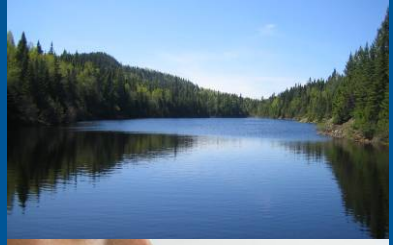







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
March 12, 2014 to May 14, 2014

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 March 12, 2014 until removal on May 14, 2014.

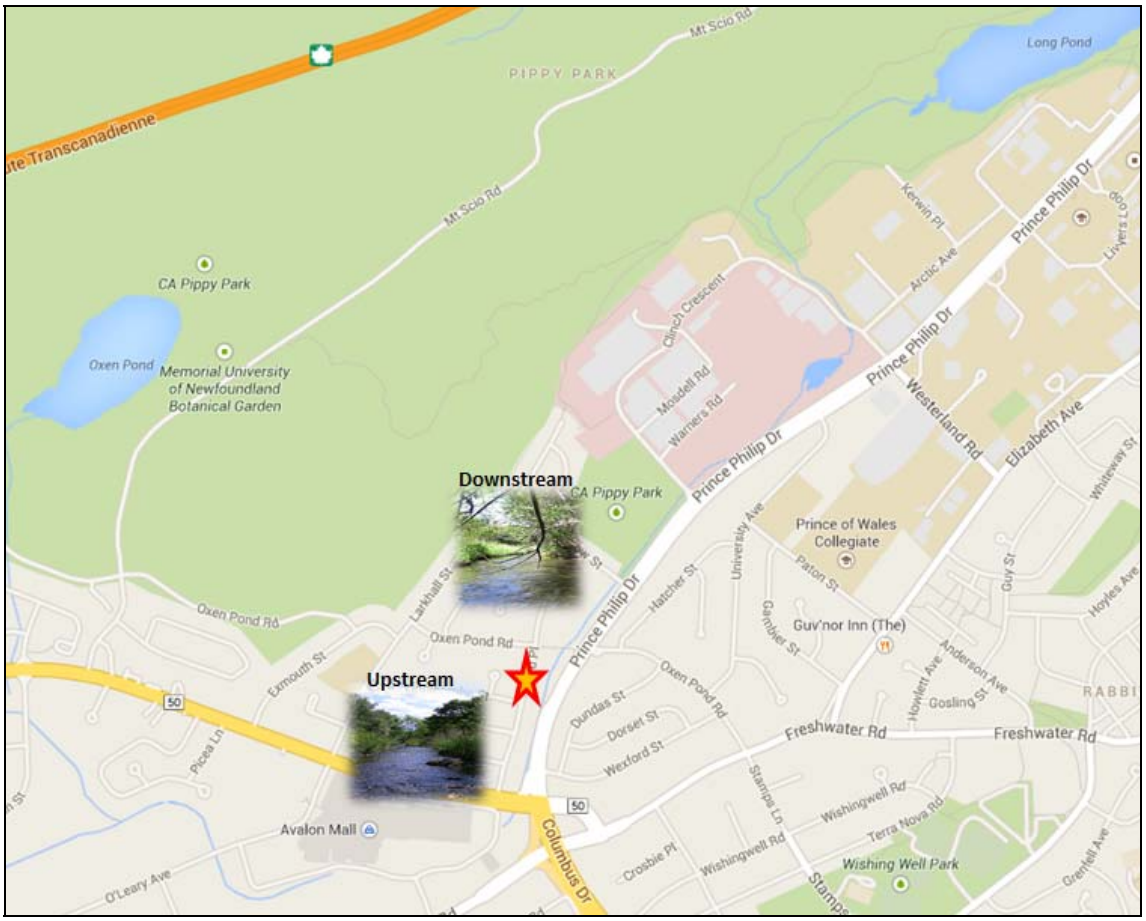

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 March 12, 2014 through to May 14, 2014 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	**Mar 12 2014**	**Deployment**	Excellent	Good	Good	Excellent	Poor
	May 14 2014	**Removal**	Excellent	Excellent	Excellent	Good	Excellent

At the Leary's Brook station at the point of deployment, the water temperature and dissolved oxygen data ranked as 'Excellent'. The pH and conductivity reading for deployment ranked as 'Good'. The turbidity data comparison ranked the data as 'Poor' during initial deployment; it is possible that something passed over the sensor during the sensor taking a reading. Visually there was evidence of the water being slightly turbid.

