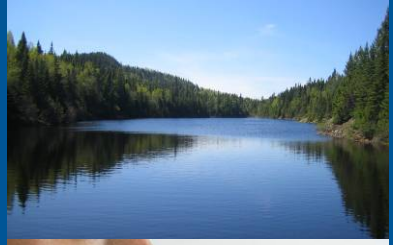







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
September 16, 2014 to October 23, 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 September 16, 2014 until removal on October 23, 2014.

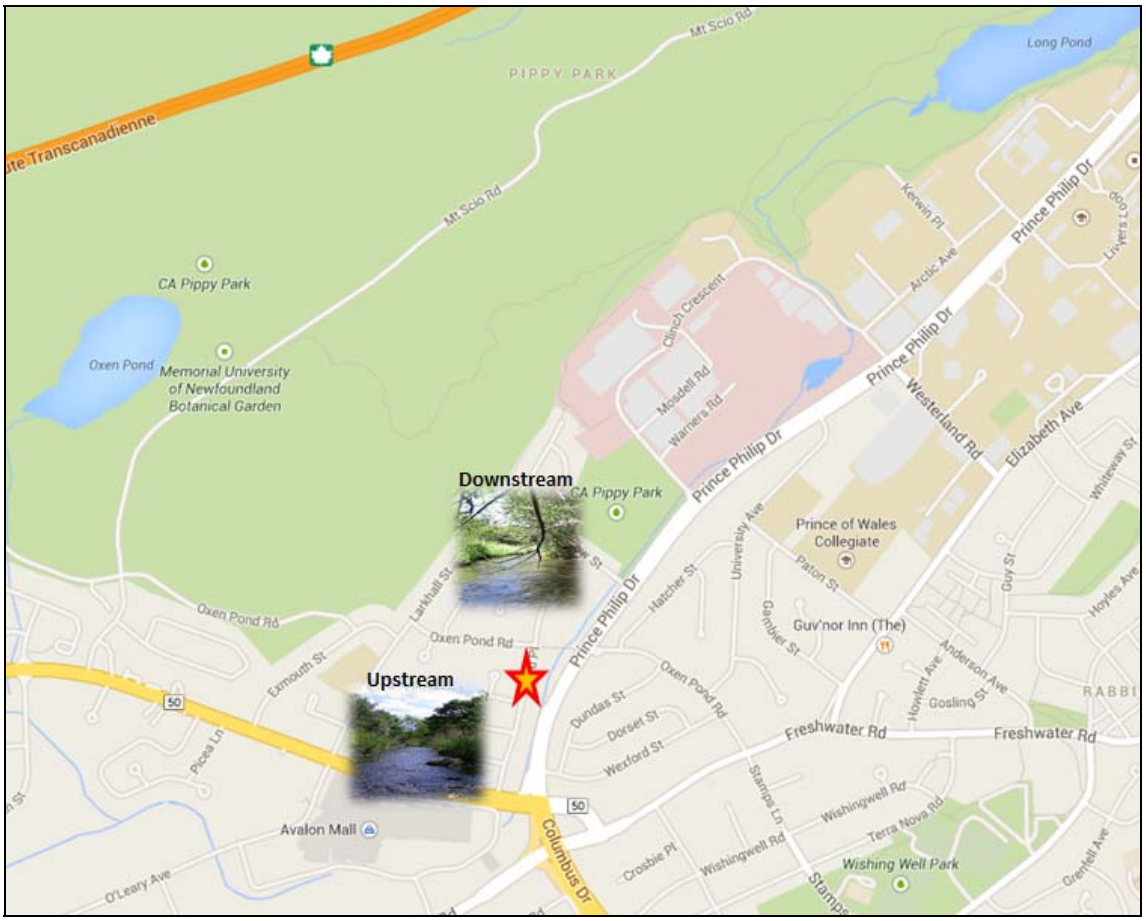

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 September 16, 2014 through to October 23, 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	**Sept 16 2014**	**Deployment**	Excellent	Excellent	Excellent	Excellent	Excellent
	Oct 23 2014	**Removal**	Excellent	Excellent	Excellent	Excellent	Excellent

At the Leary's Brook station at the point of deployment all parameter data ranked as 'Excellent' for deployment of the field sonde.

