Real-Time Water Quality Report

Waterford River at Kilbride

Deployment Period
September 25, 2020 to October 26, 2020

Newfoundland Labrador

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

Waterford River at Kilbride, Newfoundland and Labrador

Water Resources Management Division
Department of Environment & Climate Change
4th Floor, Confederation Building, West Block

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 September 25, 2020 until removal on October 26, 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

	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 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	**Sept 25**	**Deployment**	Excellent	Good	Good	Excellent	Excellent
	October 26	**Removal**	Excellent	Good	Excellent	Excellent	Excellent

At deployment and removal, all parameters ranked either 'Excellent' or 'Good'.

Waterford River at Kilbride

Water Temperature

Water temperature ranged from 6.68°C to 18.85°C during this deployment period (Figure 2).

Over the duration of the deployment period, the water temperature gradually decreases into the fall, mirroring air temperatures as Fall progresses. Rises in water temperature during high stage events indicate the addition of warmer water from precipitation, likely from seasonal tropical storms.

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.

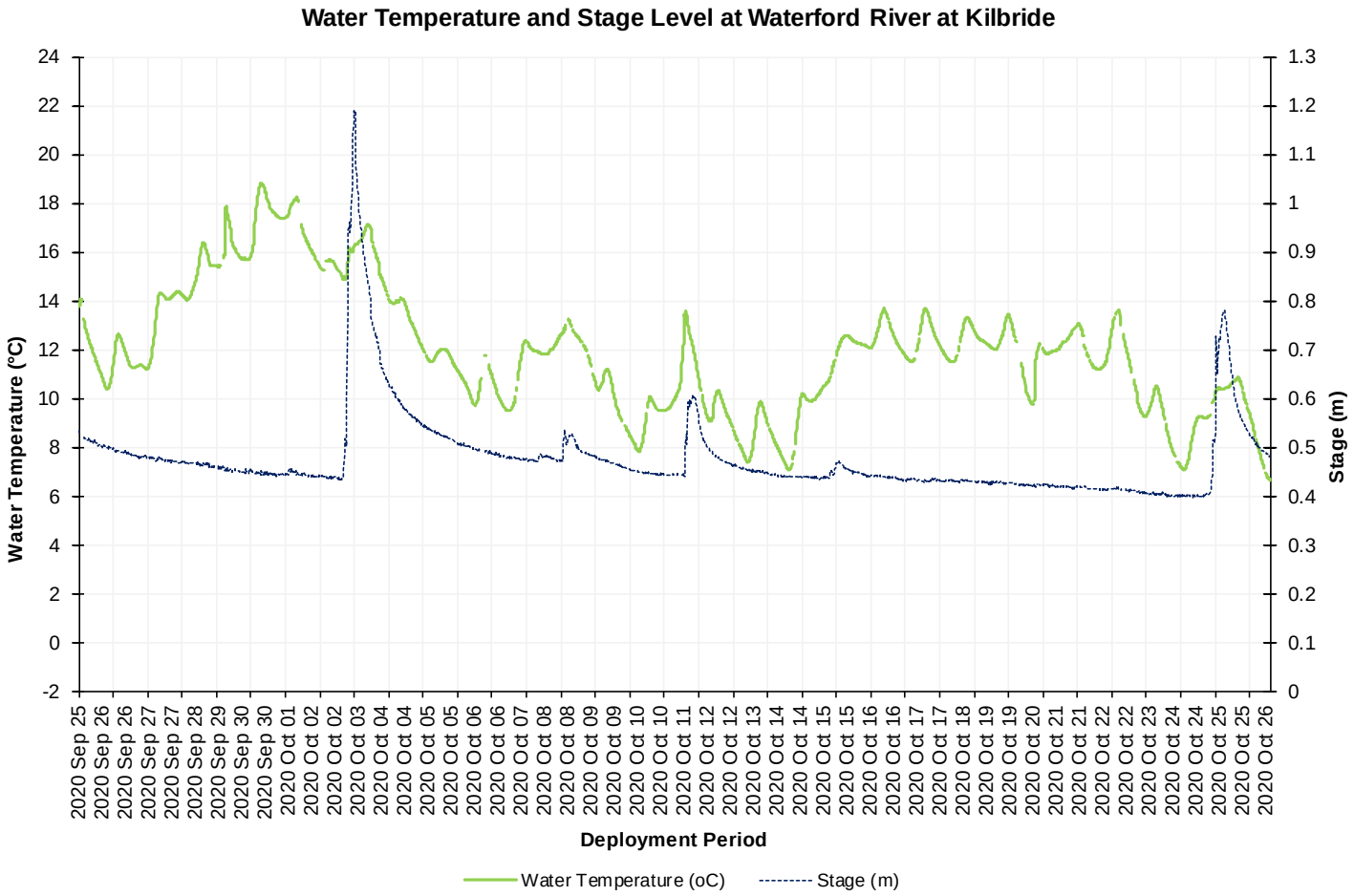

