

# Real-Time Water Quality Report

## Waterford River at Kilbride

Deployment Period  
April 13, 2018 to May 8, 2018



Government of Newfoundland & Labrador  
Department of Municipal Affairs & Environment  
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 April 13, 2018 until removal on May 8, 2018.



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 alongside 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 Municipal Affairs and Environment (MAE) 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 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	April 13	Deployment	Excellent	Good	Good	Excellent	Excellent
	May 8	Removal	Excellent	Excellent	Poor	Poor	Good

On deployment the ranking of the field data against the QAQC data was: water temperature, pH, specific conductivity, dissolved oxygen and turbidity data ranked as 'Excellent' and 'Good'. Parameters were acceptable for the initial deployment of the field instrument.

At removal of the instrument, water temperature, pH, and turbidity ranked as 'Excellent' and 'Good', while the specific conductivity and dissolved oxygen data ranked as 'Poor'. During this deployment there was evidence that someone or something had disturbed the instrument and removed it from the water. This would affect the specific conductivity values and the dissolved oxygen values.

#### **Concerns or Issues during the Deployment Period**

Toward the end of deployment there was evidence that someone or something had disturbed the instrument and had either removed it from the water or tampered with the instrument in some way. Specific conductivity values dropped to 0  $\mu\text{S}/\text{cm}$  and dissolved oxygen displayed erratic readings. Due to these variances the data was not representative of the brook and was removed from the graphs for specific conductivity and dissolved oxygen.

## Waterford River at Kilbride

### Water Temperature

Water temperature ranged from 0.39°C to 14.87°C during this deployment period (Figure 2).

Over the duration of the deployment period the water temperature is generally consistent, as the weather warms into Spring the water temperatures will start to increase. Several decreases and increases in water temperature correspond with the changes in the stage levels. During high stage events water temperature decreases for a short period of time before returning to the diurnal pattern.

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.