At removal, all parameter data ranked as 'Excellent' when compared against the QA sonde.

Deployment Notes

Please note that stage and streamflow 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 8.20°C to 17.60°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.

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 September 27th and October 18th, 2014. The stage event on October 12th (highlighted in red) caused the water temperature to drop indicating that the air temperature was been lower during that rainfall event.

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.

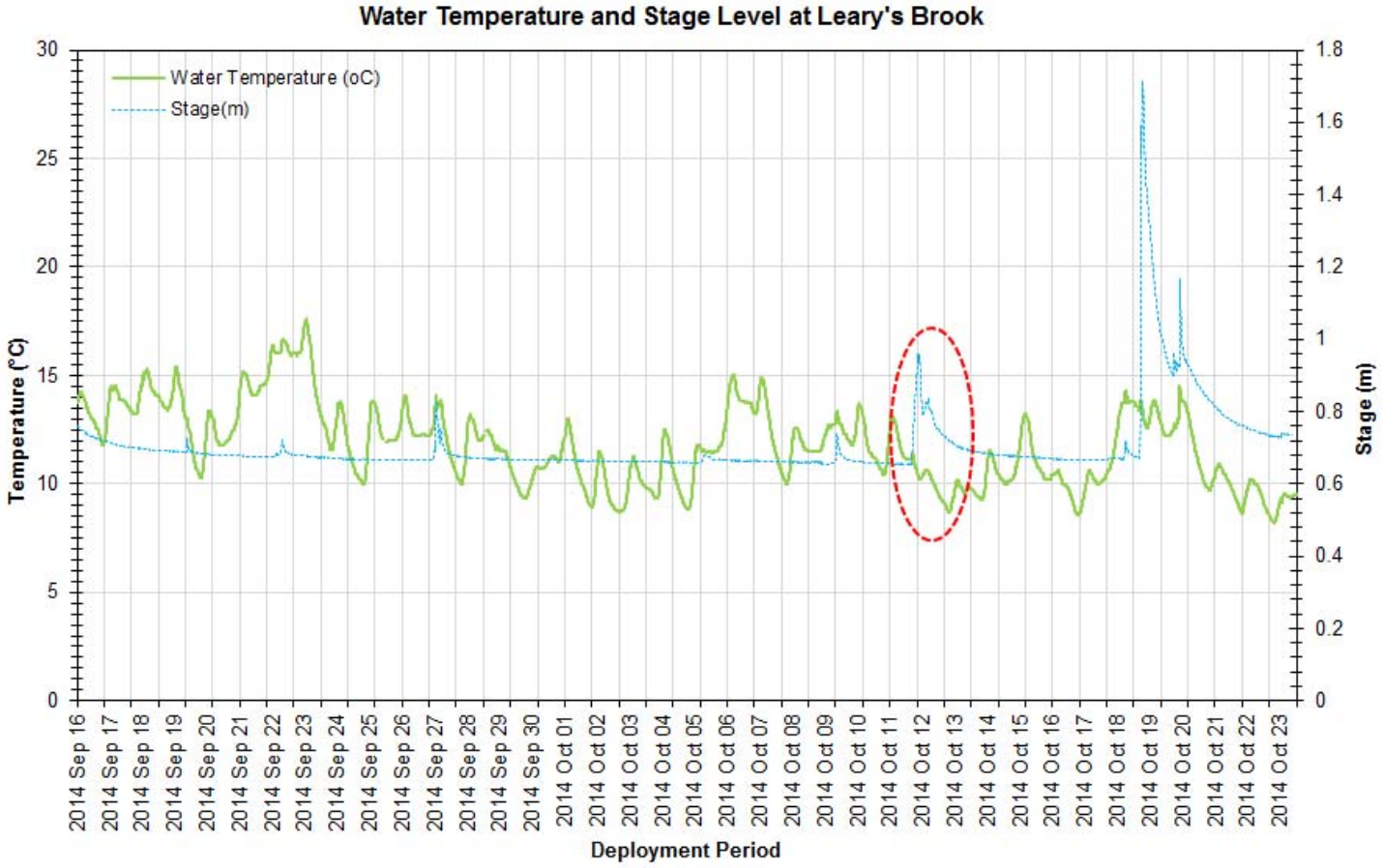

Figure 2: Water temperature (°C) and Stage (m) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 5.47 pH units and 7.26 pH units (Figure 3).

At the beginning of the deployment period the pH levels remained within the CCME guidelines for the protection of aquatic life. The pH levels dipped below the guideline after September 25th, and decreased slightly for the remainder of the deployment period.

The increase in stage on October 18th causes the pH to drop. This is an expected occurrence as the surge of water will flush the brook and all minerals and particles present 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.

