



# Real-Time Water Quality Report Leary's Brook at Prince Philip Drive

Deployment Period  
July 19<sup>th</sup> to September 1<sup>st</sup>, 2022



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## General

The Water Resources Management Division, in partnership with Environment and Climate Change Canada (ECCC), maintains a real-time water quality and water quantity monitoring station at Leary's Brook, adjacent to Prince Phillip Drive in St. John's, Newfoundland.

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 station. Leary's Brook is an urban stream which flows through industrial and commercial areas and is adjacent to a major roadway.

This report covers the period between the July 19<sup>th</sup>, 2022 deployment and September 1<sup>st</sup>, 2022 removal.

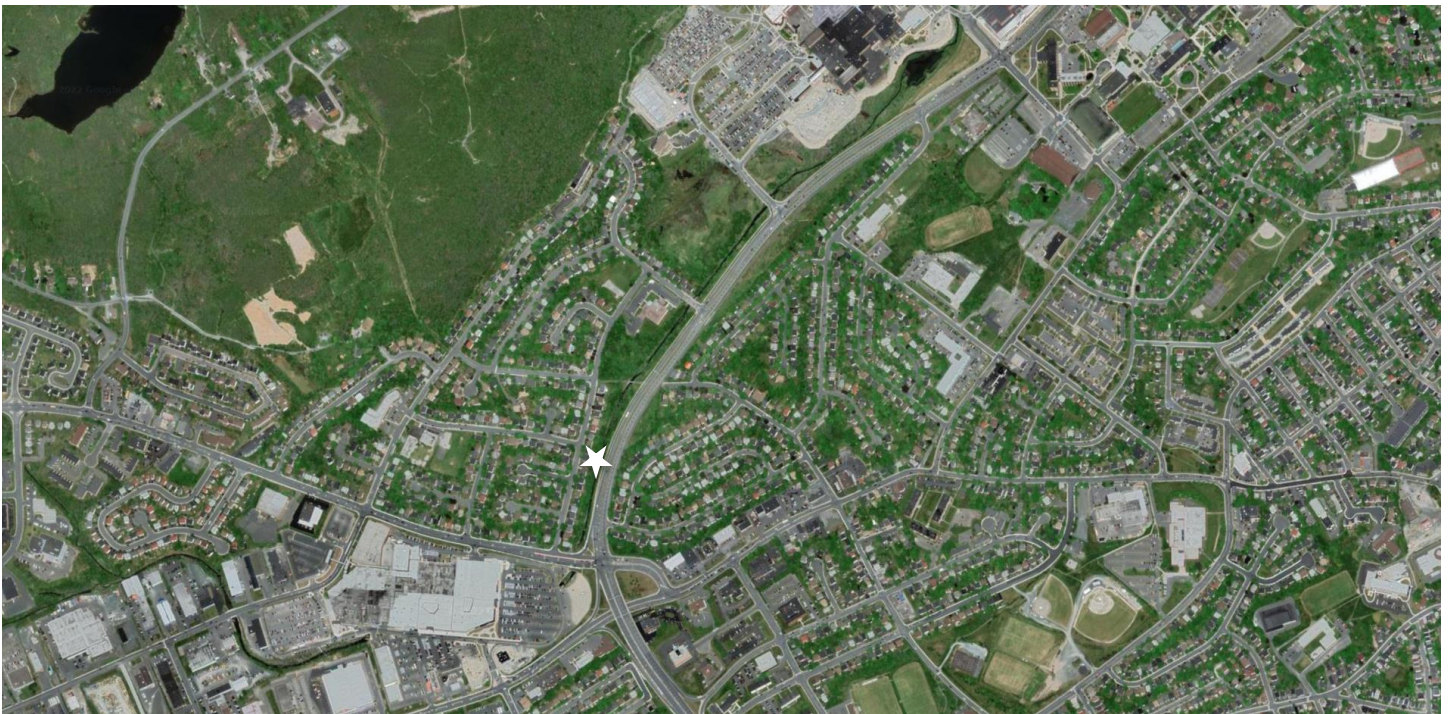


Figure 1 Leary's Brook Real-Time Water Quality and Quantity Station

## Quality Assurance and Quality Control

To ensure the effectiveness and reliability of the real time water quality monitoring program, quality assurance, quality control, and quality assessment procedures have been implemented. 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).