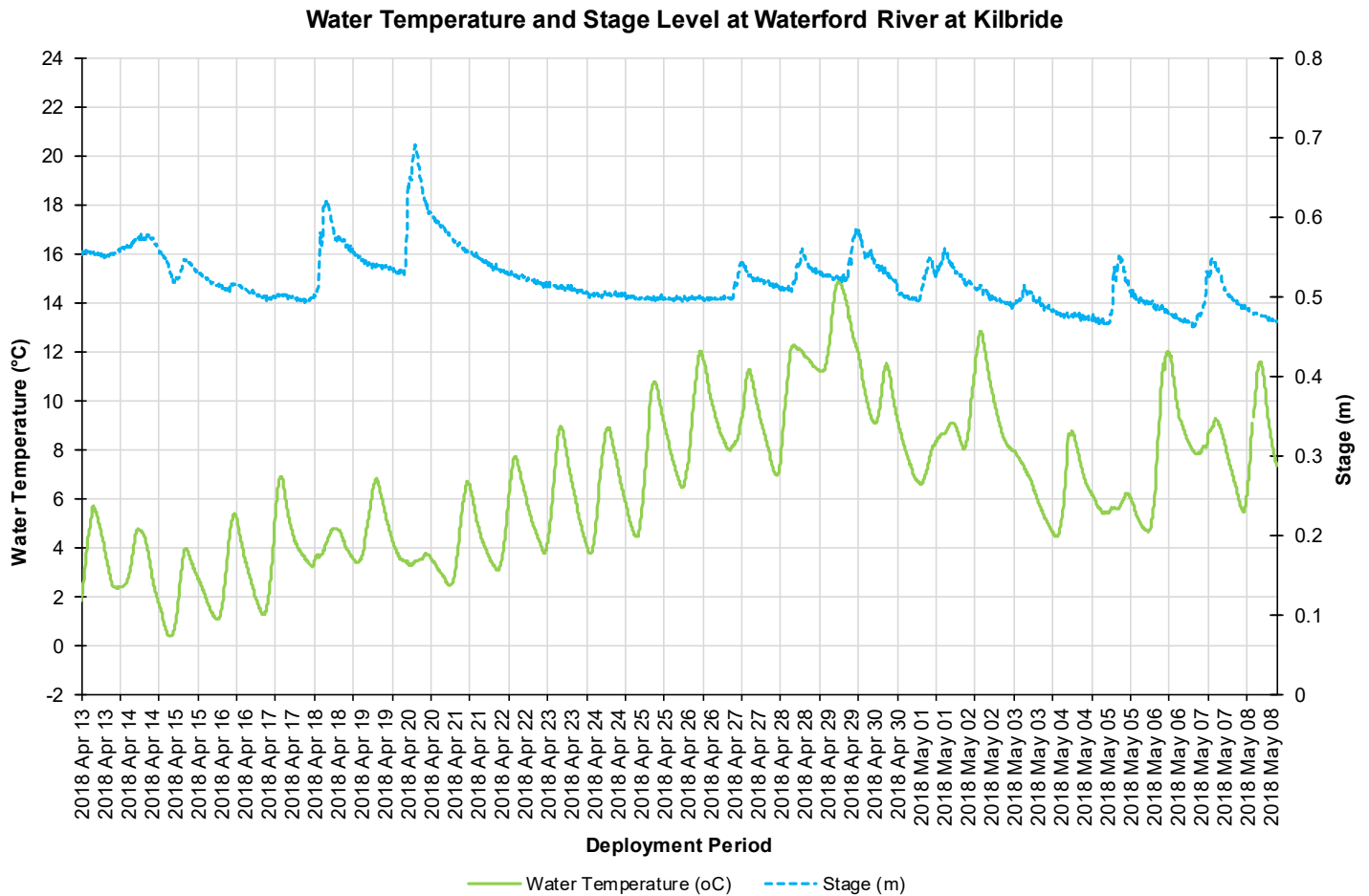


Figure 2: Water temperature (°C) and Stage (m) values at Waterford River at Kilbride

## pH

Throughout the deployment period, pH values ranged between 6.68 pH units and 7.38 pH units (Figure 3).

In this graph the CCME guideline provides a basis by which to judge the overall health of the brook. During this deployment the pH levels did not indicate that there were any immediate issues with water quality in Waterford River as values remained between the minimum and maximum guidelines. The median pH level was 6.94 pH units, lower than that of the past deployment pH median of 7.46 pH units.

Please note the stage data is raw data that is published on the ECCC web page. 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.