At removal, the temperature, pH, and conductivity and turbidity data all ranked 'Excellent'. The dissolved oxygen ranked as 'Good'. All rankings are acceptable for an instrument that was deployed for an extended time.

Deployment Notes

Please note that the 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.

Please note stage data was not able to be graphed alongside the water quality parameters for this report.

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 -0.12°C to 8.03°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. As the seasonal air temperatures start to increase there is an increase in the water temperature as the deployment period continues.

The water temperature displayed on Figure 2 is typical of shallow streams and ponds. Shallow water bodies are highly influenced by variations in ambient air temperatures.

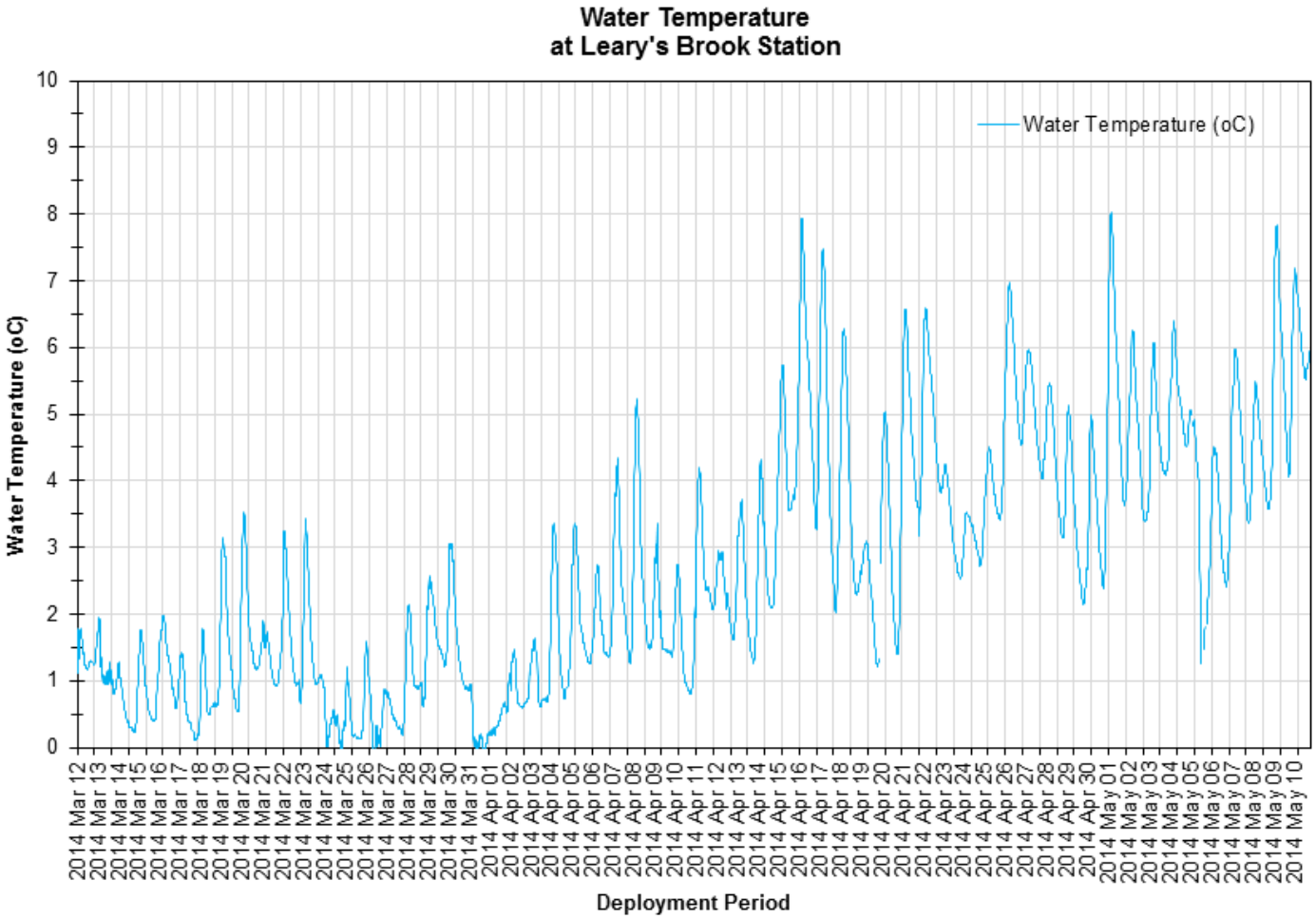

Figure 2: Water temperature (°C) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.42 pH units and 7.06 pH units (Figure 3).

During the deployment, the majority of pH values were between the minimum and maximum CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). There are three events whereby the pH data dip below the guideline, as noted on March 14th, March 27th and April 16th, 2014. Rainfall events do have the influence to lower the pH levels for a short period of time. It is likely these dips in pH may be a result of the precipitation.

The CCME guideline provides a basis by which to judge the overall health of the brook. Naturally, all streams and brooks are different. Leary's Brook pH median was 6.72 (pH units) for this deployment period.

