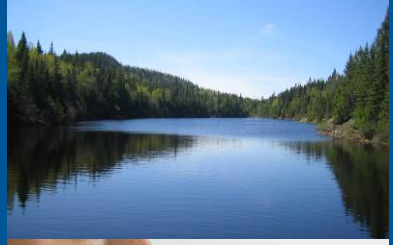







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
November 26, 2014 to January 21, 2015

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division

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General

The Water Resources Management Division (WRMD), in partnership with Environment Canada, maintain a real-time water quality and water quantity monitoring station along Prince Phillip Parkway.

The real-time station allows for assessment and management of the water body. This deployment report discusses water quality related events occurring at the Leary's Brook station.

The purpose of this real-time station is to monitor, process and publish hydrometric (water quantity) and real-time water quality data at the real-time station. Leary's Brook is in the vicinity of the Avalon Mall, a highly developed urban area and an extremely busy roadway.

This report covers the deployment on November 26, 2014 until removal on January 21, 2015.

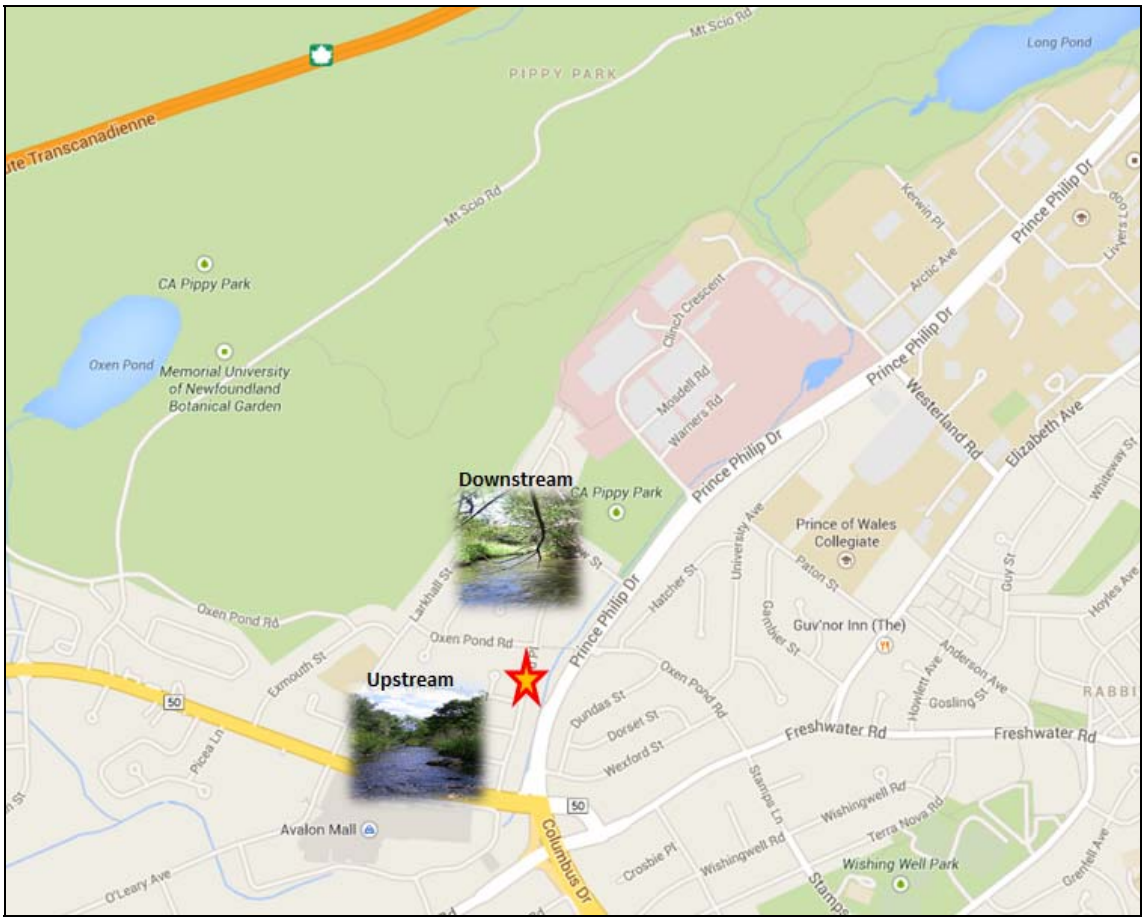

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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).