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

The most important sensor on any sonde is the temperature sensor. All other parameters can be divided into subgroups of temperature dependent, temperature compensated, and temperature independent. Due to the temperature sensor's location on the sonde, the entire device 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.

The deployment and removal instrument performance rankings for Leary's Brook for this period 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	July 19, 2022	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	Sept 1, 2022	Removal	Excellent	Good	Excellent	Fair	Poor

At the time of deployment, temperature, pH, dissolved oxygen, and turbidity ranked "Excellent;" and conductivity ranked "Good." At the time of removal, Temperature and Specific Conductivity ranked "Excellent," pH ranked "Good," Dissolved Oxygen ranked "Fair" and Turbidity ranked "Poor." When the sensor was removed on September 1<sup>st</sup>, the metal cage was completely filled with sediment.

## Data Interpretation

The following graphs and discussion illustrate water quality-related events from July 19<sup>th</sup>, 2022 to September 1<sup>st</sup>, 2022 at the Leary's Brook station.

With the exception of water quantity data (stage) and precipitation data, all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Water Survey of Canada (WSC) is responsible for QA/QC of water quantity data. Corrected and finalized data may be retrieved from the WSC website (<http://www.ec.gc.ca/rhc-wsc/>). Precipitation data from the deployment period was retrieved from the ECCC weather station at St. John's International Airport.

## Results

### Water Temperature

- Water temperature ranged from 13.80°C to 21.70°C during this deployment period, with a median value of 17.30°C and a mean value of 17.36°C.
- The water temperature data displayed in Figure 2, is typical of shallow streams and ponds. Water temperatures in shallow streams respond quickly to changes in air temperature. Water temperatures usually fall overnight and rise during daylight hours. As seen in Figure 2, water temperature is also impacted by stage.
- 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.