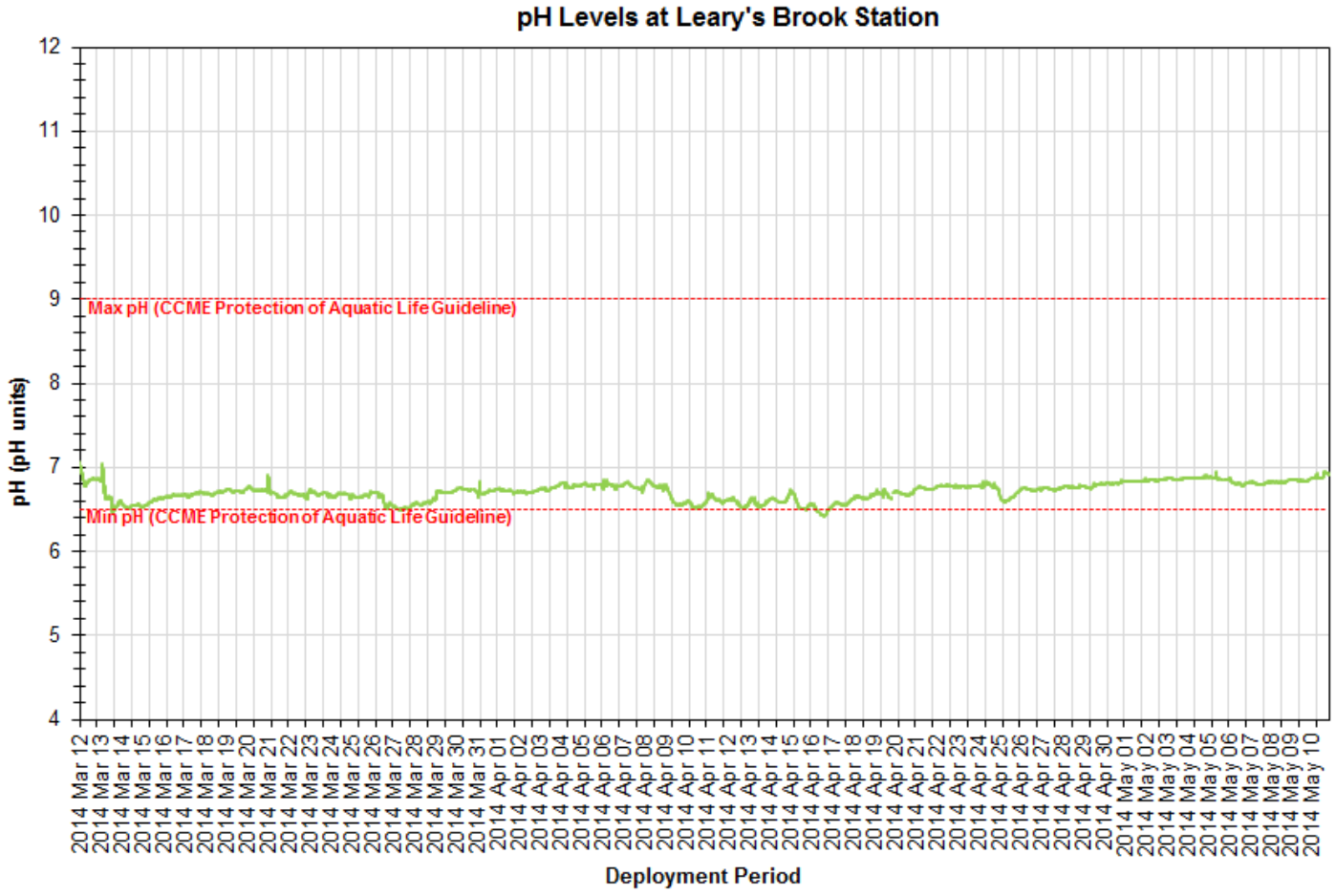

Figure 3: pH (pH units) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 141.3 µS/cm and 11175.0 µS/cm during this deployment period. TDS ranged from 0.0904 g/L to 7.1500 g/L.

During the beginning of the deployment the peaks in conductivity are likely a result of the road salt that occurs during the colder periods (Figure 4). As the ice and snow melts during the spring thaw it flushes the excess material out of the brooks hence increasing the conductivity levels.

In April the higher spikes in conductivity dissipate and the conductivity levels reduce to lower levels as the road salting is no longer occurring.