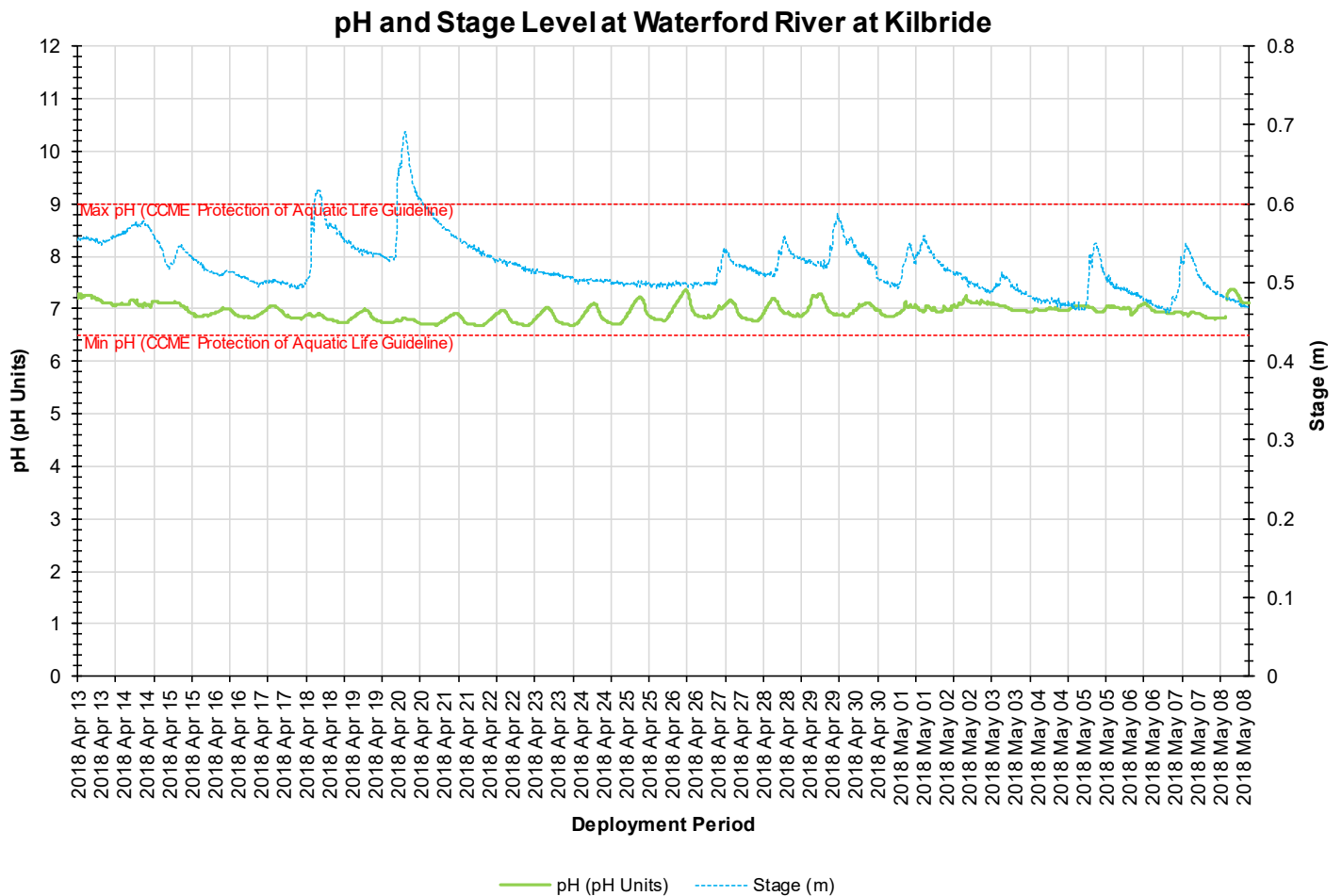


Figure 3: pH (pH units) and stage level (m) values at Waterford River at Kilbride

### Specific Conductivity & Total Dissolved Solids

The conductivity levels were within 635.0  $\mu\text{S}/\text{cm}$  and 1815.0  $\mu\text{S}/\text{cm}$  during this deployment period. TDS (a calculated value) ranged from 0.4130 g/L to 1.1800 g/L (Figure 4).

At the beginning of the deployment period, when the stage levels increase due to precipitation the specific conductance levels increase. This is a result of the increased amount of water in the river and the particle matter in the brook increasing with the spring runoff during this time of year.

Specific Conductivity data was removed from May 1<sup>st</sup> 2018 onwards, due to irregularities in the data that did not represent the brook. There was evidence to suggest that the instrument was tampered with as it was not sitting correctly in the protective cage.