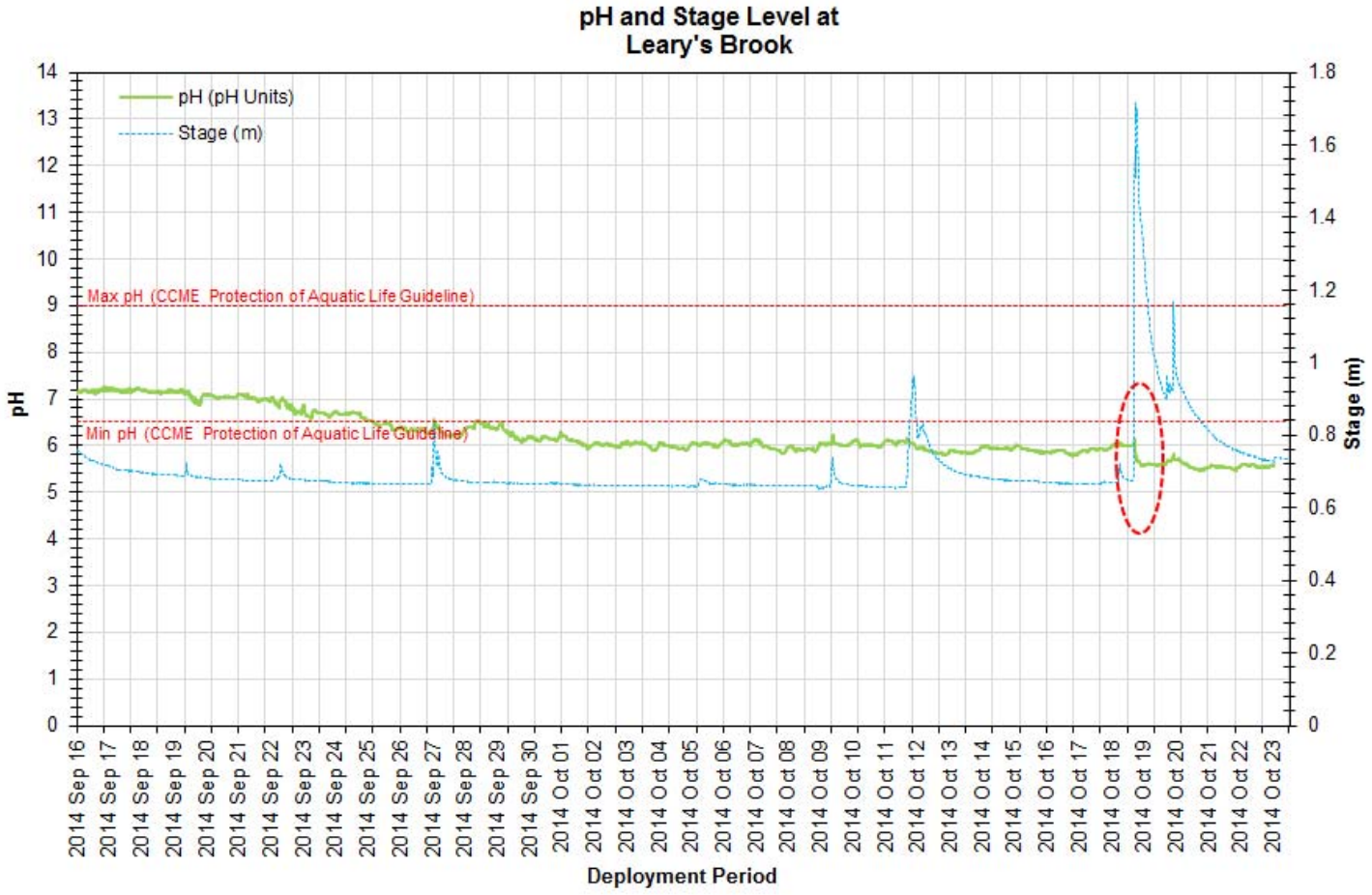

Figure 3: pH (pH units) and Stage (m) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 78.9 µS/cm and 664.0 µS/cm during this deployment period. TDS ranged from 0.0505 g/L to 0.4250 g/L.

The natural relationship between conductivity and increased stage level is evident on Figure 4. As the stage increases it flushes the suspended solids through the brook and the conductivity levels decrease. As the stage level settles the conductivity levels increase slightly as particles, sediment and minerals are naturally added to the brook (i.e. wind, runoff)

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.