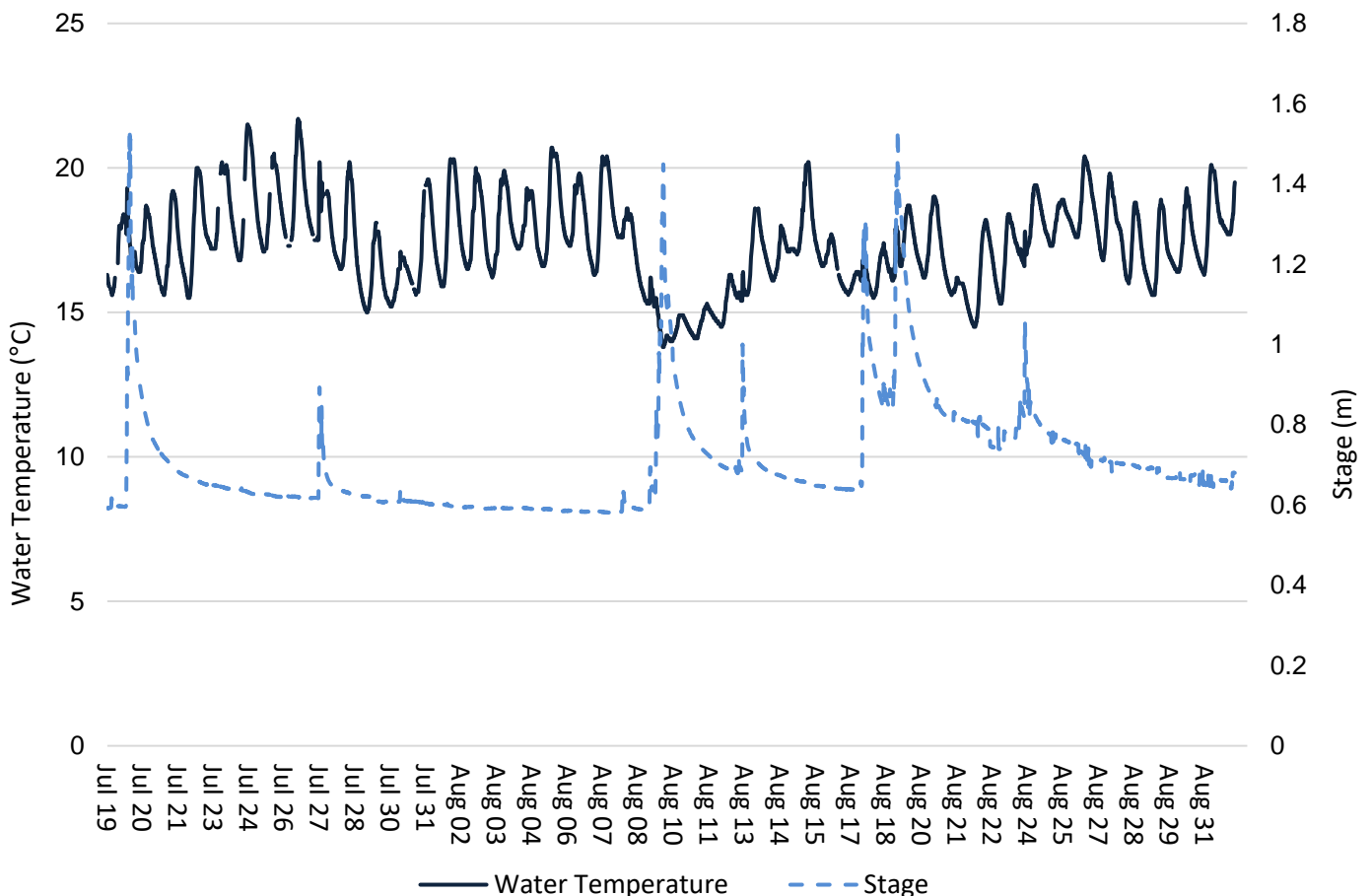


Figure 2 Water Temperature and Stage Level at Leary's Brook

### pH

- Throughout the deployment period, the pH at Leary's Brook Station ranged from 6.27 to 6.91.
- The CCME (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. Naturally, all streams and brooks are different. The median and mean pH at Leary's Brook were both 6.65 for this deployment period. The pH at Leary's Brook mostly falls between the guidelines throughout this deployment; however, at times it was slightly below.
- Figure 3, below, illustrates a slight dip in pH in Leary's Brook (the water becomes more acidic) when stage increases. In general, precipitation entering Leary's Brook has a lower pH than local surface water causing a small reduction in the pH of the brook. Daily fluctuations can be caused by respiration and photosynthesis of aquatic plants and algae.