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 taken too soon it may not accurately portray the water body.

Deployment and removal instrument performance rankings for **Leary's Brook** for the period of November 26, 2014 through to January 21, 2015 are summarized in Table 2.

Table 2: Instrument performance rankings for Leary's Brook

Station	**Date**	**Action**	**Comparison Ranking**				
			Temperature	**pH**	**Conductivity**	**Dissolved Oxygen**	**Turbidity**
Leary's Brook	**Nov 26 2014**	**Deployment**	Excellent	Excellent	Excellent	Excellent	Excellent
	Jan 21 2015	**Removal**	Excellent	Excellent	Good	Excellent	Excellent

At deployment the field instrument data when compared against the QAQC sonde ranked as 'Excellent' for all parameters. This is acceptable ranking for the water quality parameters for the beginning of the deployment period.

At removal, parameter data for temperature, pH, dissolved oxygen and turbidity ranked as 'Excellent' when compared against the QAQC sonde. The conductivity data ranked as 'Good' for removal. These are satisfactory rankings for the data. The instrument has been in the brook from November 26 through to January 21, 2015 however during the winter months there is generally less aquatic vegetation present that can block or interfere with the instruments.

Deployment Notes

Please note that stage and stream flow data included in this report, is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Precipitation data from the deployment period was retrieved from the Environment Canada's weather station at St. John's International Airport.

Leary's Brook

Water Temperature

Water temperature ranged from -0.26°C to 9.02°C during this deployment period (Figure 2).

Water temperature at this brook displays a typical variation in pattern over the deployment period. Water temperature is influenced by air temperature. The air temperature is now dropping as winter approaches hence some water temperatures reached to below zero during this deployment.

Water temperature can also be influenced by precipitation and stage increases. Significant peaks in stage can cause increases in water temperature for a short period of time. This is evident on several occasions highlighted in red on Figure 2.

As the air temperatures decrease there is a corresponding decrease with the water temperatures. There is a significant decrease in water temperatures as the colder winter temperatures occur.

Please note that stage data is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