Figure 2: Water temperature (°C) and Stage (m) values at Waterford River at Kilbride

pH

Throughout the deployment period, pH values ranged between 6.69 pH units and 7.55 pH units (Figure 3).

The CCME guideline provides a basis by which to judge the overall health of the brook. Waterford River pH values remained within the guidelines throughout the deployment. The median pH level was 6.99 pH units, slightly lower than that of the past deployment pH median of 7.28 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. The addition of slightly acidic precipitation reduces pH for a short period of time.

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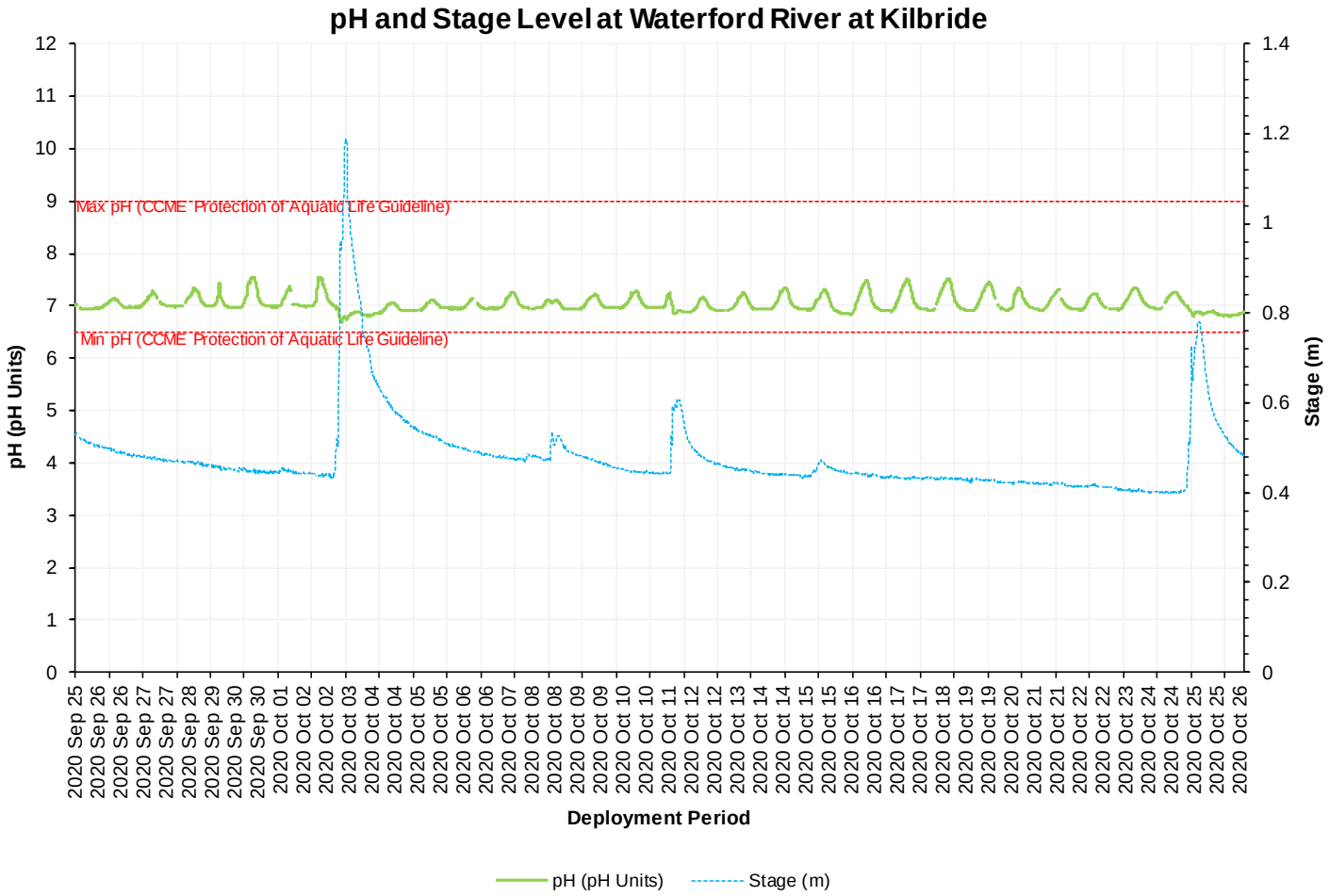