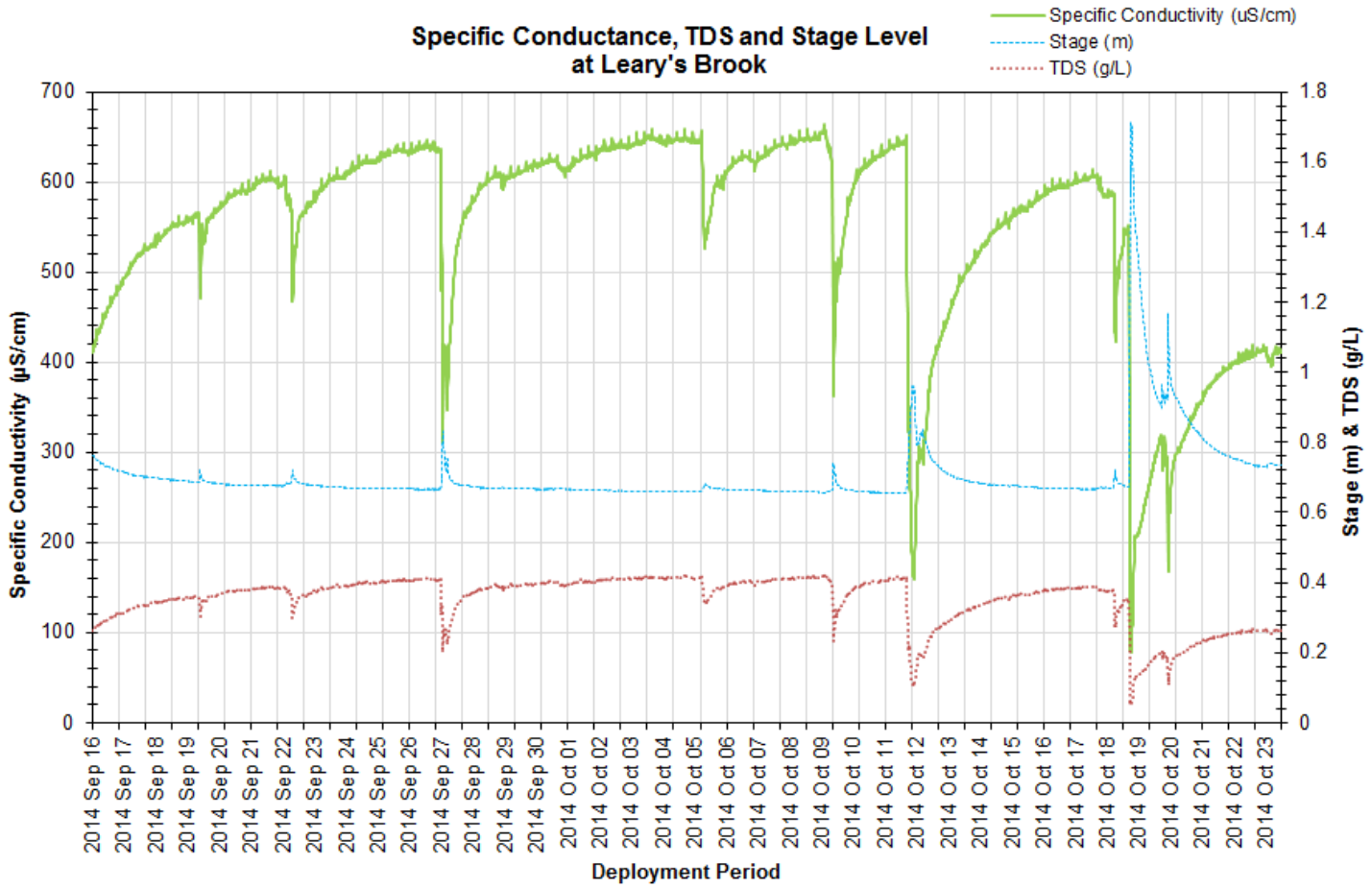

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Leary's Brook Station

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 88.6% Sat and 98.5% Sat. Dissolved Oxygen (mg/L) measured 8.98 mg/L to 11.32 mg/L.

Naturally as the months get cooler the Dissolved Oxygen present in the water will increase overall. Daily Dissolved Oxygen will be influenced by the daily temperatures changes, rainfall and sunlight hours.

It is not unusual for Dissolved Oxygen to drop below the CCME guidelines for Early Life Stages for short periods of time on warmer days. During this deployment the Dissolved Oxygen did dip below the CCME guidelines for the protection of early life stages, however did not dip below the minimum Dissolved Oxygen CCME guideline for other life stages (Figure 5).