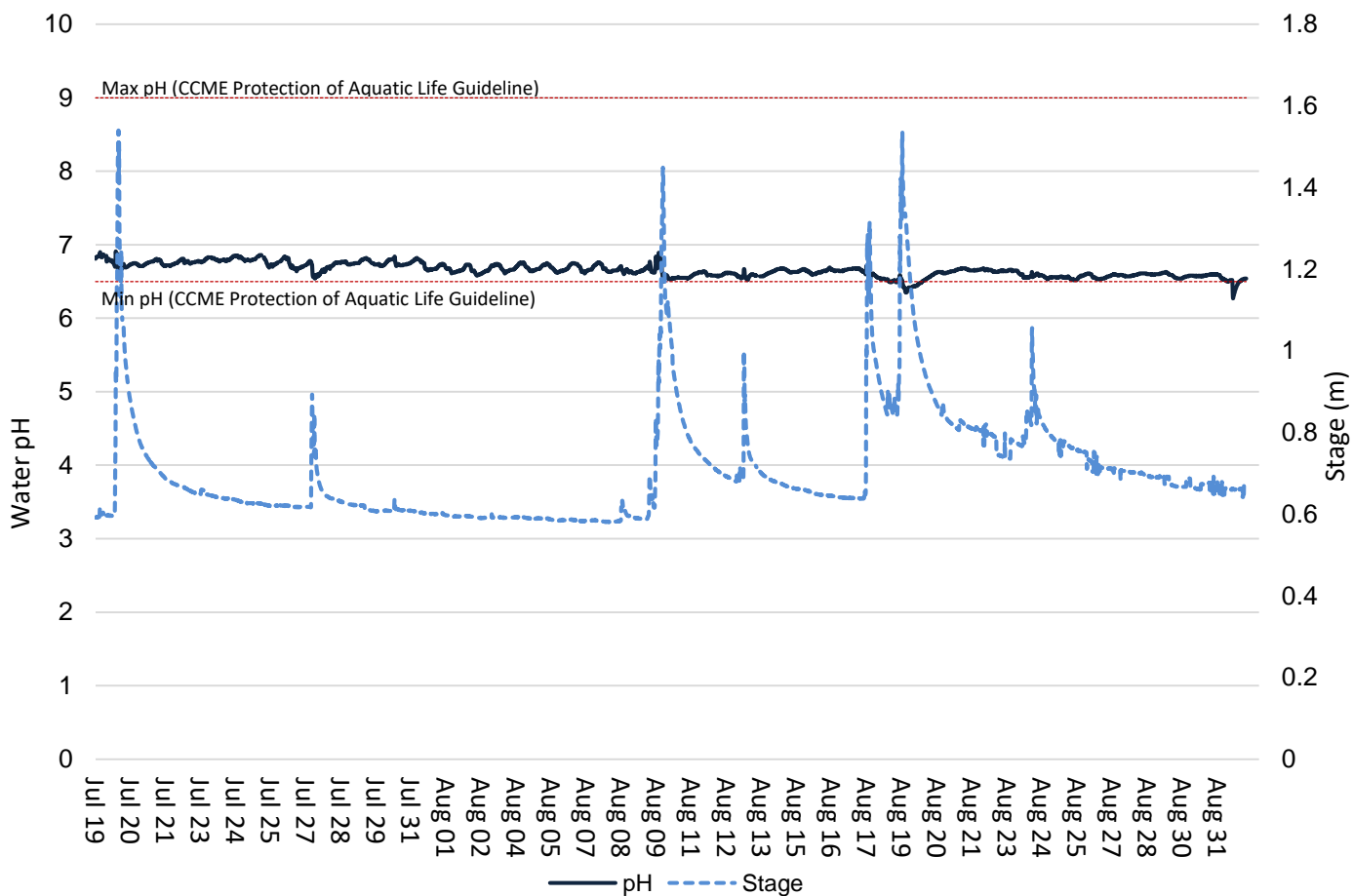


Figure 3 Water pH and Stage at Leary's Brook



### Specific Conductivity

- The conductivity levels ranged from 59.6  $\mu\text{S}/\text{cm}$  to 1162.9  $\mu\text{S}/\text{cm}$  during this deployment period. The median and mean specific conductivities were 716.0  $\mu\text{S}/\text{cm}$  and 744.6  $\mu\text{S}/\text{cm}$  respectively.
- Figure 4 illustrates the downward trend of specific conductivity throughout this deployment period. Precipitation and stage levels were very low during July, which increased specific conductivity. In August when there was more precipitation, specific conductivity levels dropped. Rain water has a lower specific conductivity than Leary's Brook, resulting in a temporary decrease in conductivity as the system is diluted.