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

### Specific Conductance, TDS and Stage Level at Waterford River at Kilbride

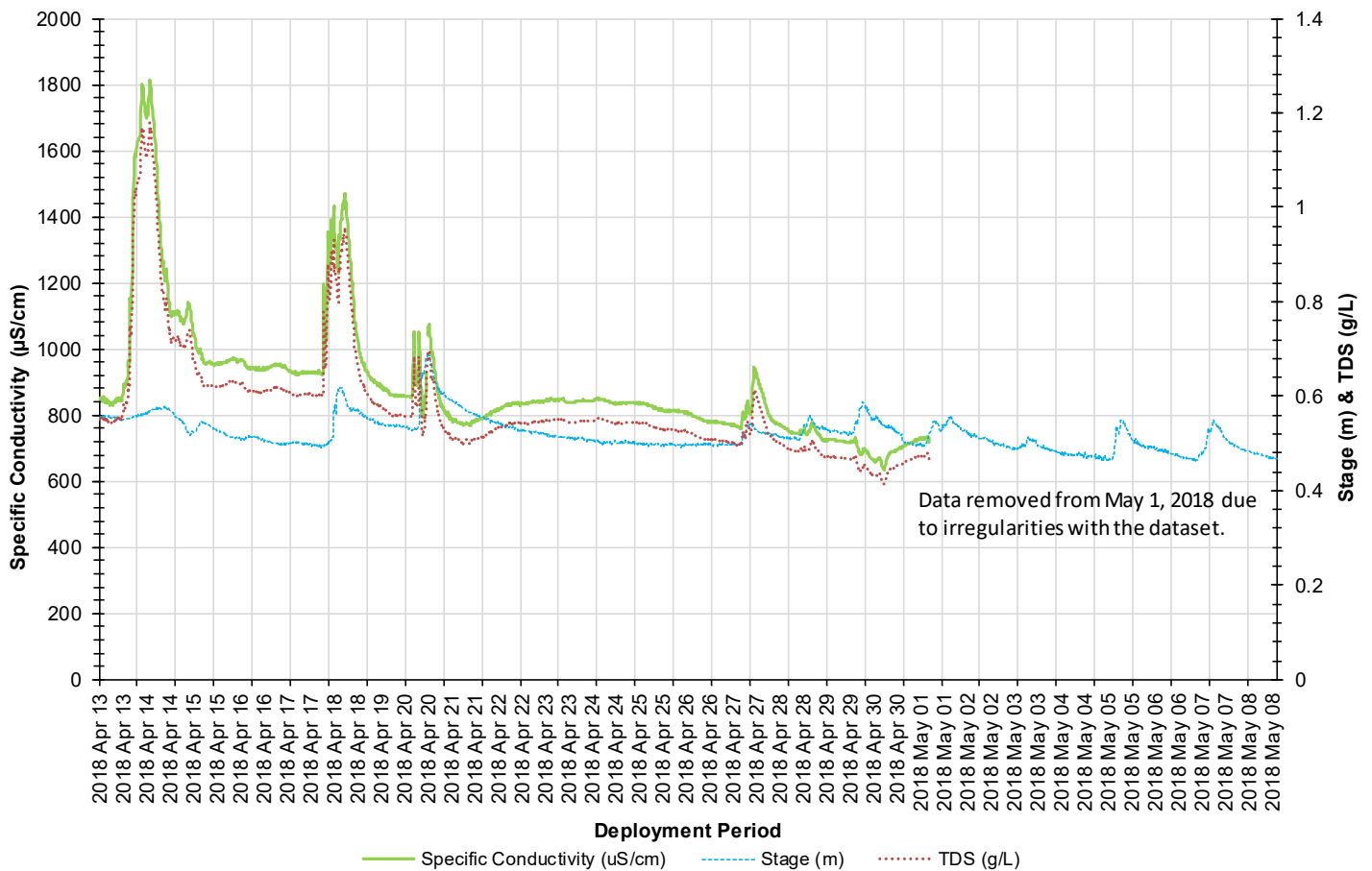


Figure 4: Specific conductivity ( $\mu\text{S}/\text{cm}$ ), TDS (g/L) and stage (m) values at Waterford River at Kilbride.



### 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 10.00 mg/L to a maximum of 14.21 mg/L. The percent saturation levels for dissolved oxygen ranged within 95.7 % Saturation to 108.1 % Saturation (Figure 5).

Water temperature is graphed with dissolved oxygen as it directly influences the concentration of dissolved oxygen in the water column. Higher water temperatures decrease the concentration level of dissolved oxygen present in the brook. During this deployment, the dissolved oxygen levels remained above the CCME Guideline for the Protection of Early life stages (9.5mg/L) and other life stages. This is a normal occurrence for this time of year as water temperatures are cold.

Dissolved oxygen data was removed from May 1<sup>st</sup>, 2018 onwards, due to irregularities in the data that did not represent the brook. There was evidence to suggest that the instrument was tampered with as it was not sitting correctly in the protective cage.