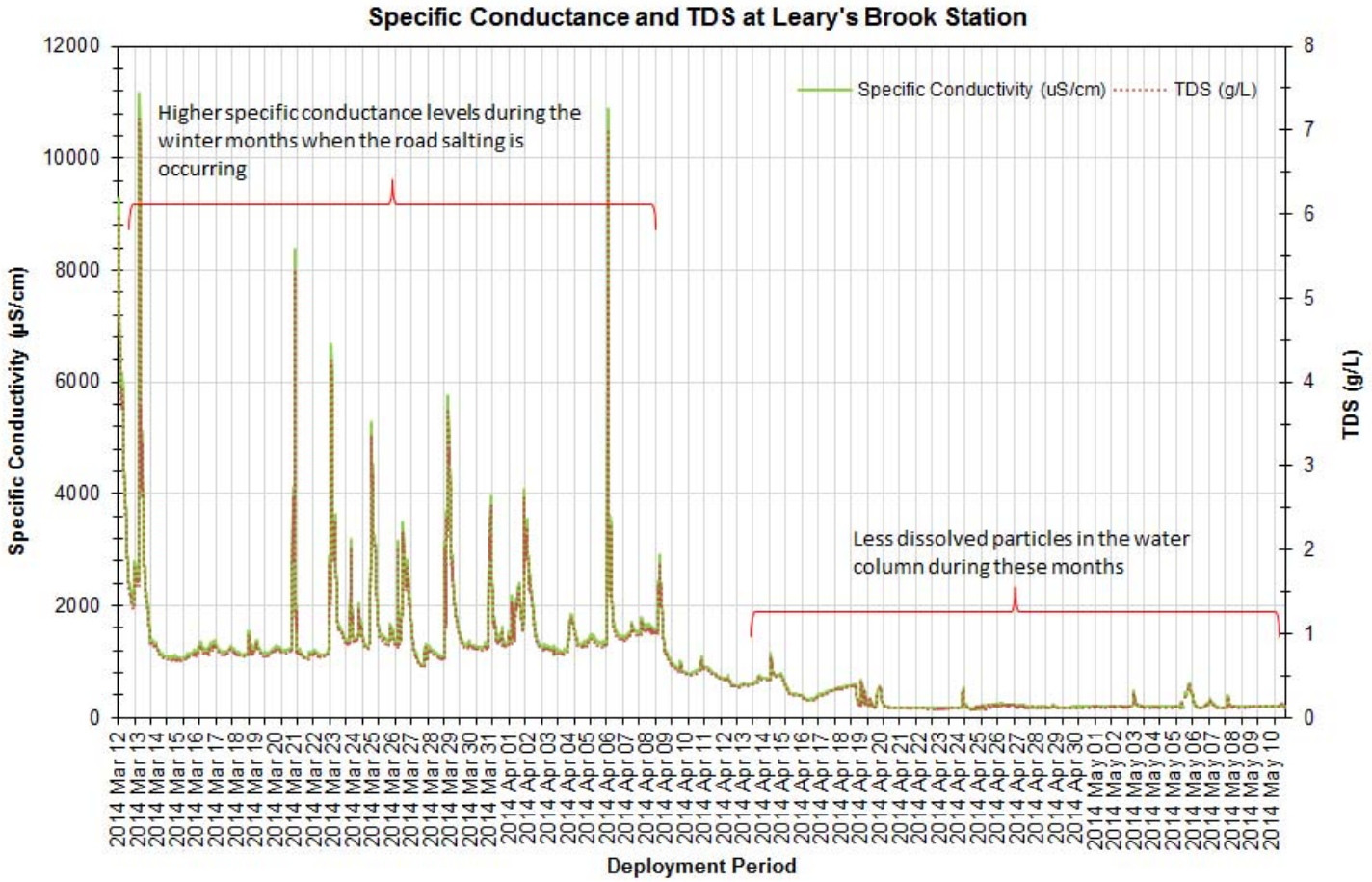

Figure 4: Specific conductivity (µS/cm) & TDS (g/L) values at Leary's Brook Station

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 89.3% Sat and 98.2% Sat. Dissolved Oxygen (mg/L) measured 10.96 mg/L to 13.91 mg/L.

The Dissolved Oxygen mg/L values are well above the minimum Dissolved Oxygen CCME guideline for early life stages throughout this deployment period (Figure 5).

There is a slight decrease in dissolved oxygen concentration across the deployment period; however this is to be expected as the air and water temperatures start to increase into the spring months.