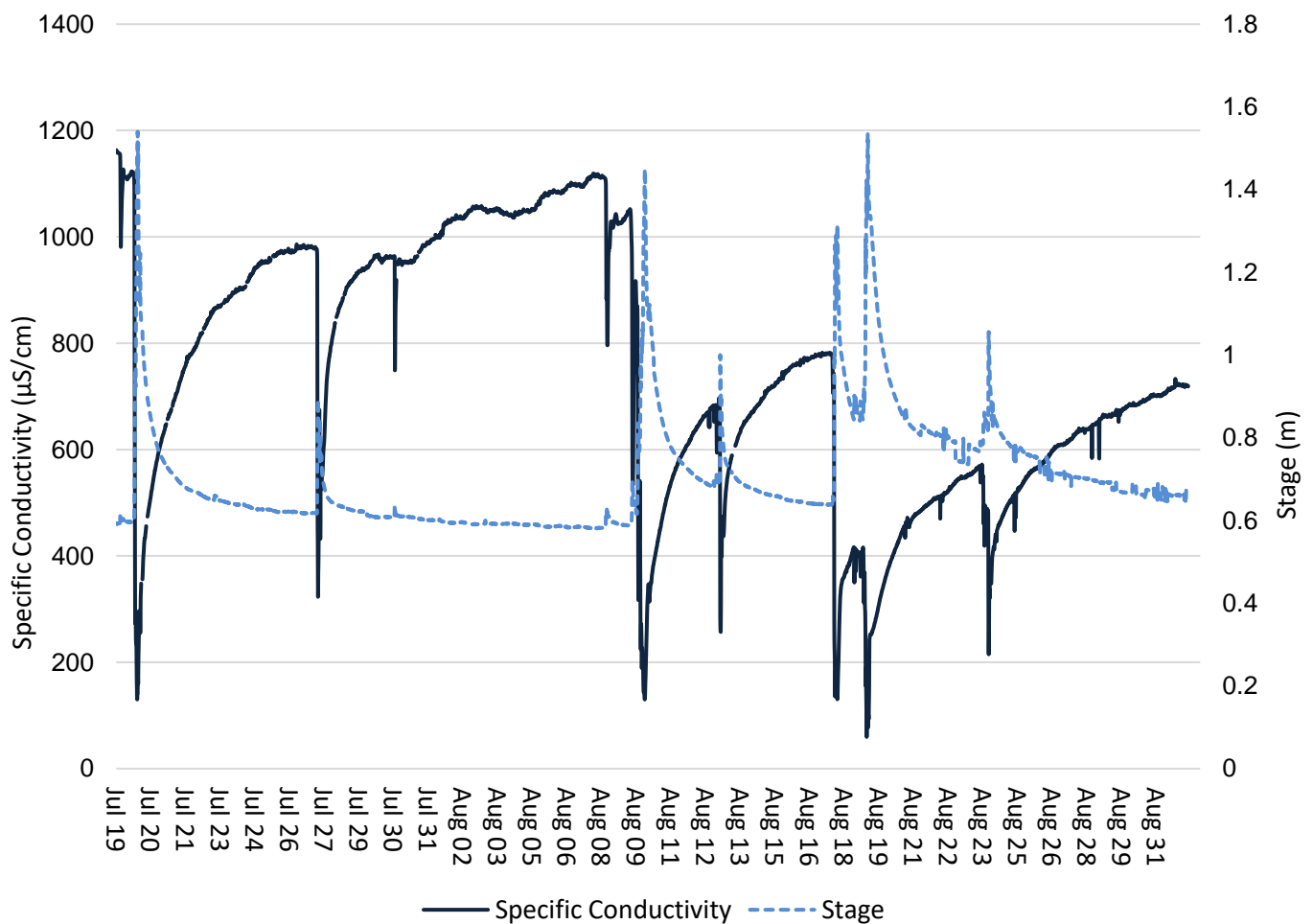


Figure 4 Specific conductivity values at Leary's Brook Station.

### Total Dissolved Solids

- The values for total dissolved solids (TDS) ranged from 0.0381 g/mL to 0.7440 g/mL during this deployment period. The median and mean for TDS were 0.4580 g/mL and 0.4765 g/mL respectively.
- TDS is calculated from the conductivity and temperature probes. Pure water has low conductivity. Electrical currents are conducted by ions in solution, so increases in TDS will result in an increase in conductivity. Figure 5, below, illustrates how an increase to stage can lead to a decrease in TDS during seasons when road salts are not applied to nearby surfaces.

