



Real-Time Water Quality Report

Waterford River at Kilbride

Deployment Period
October 26, 2020 to December 1, 2020



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 October 26, 2020 until removal on December 1, 2020.



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.

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 1).

WRMD staff at the Department of Environment & Climate Change (ECC) are responsible for 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 to 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	October 26	Deployment	Excellent	Good	Excellent	Fair	NA
	December 1	Removal	Good	Fair	Excellent	Good	NA

Due to abnormal turbidity values during deployment, turbidity has been removed from this deployment report. The sensor is not ranked as it was faulty during deployment.

Upon deployment and removal, all other water quality sensors ranked ‘Excellent’ to ‘Fair’.

Waterford River at Kilbride

Water Temperature

Water temperature ranged from 2.15 °C to 10.79 °C during this deployment period (Figure 2).

Water temperature decreases gradually over the deployment period as both air and water temperatures cool into the late Fall. Dips in water temperature during high stage events indicate fall weather events bringing colder temperatures and rain, further decreasing the river's temperature.

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.

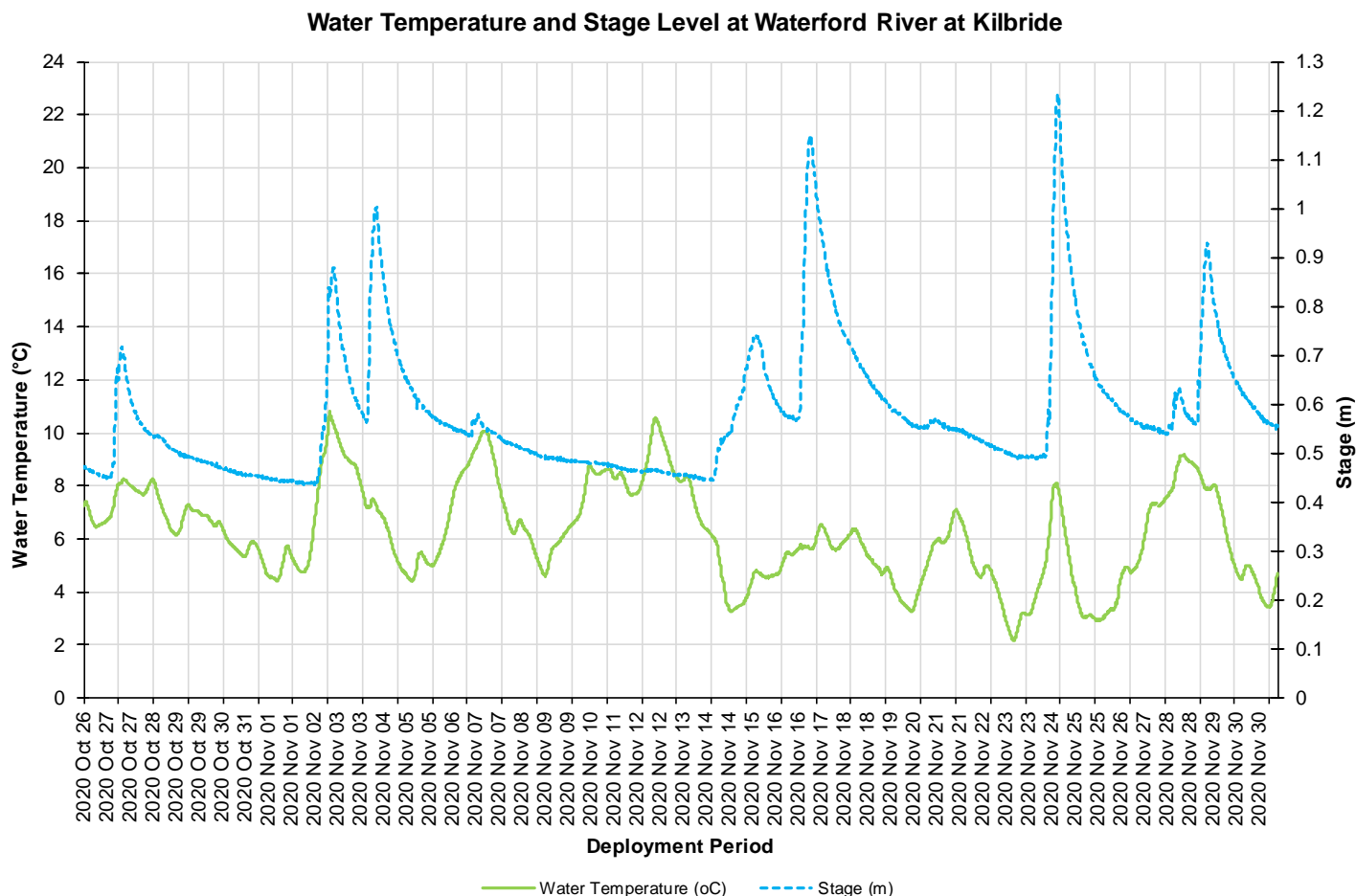


Figure 2: Water temperature (°C) and Stage (m) values at Waterford River at Kilbride

pH