Figure 3: pH (pH units) and stage level (m) values at Waterford River at Kilbride

Specific Conductivity & Total Dissolved Solids

The conductivity levels were within 203 µS/cm and 573 µS/cm during this deployment period. TDS (a calculated value) ranged from 0.132 g/L to 0.372 g/L (Figure 4).

The conductivity levels react to the high stage events by decreasing for a period as the system is diluted before returning to background levels. This site is on an urban brook with a lot of influence from surrounding urban roads and residential housing.

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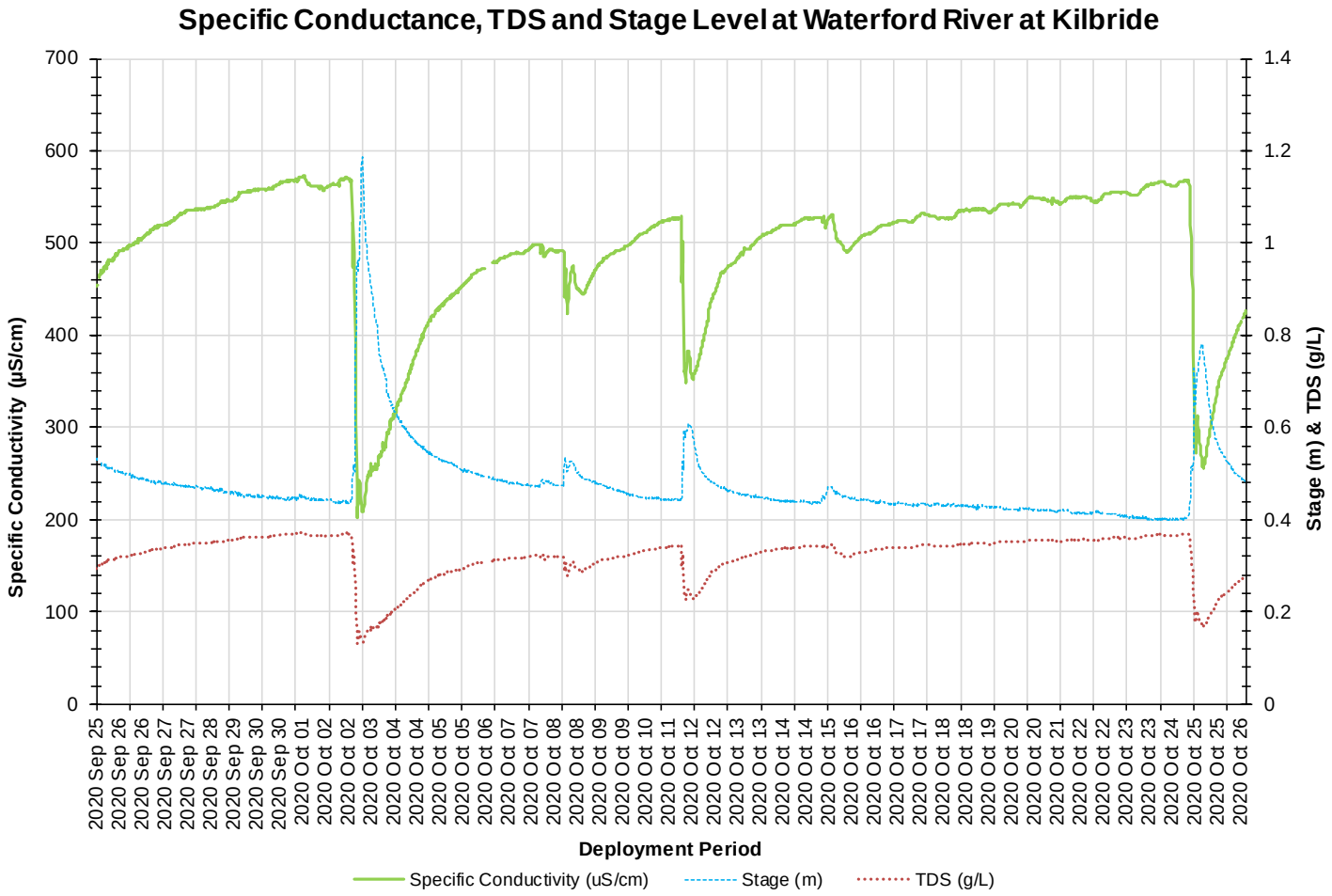