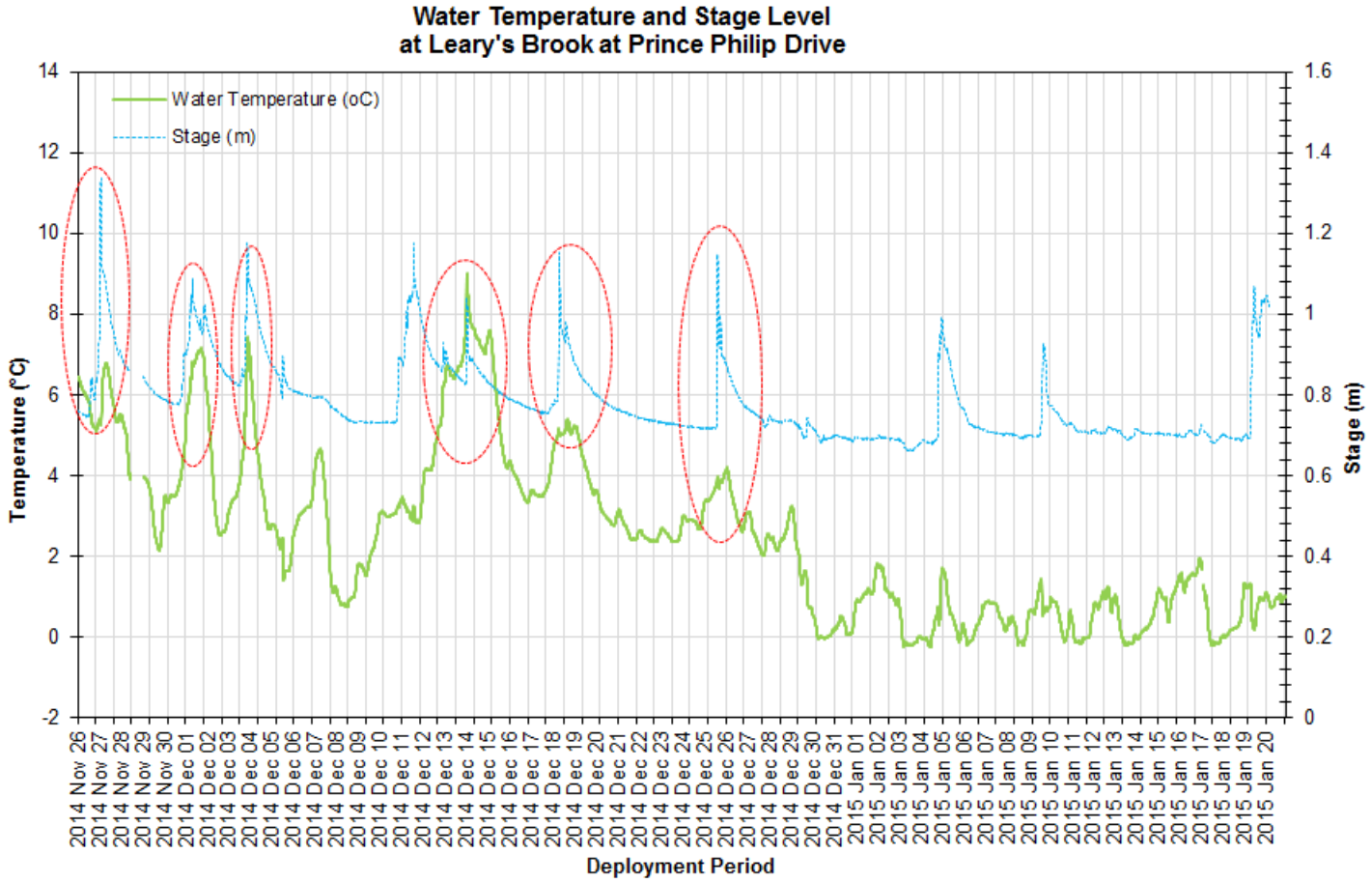

Figure 2: Water temperature (°C) and Stage (m) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.62 pH units and 6.99 pH units (Figure 3).

For this deployment period the pH values stayed within the CCME guidelines for the protection of aquatic life. The pH levels do dip slightly during each stage increase for a short period of time.

Please note that stage data in this report is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