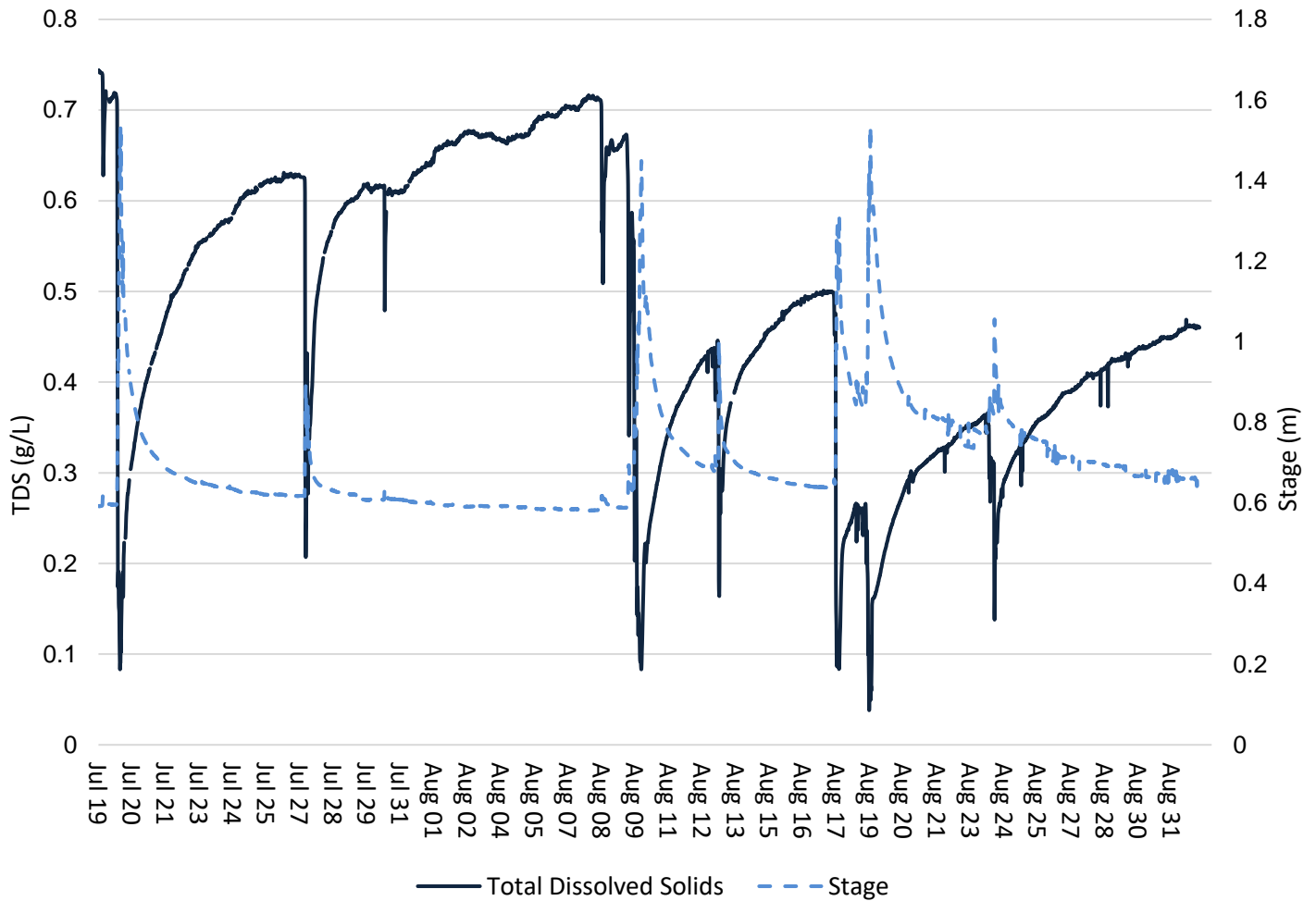


Figure 5 Total Dissolved Solids in Water and Stage Level at Leary's Brook.

### Dissolved Oxygen

- The sonde measures dissolved oxygen (DO) (mg/L) and then calculates the percent saturation (% Sat) using the dissolved oxygen and temperature sensors.
- The DO % sat levels during the deployment period ranged from 75.6% to 98.6%, with a median and mean value of 94.0% and 93.4% respectively. Dissolved oxygen (mg/L) measured from 6.94 mg/L to 10.01 mg/L, with a median and mean value of 8.85 mg/L and 8.81 mg/L respectively. The dissolved oxygen (mg/L) values were above the minimum dissolved oxygen CCME Guidelines for the protection of other life stages throughout the deployment period; however, the dissolved oxygen levels dropped below the CCME guideline for the protection of early stage life throughout most of the deployment.
- Small decreases in available oxygen are associated with increases in water temperature, because warm water can hold less dissolved oxygen than cold water.