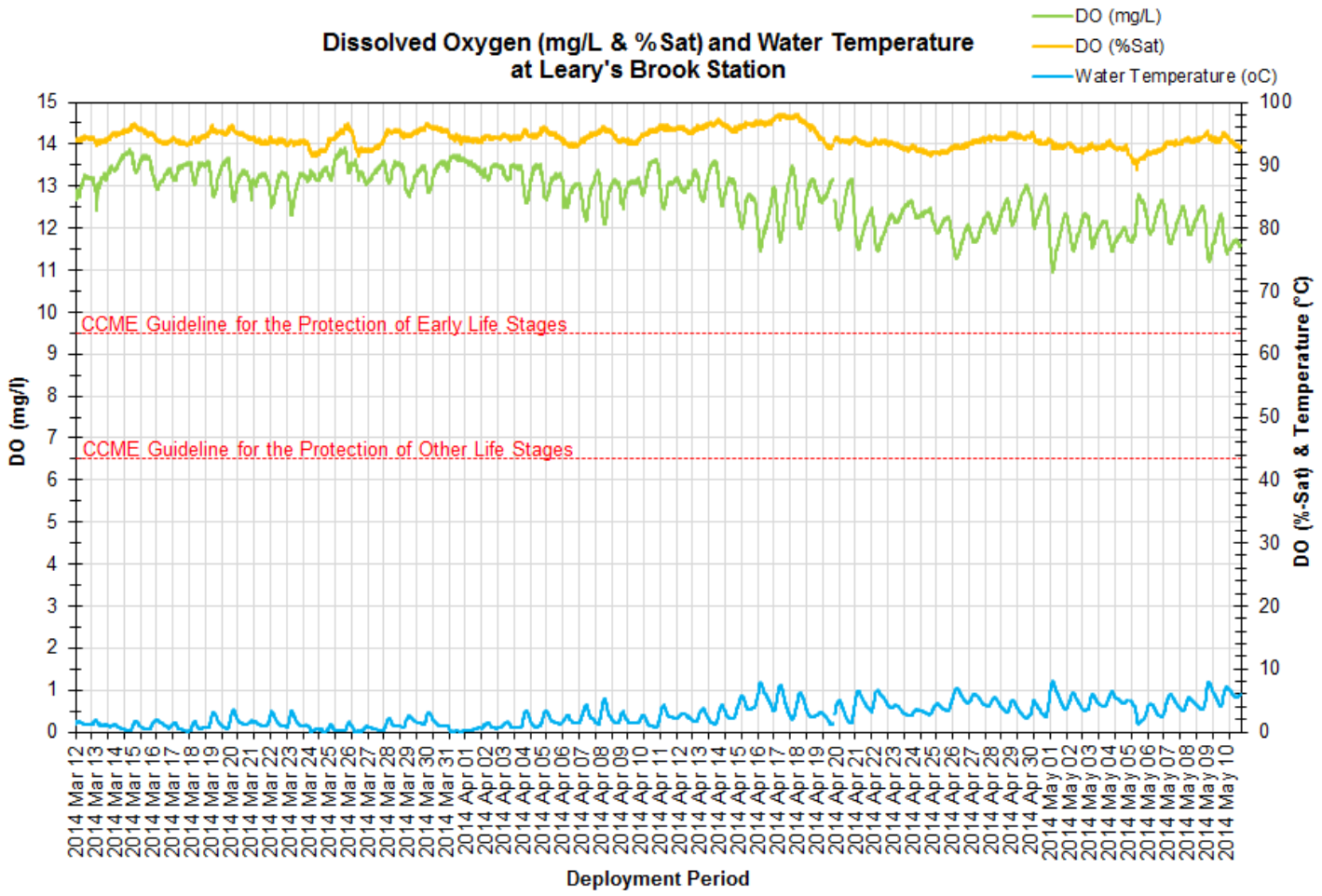

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity sensor records values between 0 NTU and 3000 NTU. However a turbidity reading of 3000NTU is identified as an error and is not a true turbidity value. Readings of 3000 NTU should not be included in any statistical analysis.

The turbidity readings during this deployment ranged within 0.0 NTU to 1269.0 NTU (Figure 6).

Rainfall and subsequent runoff can cause an increase in sediment and material flowing into the brook. These events can influence the turbidity levels in the brook.

