waterford River and Mean Air Temperatures (oC) recorded at St. John's Airport Weather Station