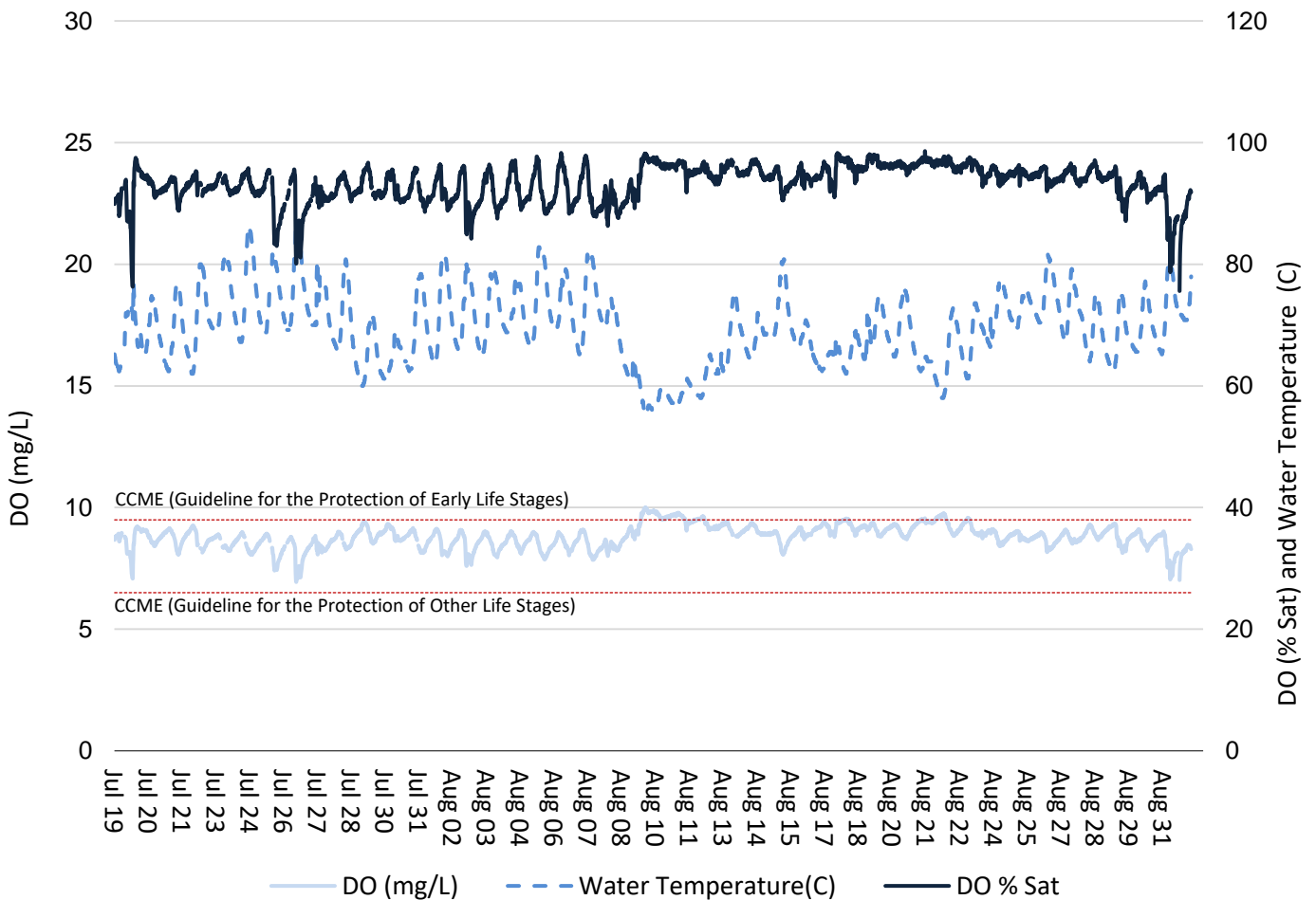


Figure 6 Dissolved oxygen (mg/L & % Sat) and water temperature (°C) values at Leary's Brook Station.

### Turbidity

- The turbidity readings during this deployment ranged between 0.0 NTU to 113.9 NTU with median and mean values of 0.8 NTU and 3.6 NTU respectively.
- Increases in turbidity (cloudiness) are usually caused by increased runoff during precipitation events. Runoff carries silt and other debris into Leary's Brook. Upstream construction and the inadequate control of silt-laden runoff can also cause turbidity to increase. As shown in figure 7, most turbidity increases during this period correlate with runoff from precipitation events. Construction occurred near Leary's Brook station during this deployment period, which may have contributed to turbidity levels. Turbidity data after Aug 24<sup>th</sup> was removed due to sensor error. Upon removal, the metal cage was filled with gravel which may have impacted the results.