Throughout the deployment period, pH values ranged between 6.14 pH units and 6.83 pH units (Figure 3).

The CCME guideline provides a basis by which to judge the overall health of the brook. Waterford River pH values were below the pH guideline for the majority of this deployment.

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. The median pH level for this deployment was 6.48 pH units, slightly lower than that of the past deployment pH median of 6.99 pH units. The numerous stage increases during this deployment constantly reduced the pH in the river, accounting for this lower median value (Figure 3) as the river's pH never had time to recover before another precipitation event arrived.

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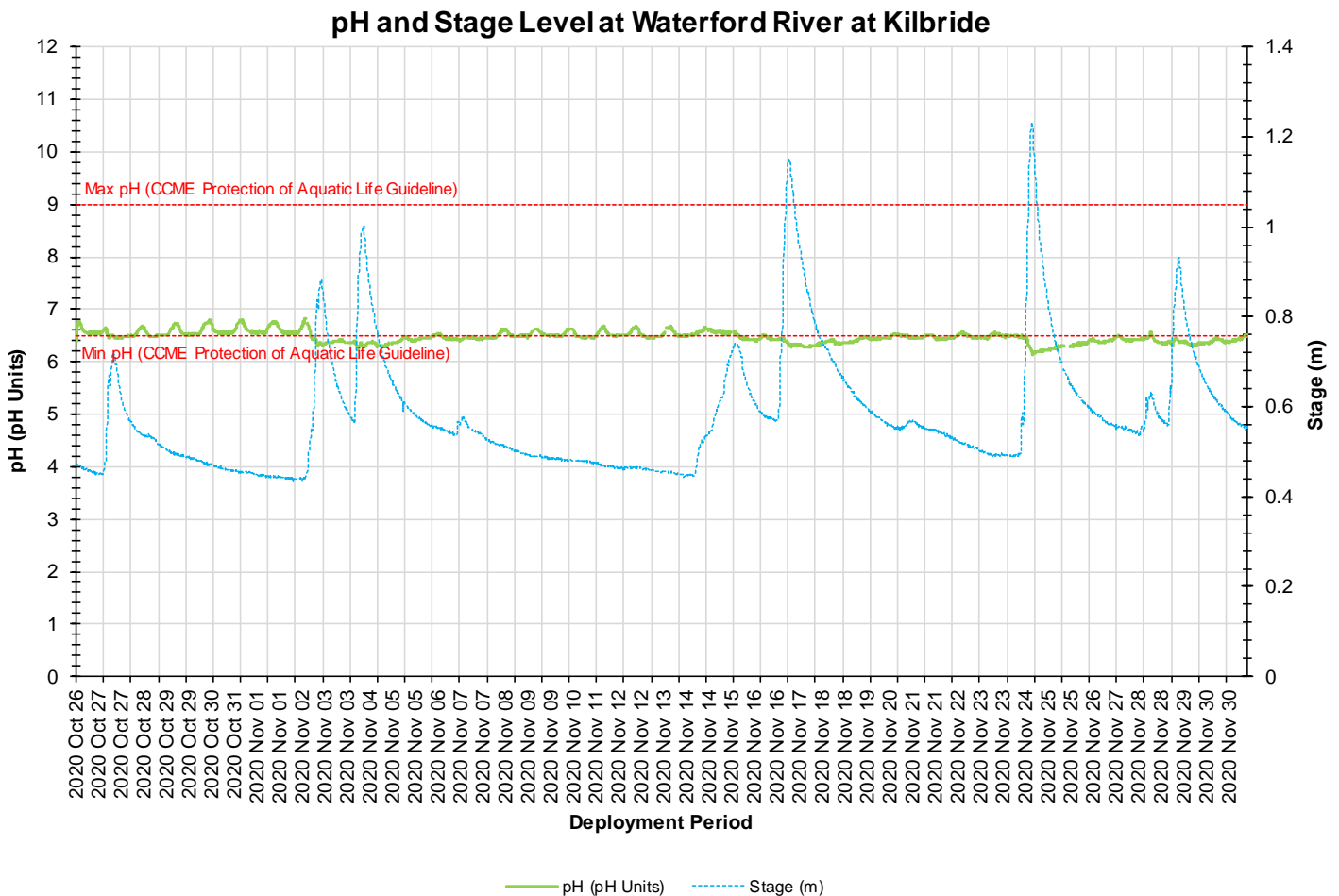