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Waterford River at Kilbride.

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 9.29 mg/L to a maximum of 12.79 mg/L. The percent saturation levels for dissolved oxygen ranged within 93.1 % Saturation to 113.1 % Saturation (Figure 5).

As the water temperature cools, it allows for an increase in dissolved oxygen present in the brook. For the majority of this deployment, the dissolved oxygen levels remained above the CCME Guideline for the Protection of Early life stages (9.5 mg/L) and other life stages (6.5 mg/L).

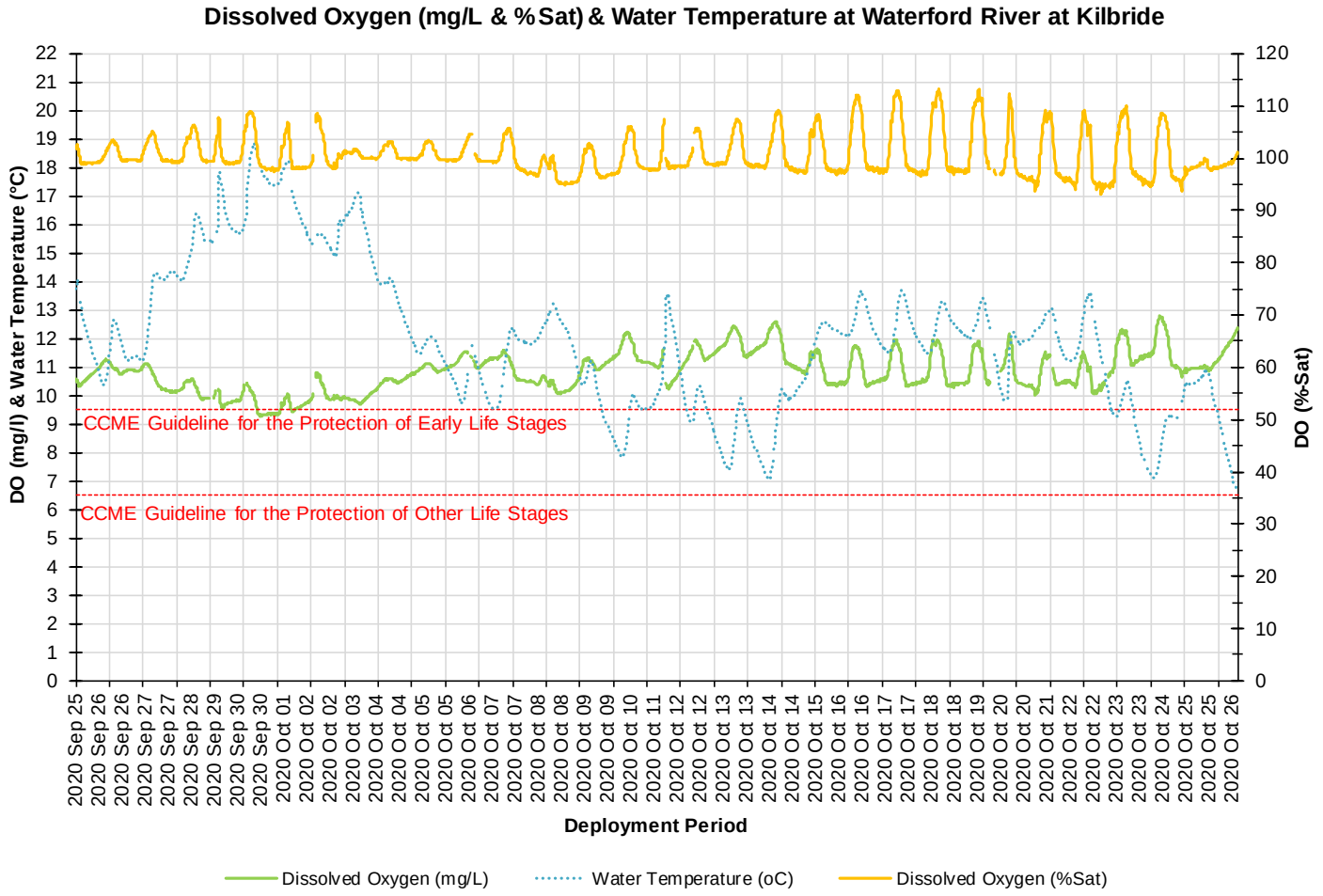

Figure 5: Dissolved Oxygen (mg/L & Percent Saturation) values at Waterford River at Kilbride.

Turbidity

Turbidity levels during the deployment ranged within 0.3 NTU and 900.4 NTU (Figure 6).

The higher turbidity events correlate with increases in stage. There was recorded rainfall during all of the high stage increases (Figure 6). Precipitation can increase the presence of suspended material in water through the movement of soil and sediment from nearby urban areas as well as resuspension of these materials in the water column.