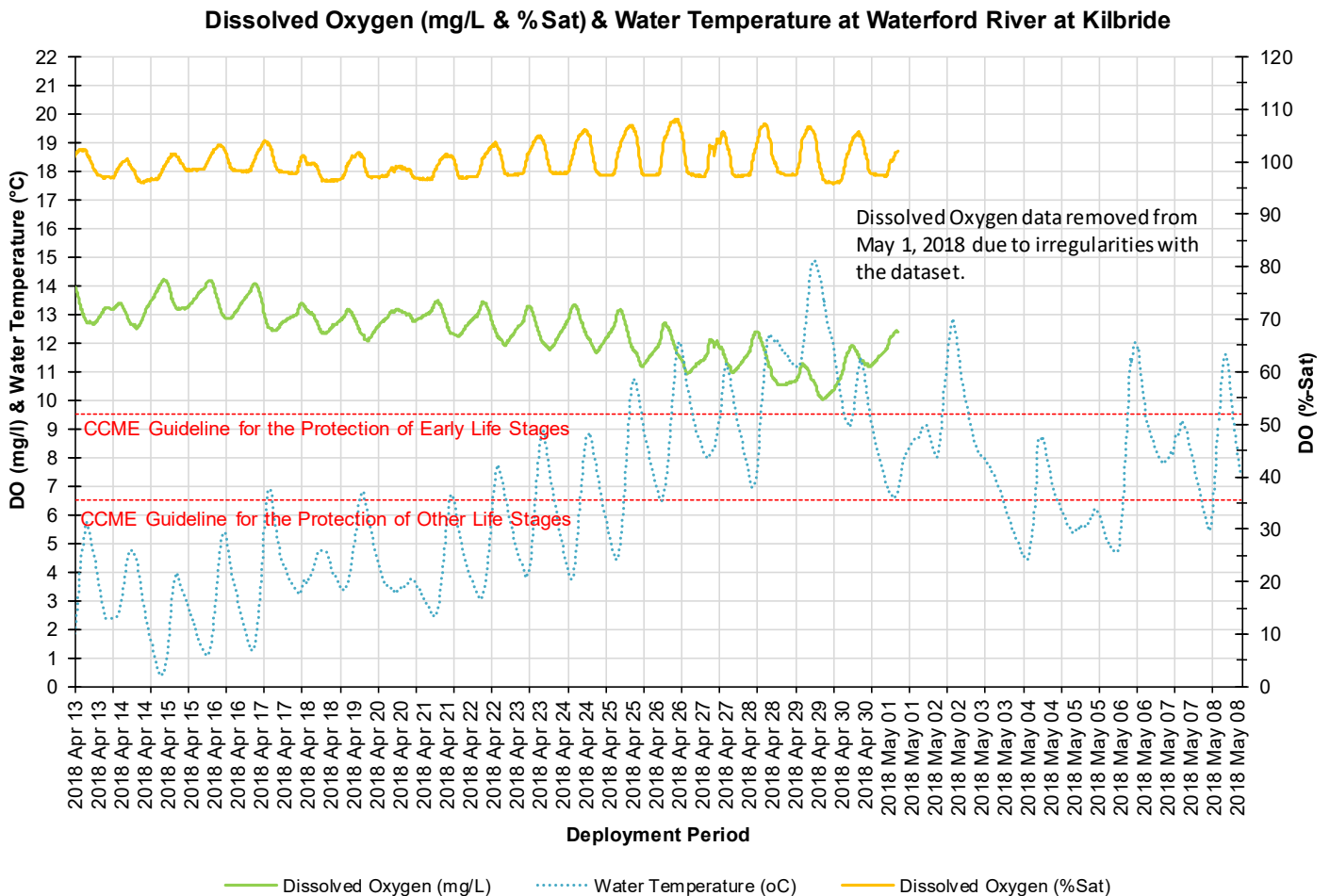


Figure 5: Dissolved Oxygen (mg/L & Percent Saturation) values at Waterford River at Kilbride.

### Turbidity

Turbidity levels during the deployment ranged within 0.5 NTU and 77.9 NTU (Figure 6). The deployment data had a median of 2.0 NTU which was close to the median of the previous deployment, 2.8 NTU.

Turbidity levels can change quickly at Waterford River. This site has a significant streamflow rate which can flush turbid water or sediments quickly through the brook. As this brook is in the heart of the City of St. John's the turbidity values can be heavily influenced by its surroundings.

The higher turbidity events throughout the deployment period correlate with increases in stage. There was recorded rainfall during all of the high stage increases ( Figure 7). Precipitation can increase the presence of suspended material in water through the movement of soil and sediment from nearby urban areas. The turbidity data returned to background levels after the high peaks.

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.