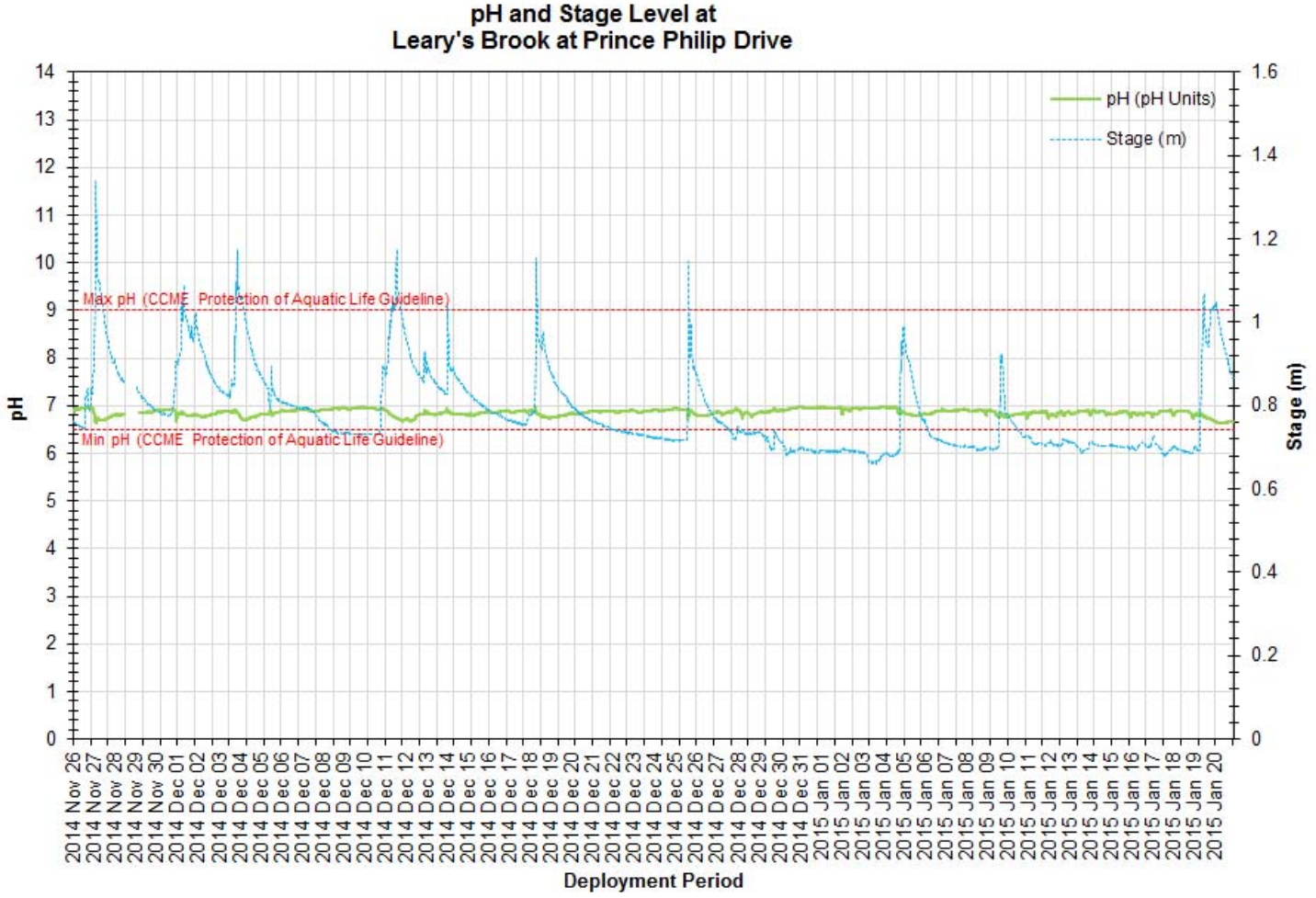

Figure 3: pH (pH units) and Stage (m) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 165.7 µS/cm and 9034.9 µS/cm during this deployment period. TDS ranged from 0.106 g/L to 5.78 g/L.

This deployment period is during the time of year that road salting is required on the icy roads to prevent traffic accidents. The road salt generally ends up in the urban brooks and this is clearly evident from December 25th to the end of the deployment period, with the significantly high conductivity values.

Rainfall events can flush the road salt into the brooks as well; it provides a medium to carry the salt. The higher conductivity peaks are likely during a rainfall event.

Please note the stage data included in this report is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