Figure 3: pH (pH units) and stage level (m) values at Waterford River at Kilbride

Specific Conductivity & Total Dissolved Solids

The conductivity levels were within 213 $\mu\text{S}/\text{cm}$ and 993 $\mu\text{S}/\text{cm}$ during this deployment period. TDS (a calculated value) ranged from 0.138 g/L to 0.6450 g/L (Figure 4).

The majority of conductivity data displays the expected trend of decreasing at the onset of high stage events before returning to background levels. On November 13th, 20th and 28th, conductivity responds differently by increasing at the onset of a rise in stage. This indicates that on these three occasions, something was entering the brook with a significantly higher conductance value. This site is on an urban brook with a lot of influence from surrounding urban roads and residential housing. Once the air temperatures dip close to 0.0°C, roads are salted to prevent freezing. It is possible that salt was flushed into nearby waterways influencing the conductivity. Runoff from construction activities upstream may also have been a factor.

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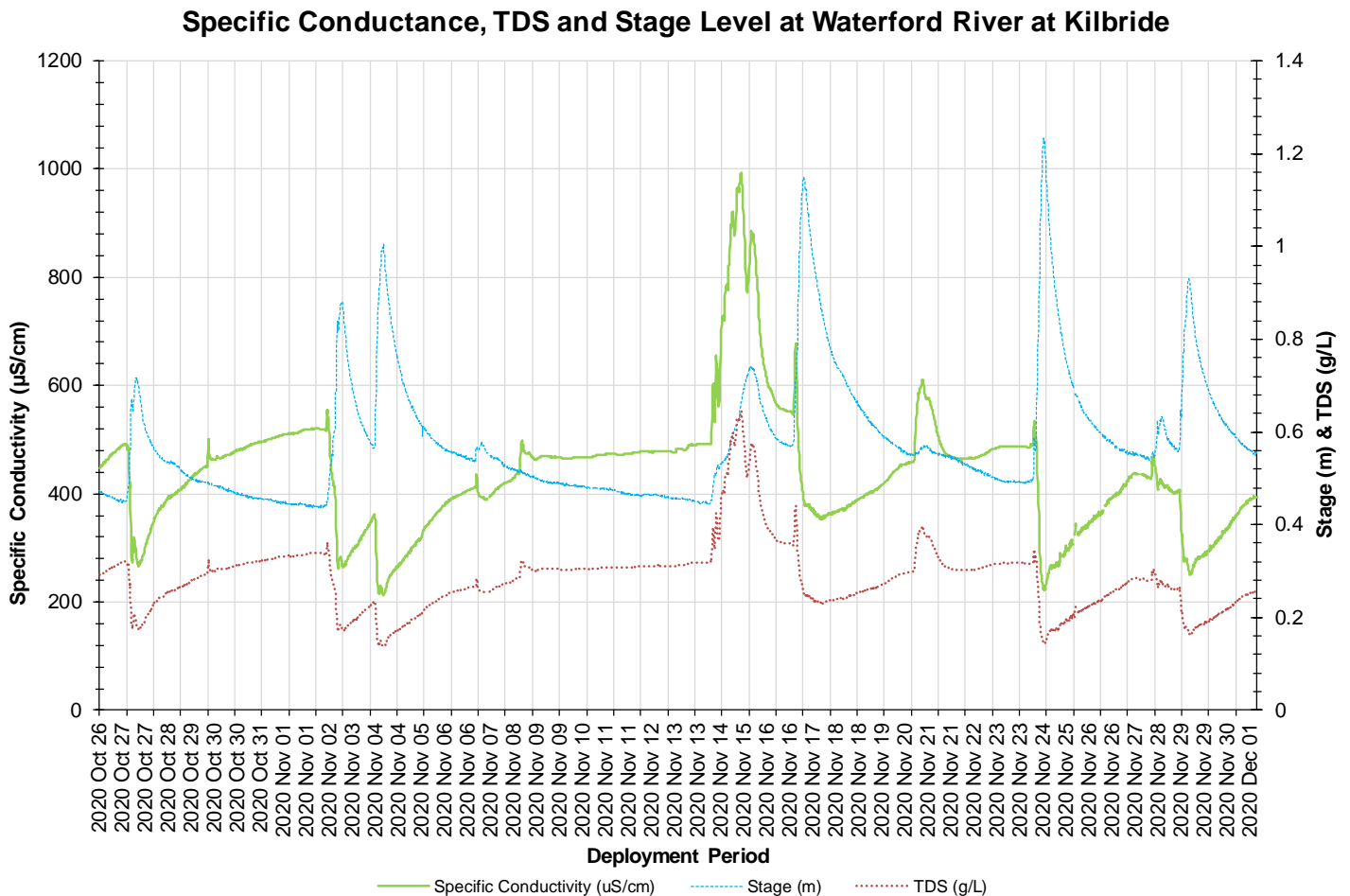


Figure 4: Specific conductivity ($\mu\text{S}/\text{cm}$), TDS (g/L) and stage (m) values at Waterford River at Kilbride.

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 10.69 mg/L to a maximum of 13.90 mg/L. The percent saturation levels for dissolved oxygen ranged within 95.1 % Saturation to 103.5 % Saturation (Figure 5).

As the water temperature gradually decreases into Fall, dissolved oxygen increases. Sharp increase in water temperature result in sharp decreases in dissolved oxygen. During this deployment, the dissolved oxygen levels remained above the CCME Guideline for the Protection of Early life (9.5mg/L) and other life stages (6.5 mg/L).