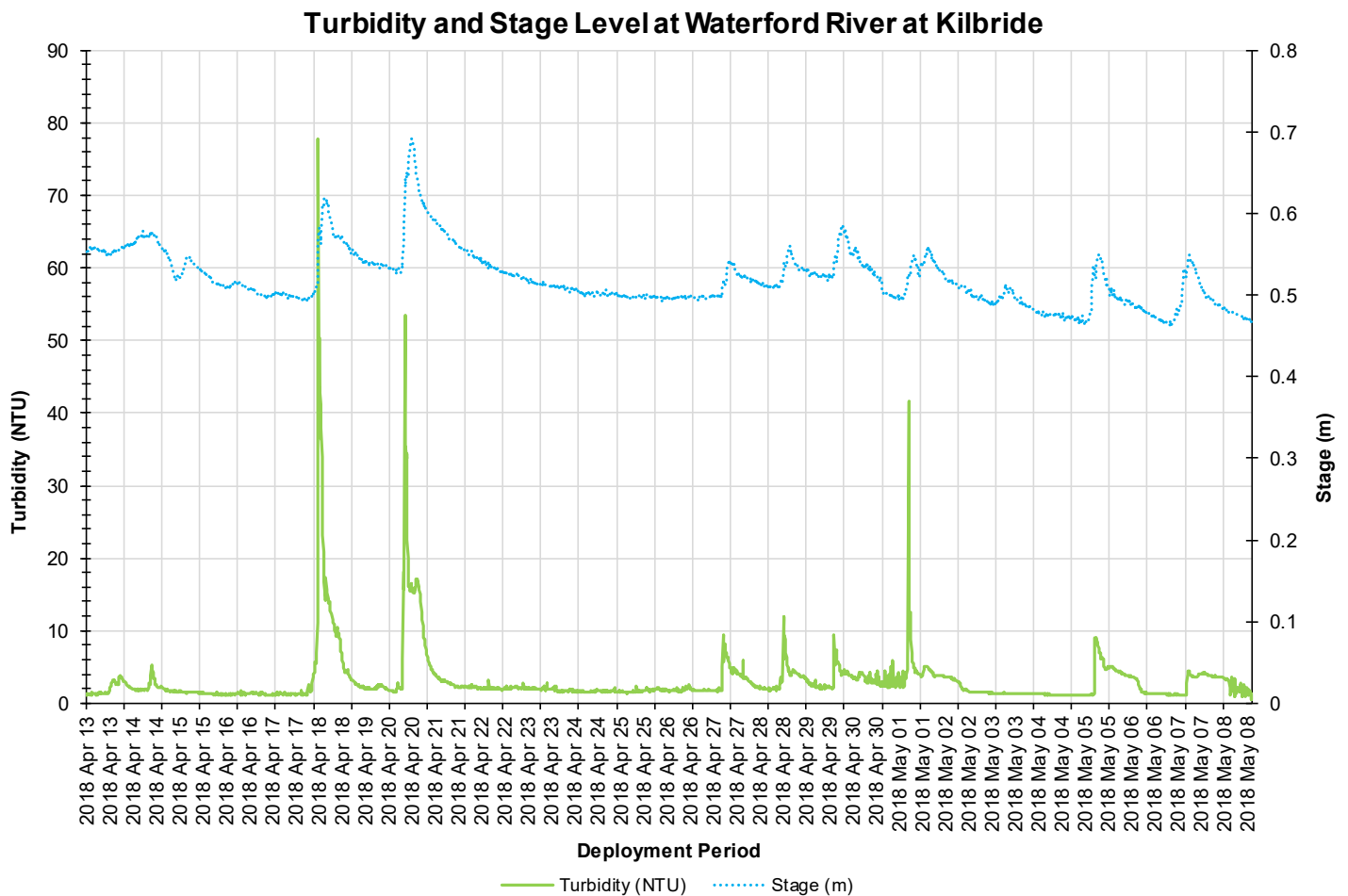


Figure 6: Turbidity (NTU) and stage level (m) values at Waterford River at Kilbride.

### 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 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 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 0.46m to 0.69m. The larger peaks in stage correspond with substantial rainfall events as noted on Figure 7. Precipitation data was obtained from 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 9.6 mm on April 18<sup>th</sup> 2018.