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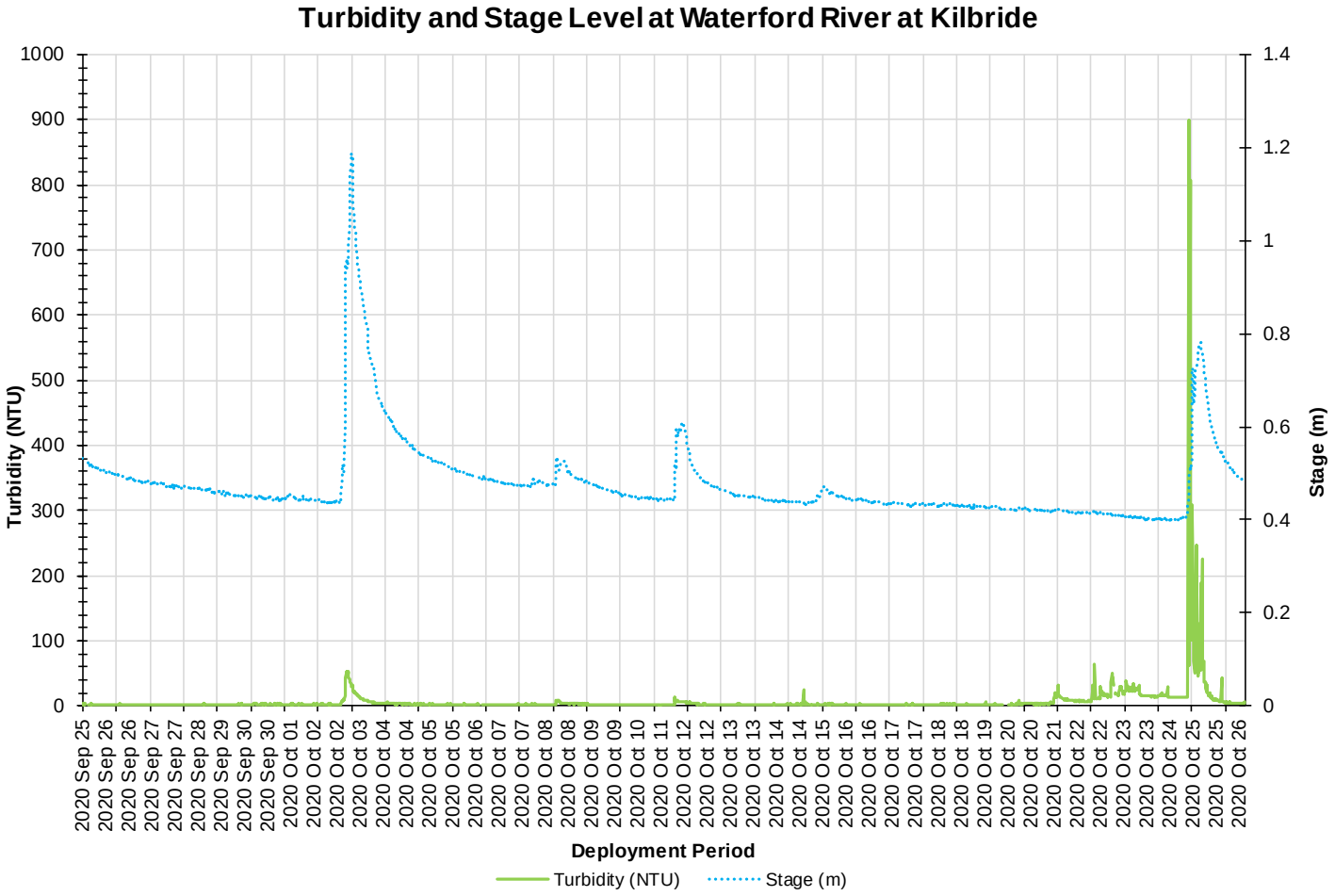


Figure 6: Turbidity (NTU) and stage level (m) values at Waterford River at Kilbride.

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 important to display as it 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 shortly after rainfall events (Figure 7) and after 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 0.398m to 1.188m. The larger peaks in stage correspond with substantial rainfall events as noted on Figure 7. Precipitation data was collected at 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 42.6 mm on October 2, 2020.