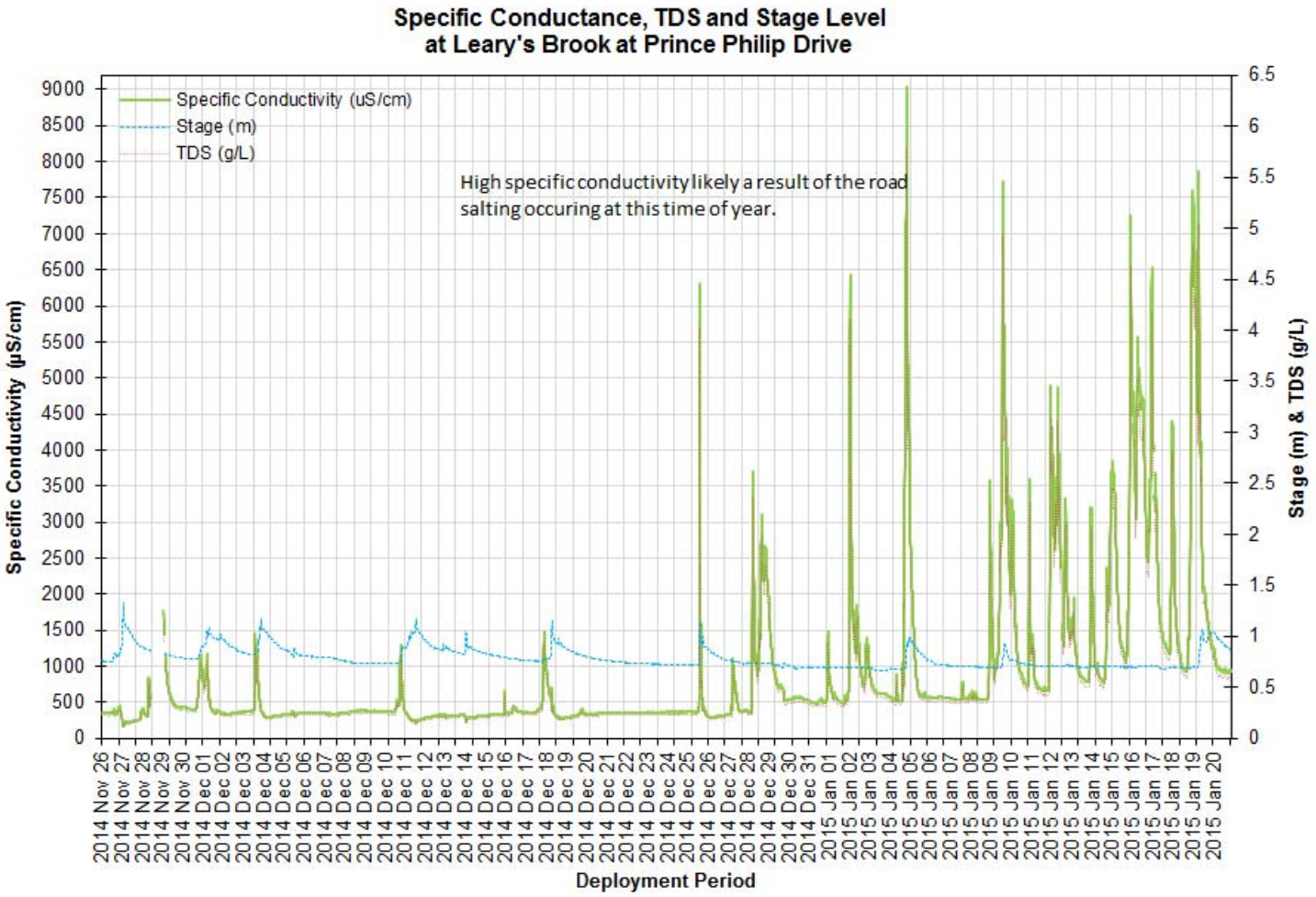

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Leary's Brook Station

Dissolved Oxygen

The instrument measures dissolved oxygen (mg/L) directly then calculates percent saturation (% Sat.).

The Dissolved Oxygen % Sat levels within this deployment period were within 95.5% Sat and 101.3% Sat. Dissolved Oxygen (mg/L) measured 11.03 mg/L to 14.60 mg/L.

Naturally as the months get cooler the Dissolved Oxygen present in the water will increase overall (Figure 5). This is evident as the Dissolved Oxygen levels increase over the deployment period corresponding with the cooler water temperatures. Daily Dissolved Oxygen levels will still be influenced by temperatures, rainfall and sunlight hours.

Dissolved oxygen can also be influenced by road salting. During some of the larger specific conductivity peaks (Figure 4) there is corresponding dips in dissolved oxygen concentration (mg/L).

During this deployment the Dissolved Oxygen did not drop below the CCME guidelines for the protection of early life stages.