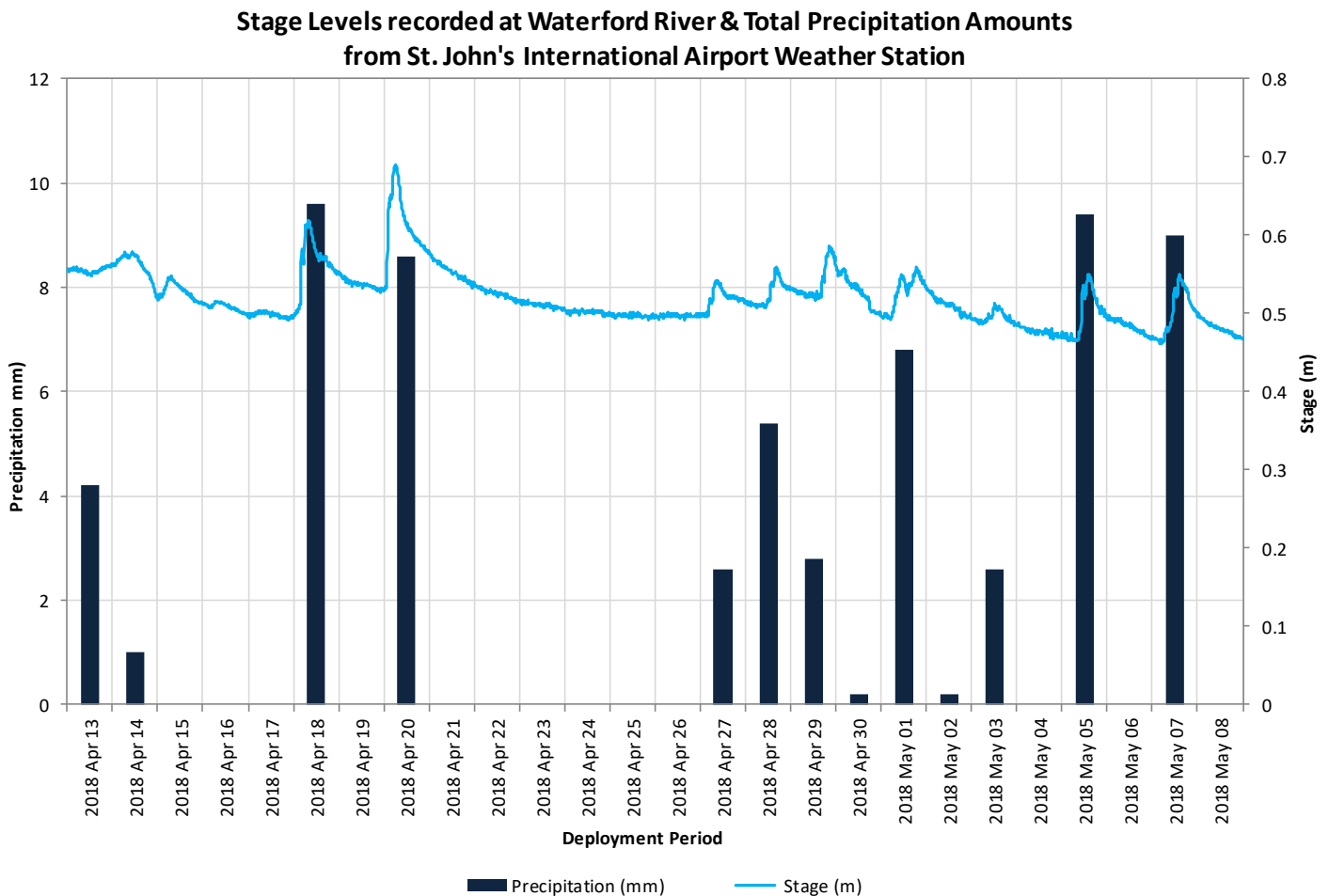


Figure 7: Stage values recorded at Waterford River at Kilbride and daily total precipitation from St. John’s Airport Weather Station.