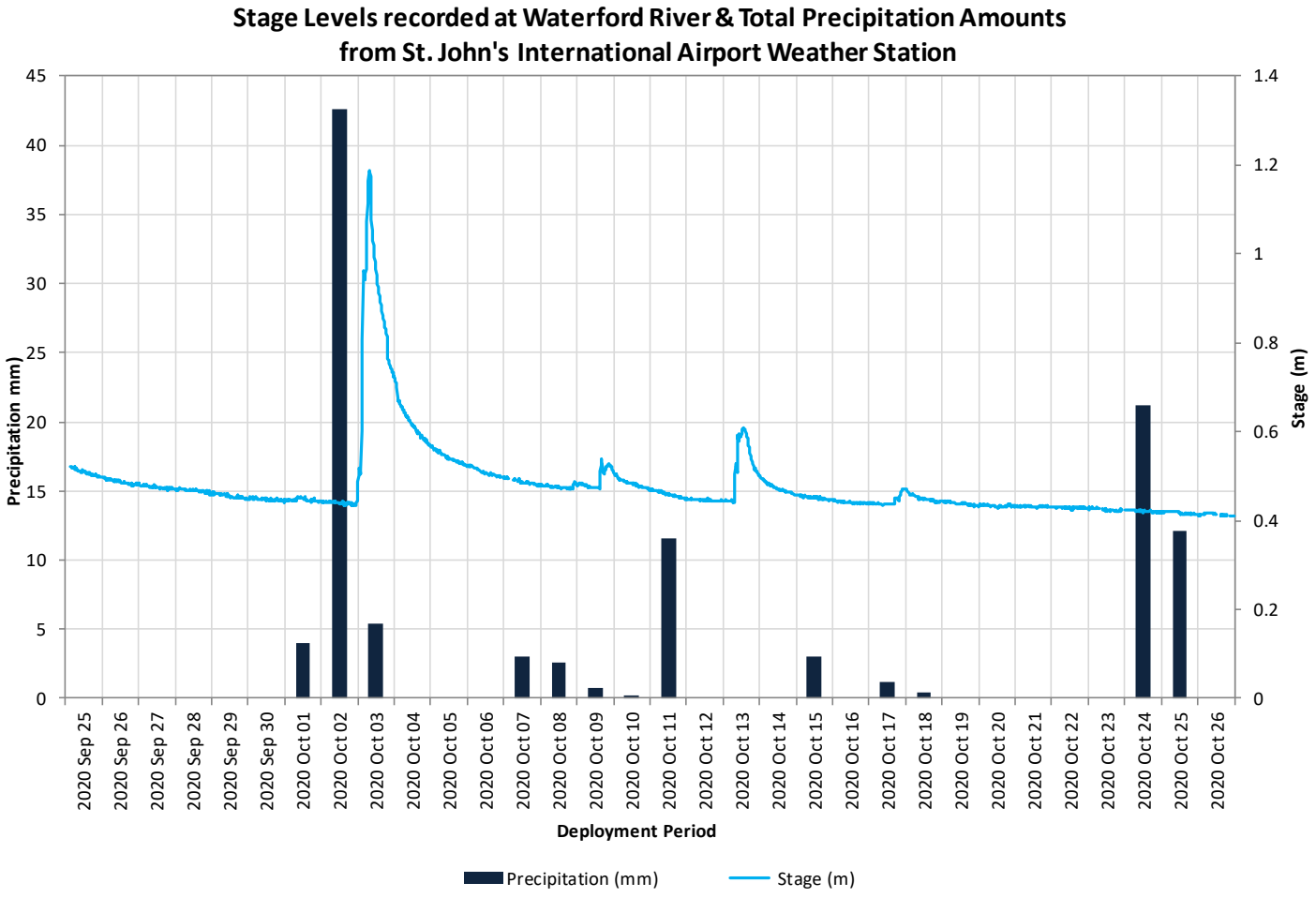
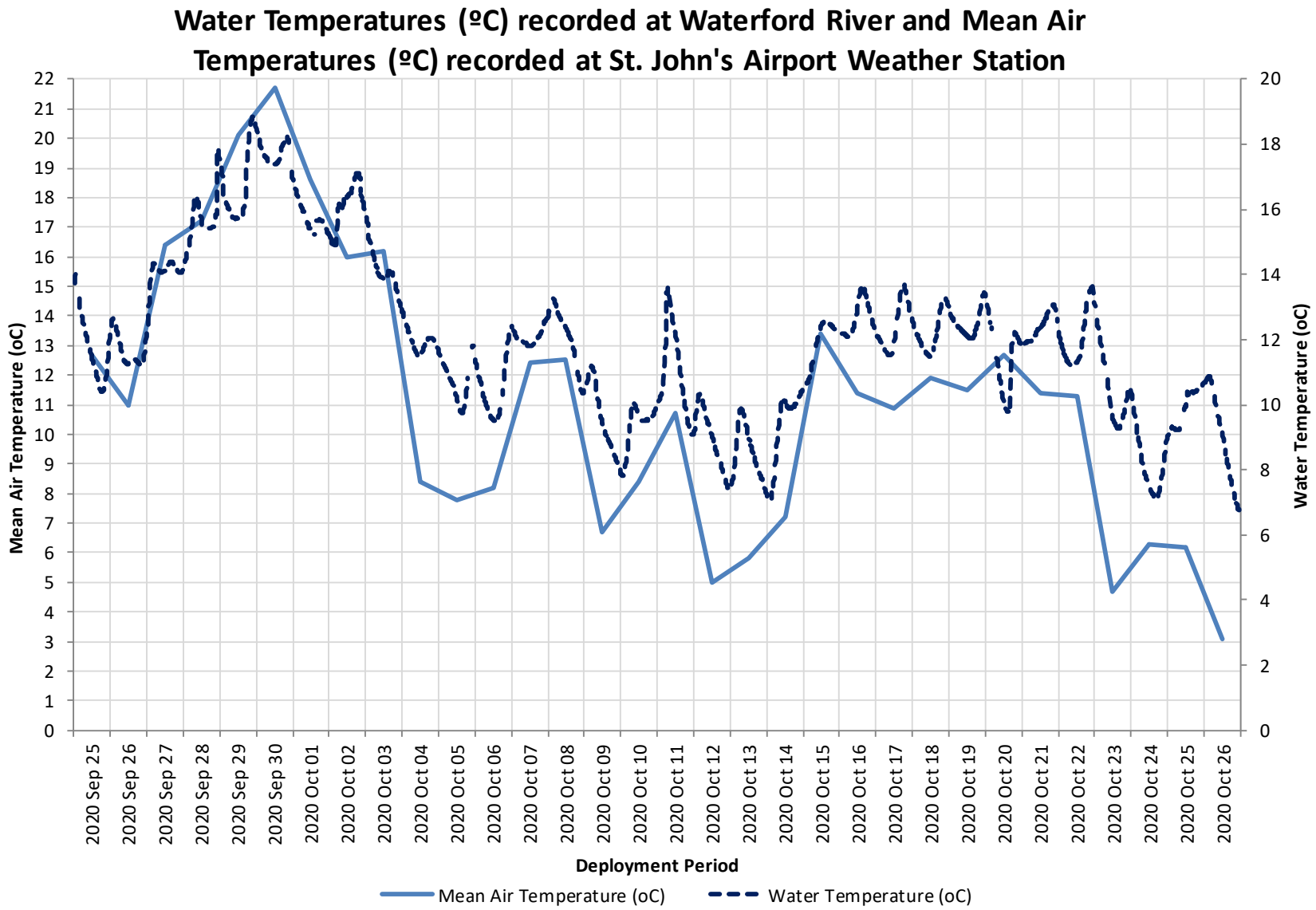


Figure 7: Stage values recorded at Waterford River at Kilbride and daily total precipitation from St. John's Airport Weather Station.

APPENDIX I


Water Temperatures (ºC) recorded at Waterford River and Mean Air Temperatures (ºC) recorded at St. John's Airport Weather Station
Mean Air Temperature (oC)
Water Temperature (oC)
Deployment Period
2020 Sep 25
2020 Sep 26
2020 Sep 27
2020 Sep 28
2020 Sep 29
2020 Sep 30
2020 Oct 01
2020 Oct 02
2020 Oct 03
2020 Oct 04
2020 Oct 05
2020 Oct 06
2020 Oct 07
2020 Oct 08
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2020 Oct 21
2020 Oct 22
2020 Oct 23
2020 Oct 24
2020 Oct 25
2020 Oct 26
Mean Air Temperature (oC)
Water Temperature (oC)