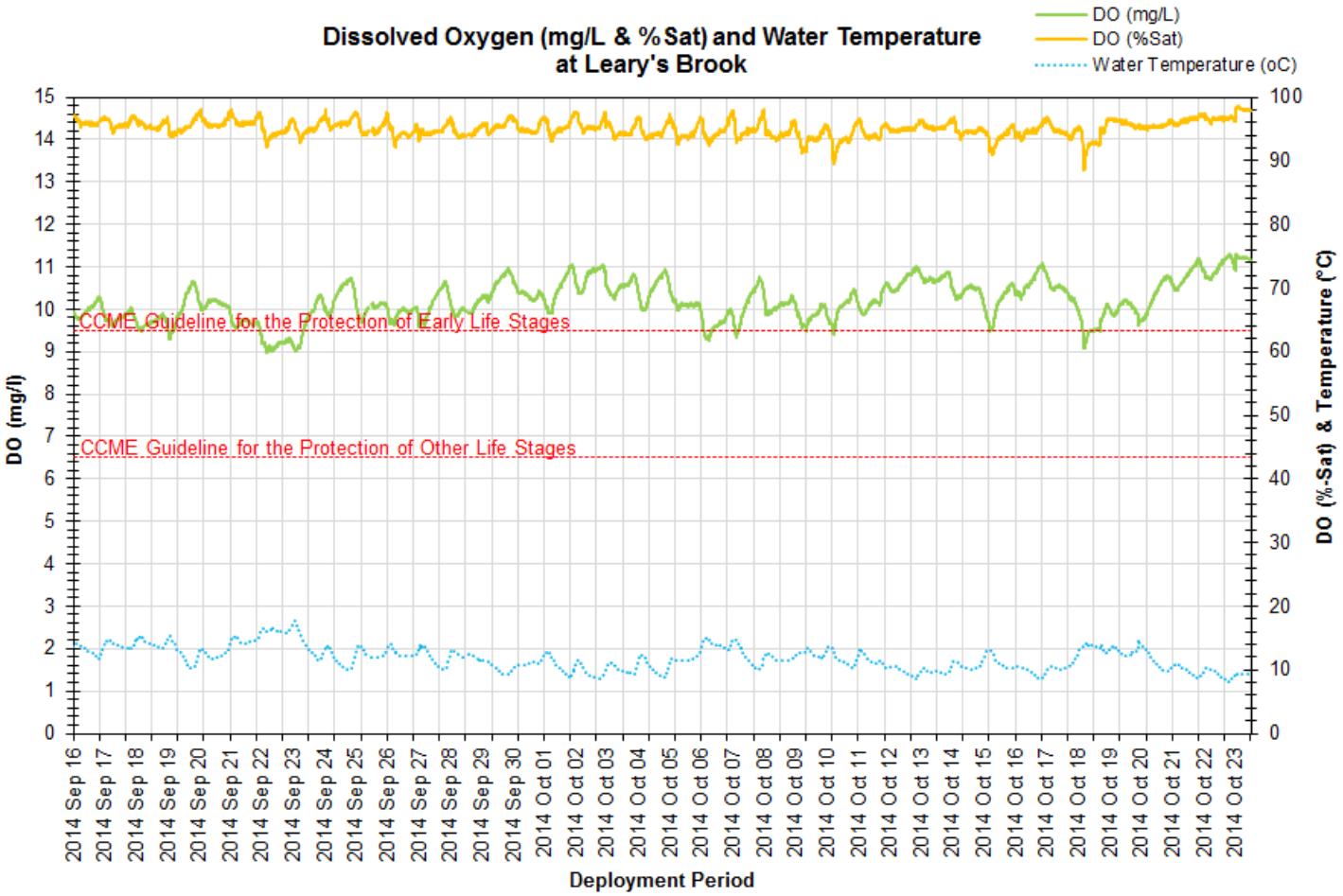

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity readings during this deployment ranged within 0.0 NTU to 195 NTU (Figure 6).

The turbidity events evident on the graph in Figure 6 correspond with precipitation events. This particular brook is influenced by the surrounding urban environment and is very flashy during rainfall events. During rainfall, and the subsequent runoff, comes an increase in sediment and material flowing into the brook and this is what is captured by the turbidity sensor.

This instrument can be impacted by the increased sediment in the brook, sediment packs around the sensors and sometimes can cause irregular readings. The turbidity data was removed from October 3rd to October 9th 2014 as it was not representing the waterway at that time due to the sediment accumulation.

The highest turbidity noted during this deployment period (circled in red) was on October 19th, 2014 this event coincides with rainfall during the same timeframe.

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.