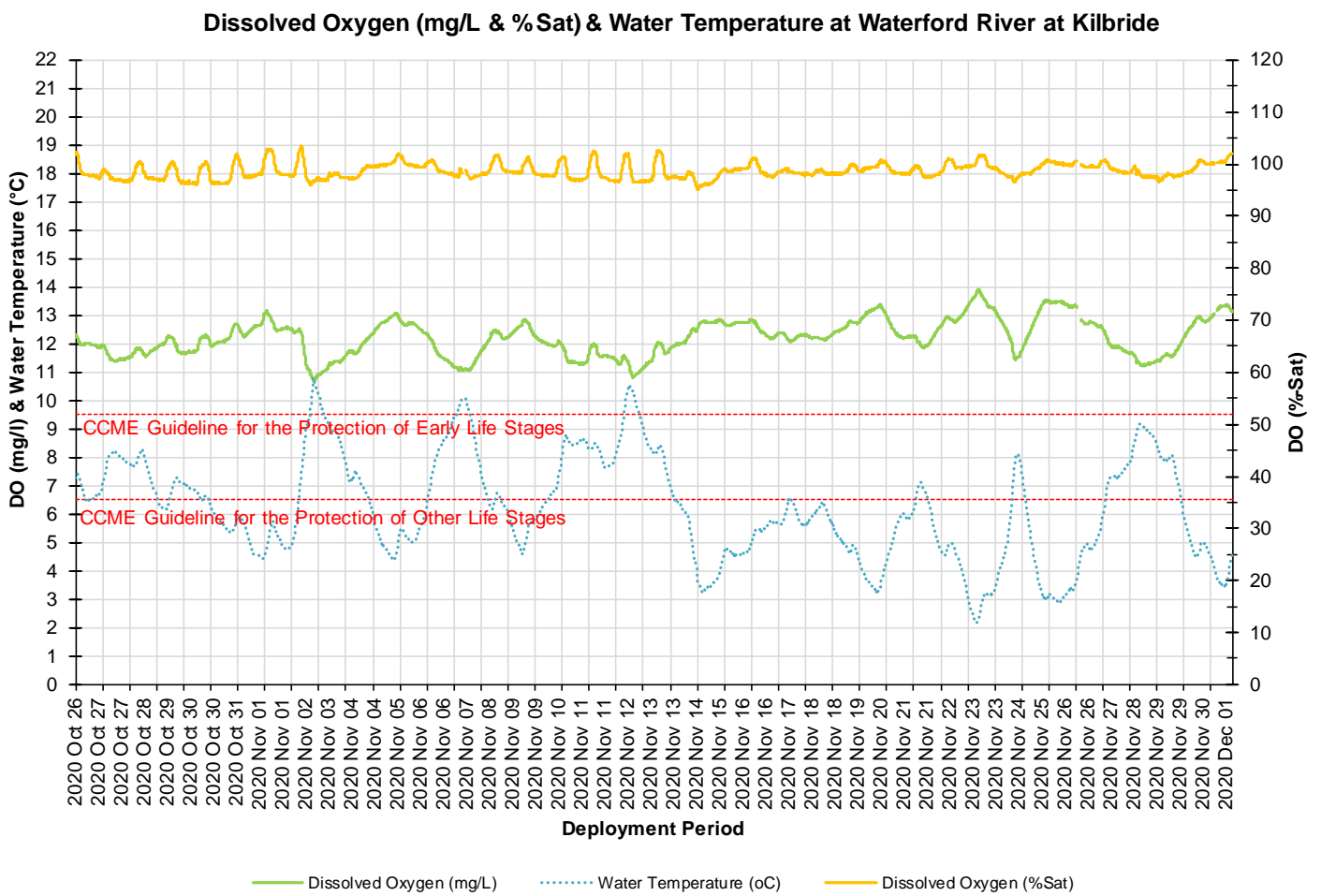


Figure 5: Dissolved Oxygen (mg/L & Percent Saturation) values at Waterford River at Kilbride.

Turbidity

After a data review it was determined that the turbidity data recorded during this deployment, was not representative of Waterford River at Kilbride station and the data was removed and will not be reported on during this monthly review.

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 provides 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 6) 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 0.44m to 1.23m. The larger peaks in stage correspond with substantial rainfall events as noted on Figure 6. 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 29.5 mm on November 24, 2020.