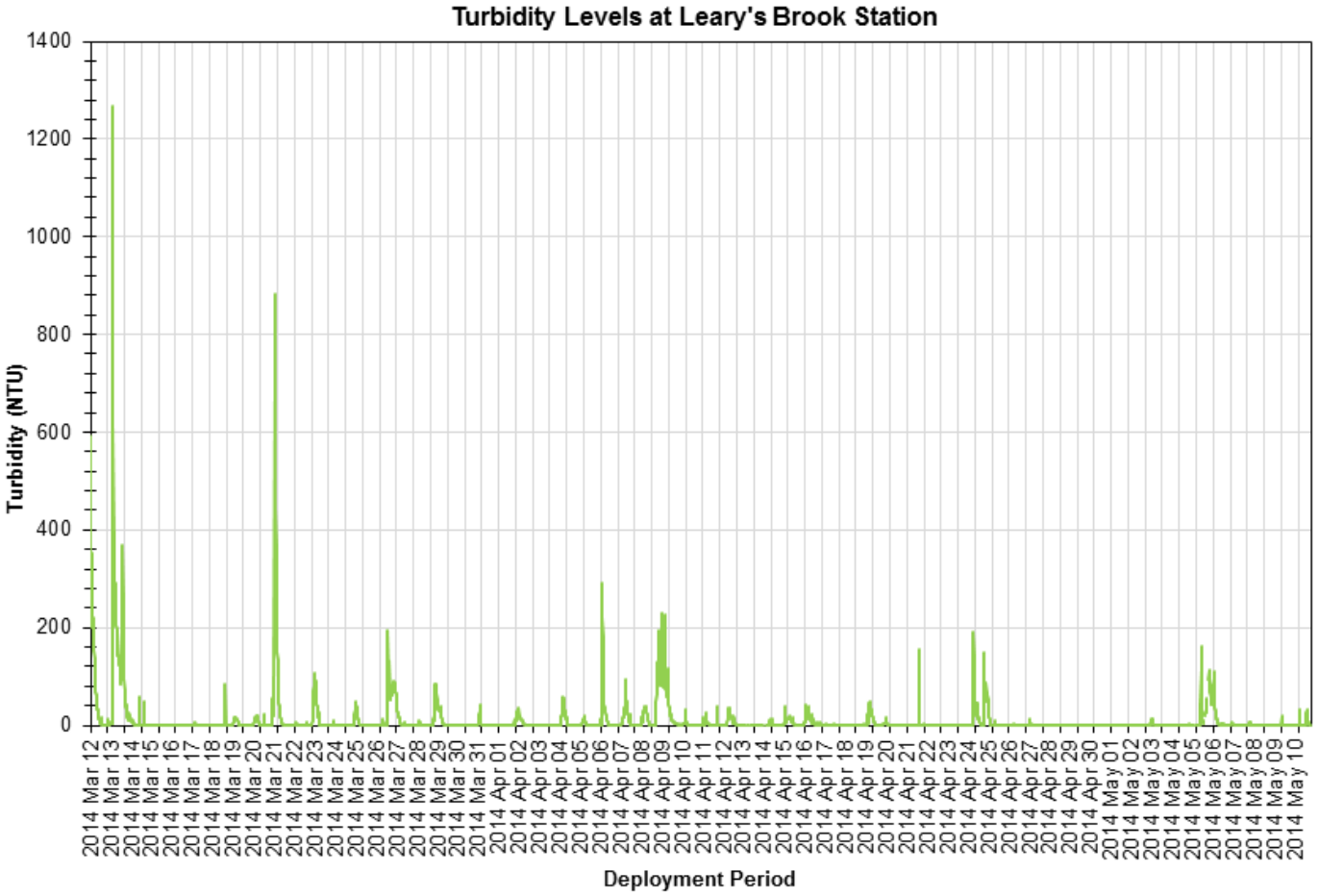

Figure 6: Turbidity (NTU) values at Leary's Brook Station

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 the stage and stream flow data in this report 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.

It is not unusual to see stage and stream flow vary throughout the deployment period (Figure 7). Stage is directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest total precipitation occurs on March 26th, 2014 at 25.6mm. This precipitation event corresponds with stage and stream flow increases for the same timeframe.