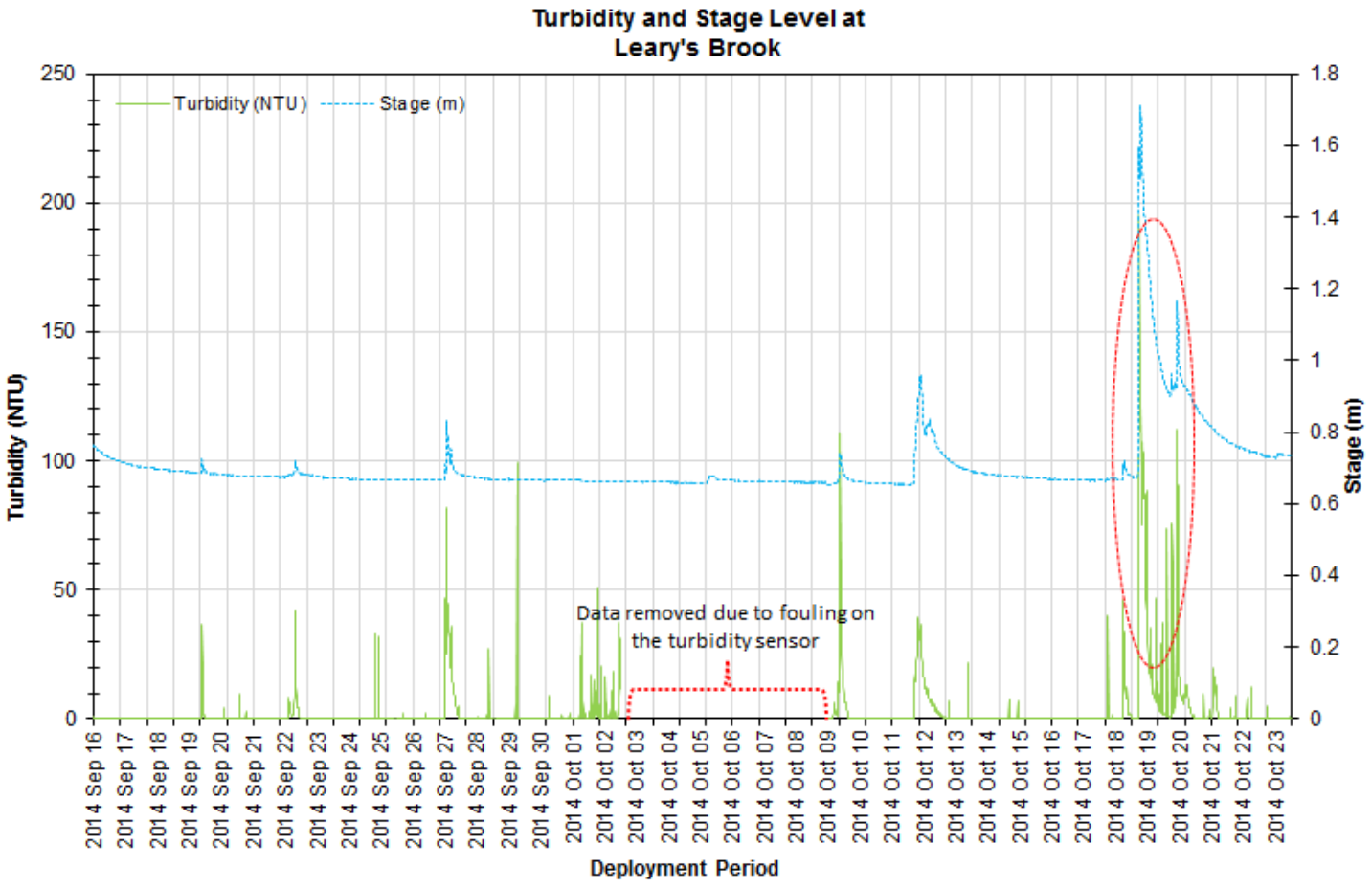

Figure 6: Turbidity (NTU) and Stage (m) values at Leary's Brook Station

Stage and Total Precipitation

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

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

The highest precipitation was recorded on October 19th, 2014 at 51mm total for that day. With the rainfall on October 19th, there is corresponding stage and streamflow increases on the same day.