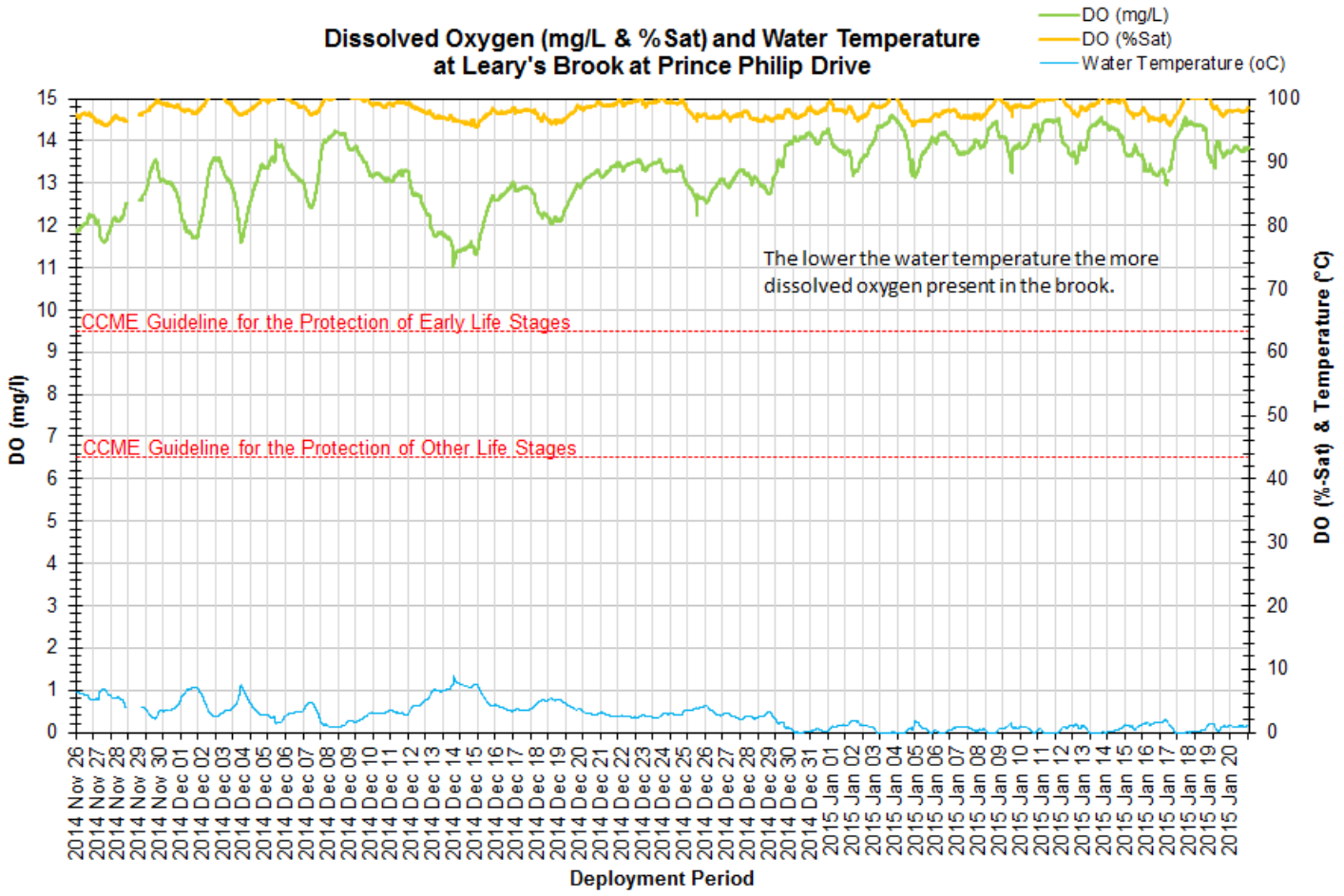

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity readings during this deployment ranged between 0.0 NTU to 818.0 NTU (Figure 6).

The majority of turbidity events displayed on the graph in Figure 6 correspond with road salting and precipitation events. This particular brook is influenced by the surrounding urban environment and is very flashy during rainfall events.

After turbidity events, streams should return to the natural turbidity levels of the brook. This is evident in Leary's Brook as the peaks only last for a short period of time before the levels return to 'normal'.

Please note the stage data is raw data that is included in this report. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