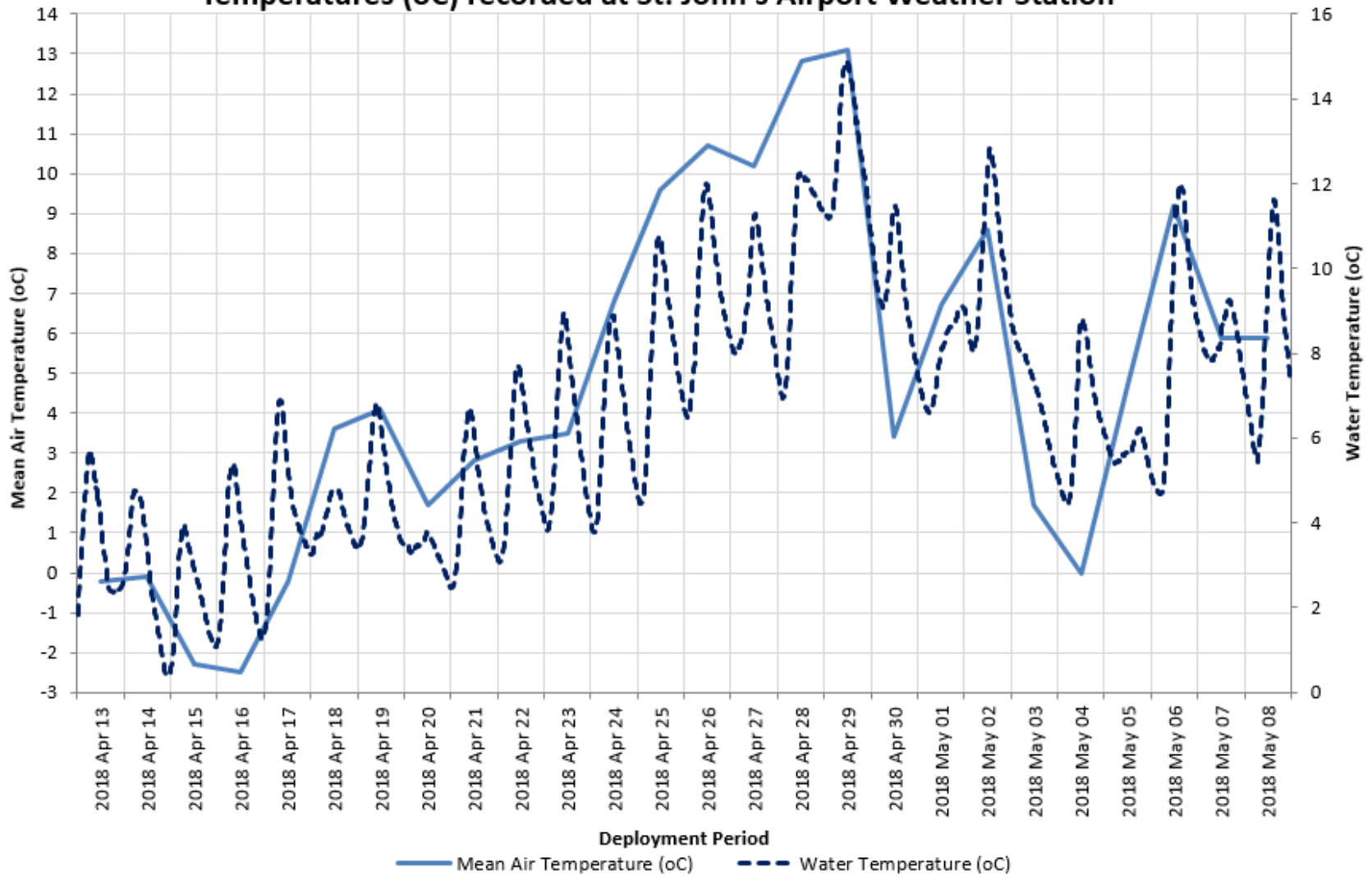
## **Conclusion**

When reviewing the graphs as a whole it is evident that the larger precipitation events influenced the water quality parameters pH, conductivity, dissolved oxygen and turbidity. As the seasons adjust, there is an increase in the air temperatures in the city. Air temperatures will influence the water temperatures in surrounding brooks and rivers. Waterford River data indicates that the slight warming of water temperatures influenced the changes in the dissolved oxygen concentrations in the brook.

After a large increase in conductivity at the beginning of the deployment period, the specific conductivity levels settled out toward the end of deployment as road salting was occurring less into the spring months. The pH values were consistent for this deployment. Dissolved oxygen was reasonably constant, with a slight decreasing trend as the water temperature increased with the seasonal change. There was evidence of tampering with the instrument around the end of April, therefore data from specific conductivity and dissolved oxygen had to be removed from the report as it did not represent the river.

APPENDIX I

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



Waterford River at Kilbride, Newfoundland and Labrador