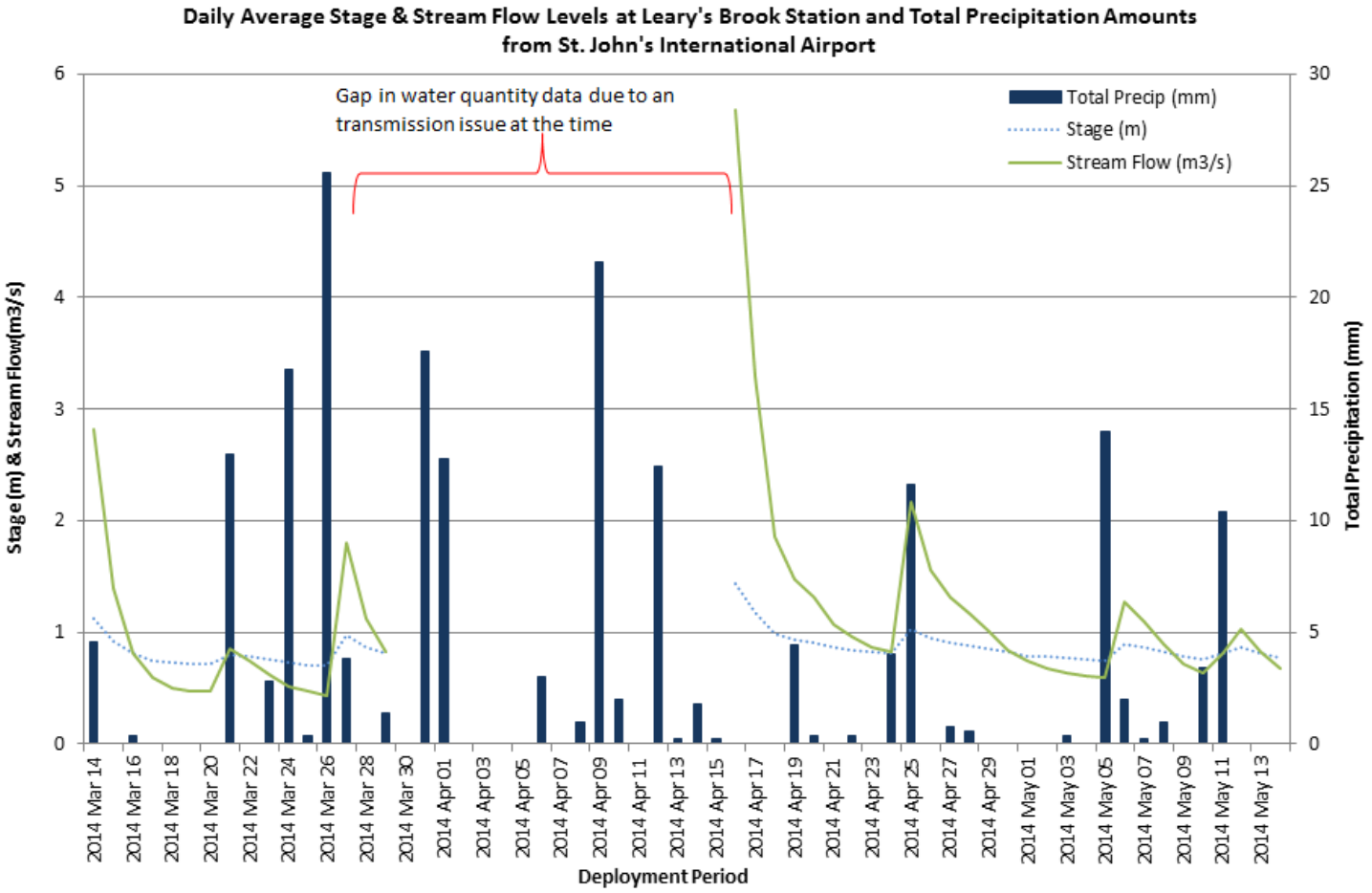

Figure 7: Stage values (m), stream flow (m3/s) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

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, which thus influenced the values of turbidity, pH, specific conductance, and TDS. As ambient air temperatures increased, there were correspondingly warmer water temperatures, which in turn slightly decreased the amount of dissolved oxygen in the water.

Early in the deployment the climatic conditions still required road salting for road safety. The addition of road salt to roadways led to increases in specific conductance and TDS as the salts were washed into the river system. However, as the air temperatures increased into spring, the conductivity levels dropped and there were fewer spikes. The Specific Conductivity median at Leary's Brook was 852.5µS/cm, which was lower than the previous deployment.

During this deployment period the median water temperature at the Leary's Brook station was 2.36°C. Water Temperature will continue to fluctuate and be influenced by the surrounding spring air temperatures.

The median pH value for Leary's Brook Station was 6.72 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 94.2 %Sat during the deployment period. The small dips in DO (mg/L and % Sat) correspond with water temperatures. The larger dips in DO (mg/L and %Sat) at Leary's Brook correspond with rainfall events.

The turbidity median value at Leary's Brook during deployment was 0.0 NTU. Increases in stage level can explain the peaks in the turbidity values during the deployment period. As organic matter and natural minerals are washed into the brook, the suspended matter in the water column will increase and the turbidity sensor and the specific conductivity sensor will pick up these additional changes in the water body.