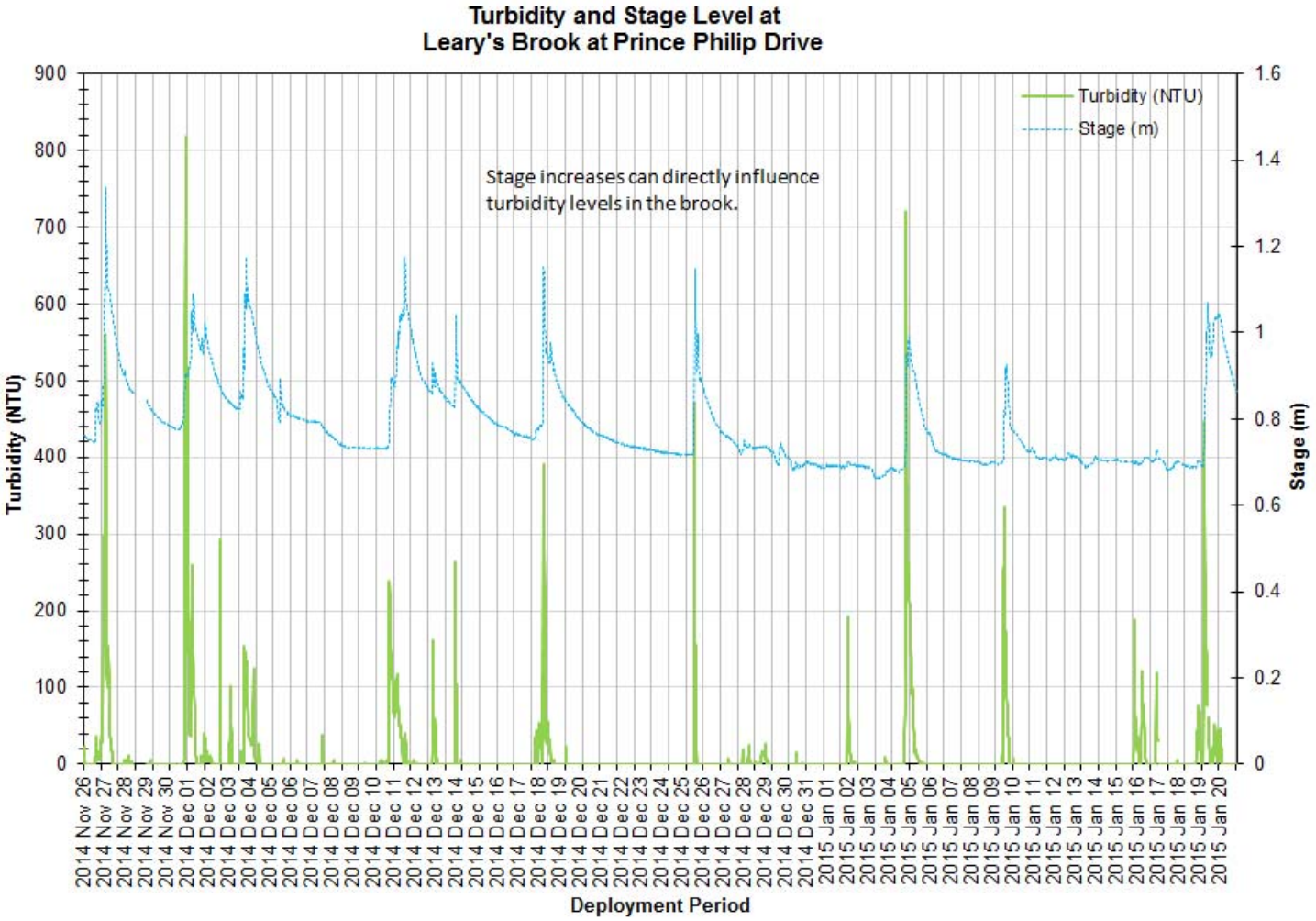

Figure 6: Turbidity (NTU) and Stage (m) values at Leary's Brook Station

Stage, Stream flow and Total Precipitation

The below graph includes precipitation data from St. John's International Airport weather station and the stage and stream flow data recorded at Leary's Brook Station. Please note that stage and stream flow data is raw data and 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.

Stage and stream flow can provide an explanation of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). It is not unusual to see stage and stream flow vary throughout the deployment period (Figure 7). These water quantity parameters are directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest precipitation was recorded on December 11th, 2014 at 26.4 mm total for that day. During this event there are corresponding stage and stream flow increases.