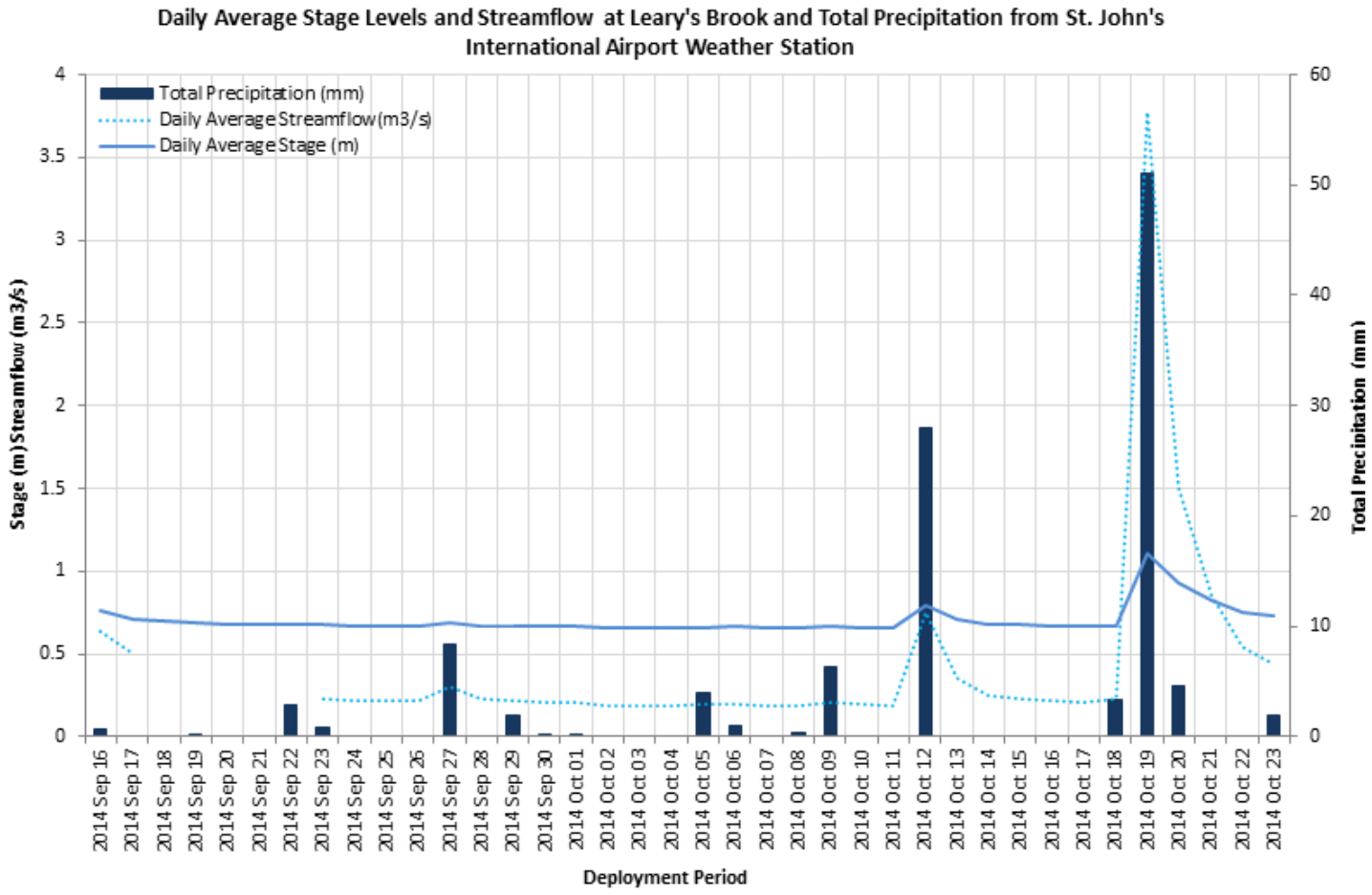

Figure 7: Stage (m) and Streamflow (m3/s) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

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. During the warmer months there were correspondingly warmer water temperatures, which in turn slightly decreased the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 11.6°C, slightly lower than previous deployment month. Water temperature will continue to fluctuate and be influenced by the Fall air temperatures.

The Specific Conductivity median at Leary's Brook was 593.0µS/cm. This conductivity median was higher than the previous deployment.

The median pH value for Leary's Brook Station was 6.05 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 95.1 % Sat during the deployment period. The small dips in DO (mg/L and % Sat) correspond with the water temperatures at those times. The larger dips in DO (mg/L and %Sat) at Leary's Brook correspond with the larger rainfall events.

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