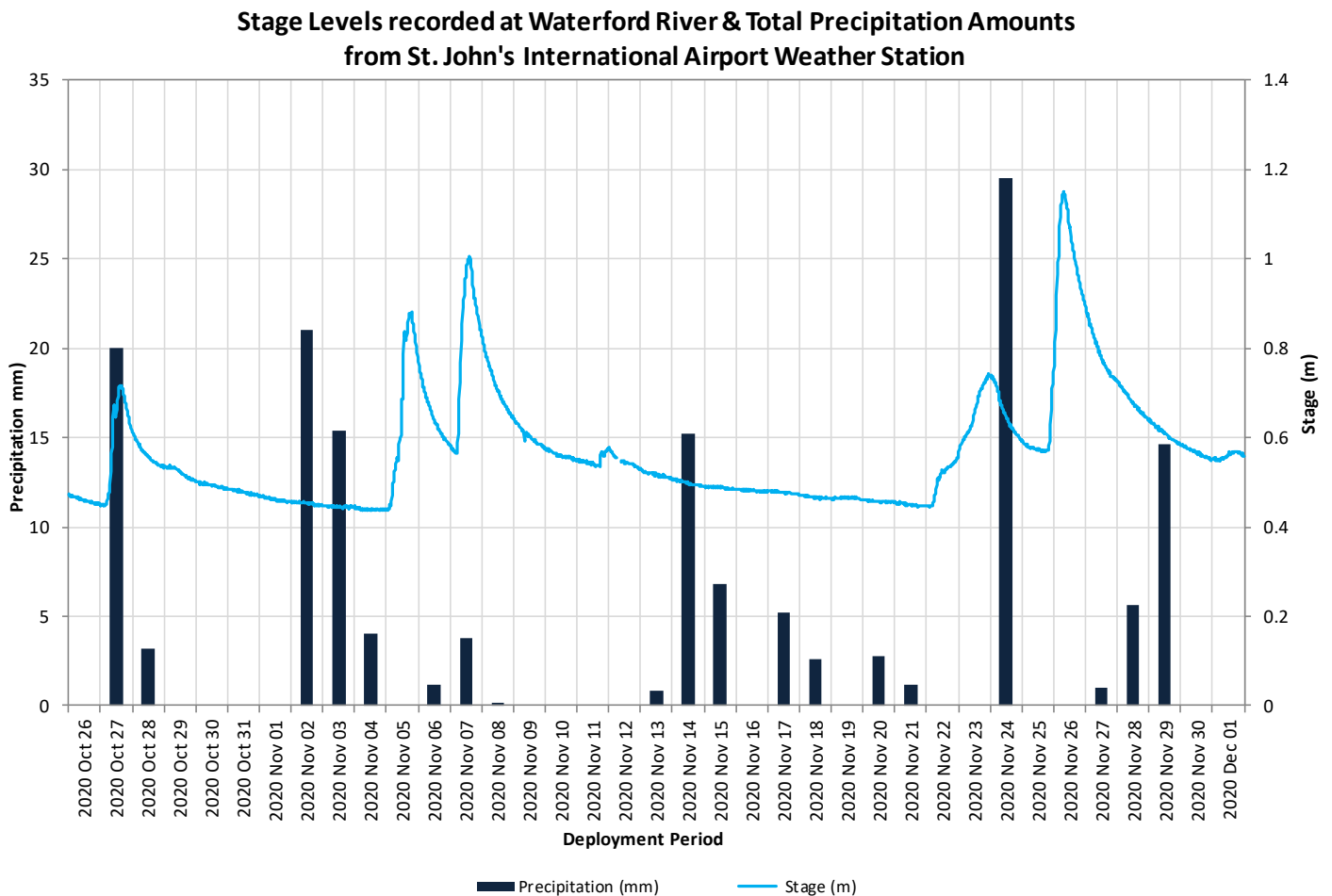


Figure 6: Stage values recorded at Waterford River at Kilbride and daily total precipitation from St. John’s Airport Weather Station.

Appendix A