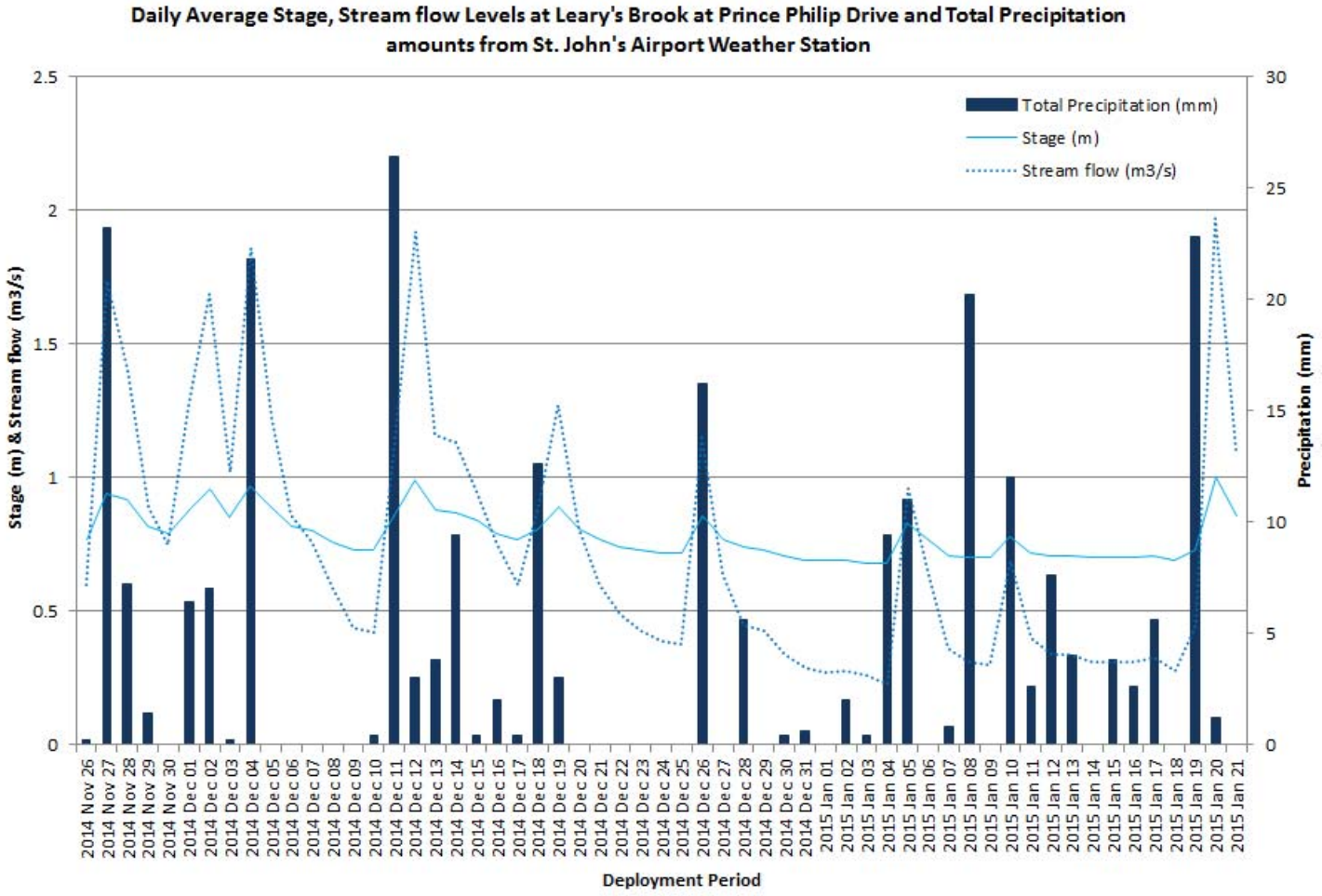

Figure 7: Stage (m) and Stream flow (m3/s) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

Conclusions

Generally in natural environments, climate and weather conditions contribute in large part to the variation in water quality parameters. During this deployment it was evident that many of the changes in the parameter data displayed on the graphs, was related to the intermittent precipitation events and small climatic changes of the seasons (i.e. temperature decreases).

Precipitation events during the deployment period led to related fluctuations in stage and stream flow, which thus influenced the values of turbidity, pH, specific conductance, and TDS. During the cooler water temperatures there are increases in the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 2.43°C, lower than previous deployment month. Water temperature will continue to vary as it is influenced by the winter air temperatures.

The Specific Conductivity median at Leary's Brook was 426.0µS/cm. This conductivity median was higher than the previous deployment.

The median pH value for Leary's Brook Station was 6.86 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 98.2% Sat during the deployment period.

The turbidity spikes correlated with increases in precipitation and coinciding stage increases. The turbidity median value at Leary's Brook during deployment was 0.0NTU.

Overall the data provided for Leary's Brook at Prince Philip Drive coincided with what would be expected of an urban brook during the winter months.