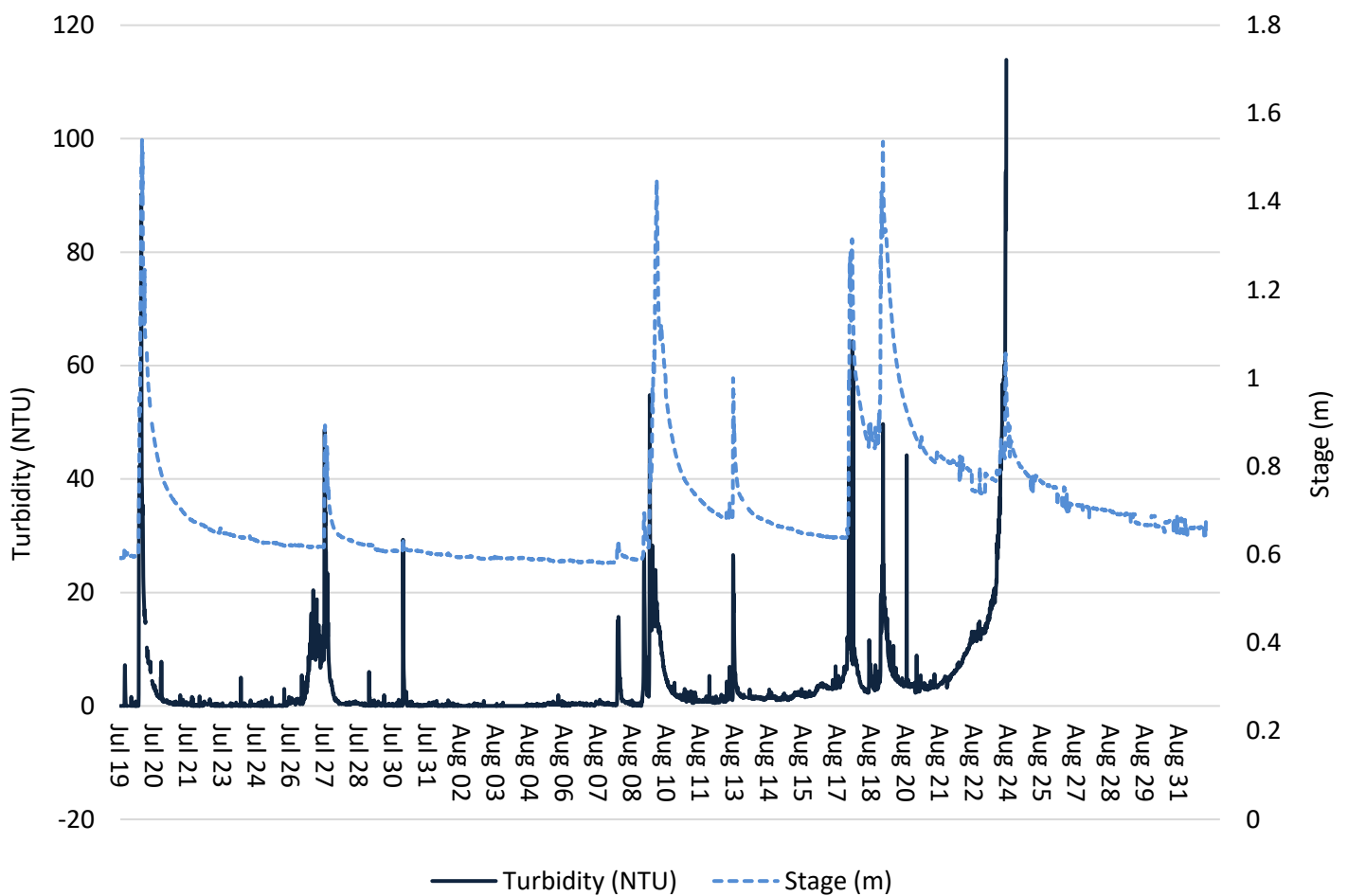


Figure 7 Turbidity (NTU) values at Leary's Brook Station

### Stage and Total Precipitation

- Figure 8, below, shows daily total precipitation data from the Pippy Park weather station and the daily average stage. Stage levels were relatively low throughout much of the deployment.
- Please note that the stage 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.
- Stage (and streamflow) usually varies significantly throughout a deployment period. Leary's Brook is an urban stream system that is subject to significant runoff; the river is considered 'flashy,' increasing and decreasing stage and streamflow quickly.

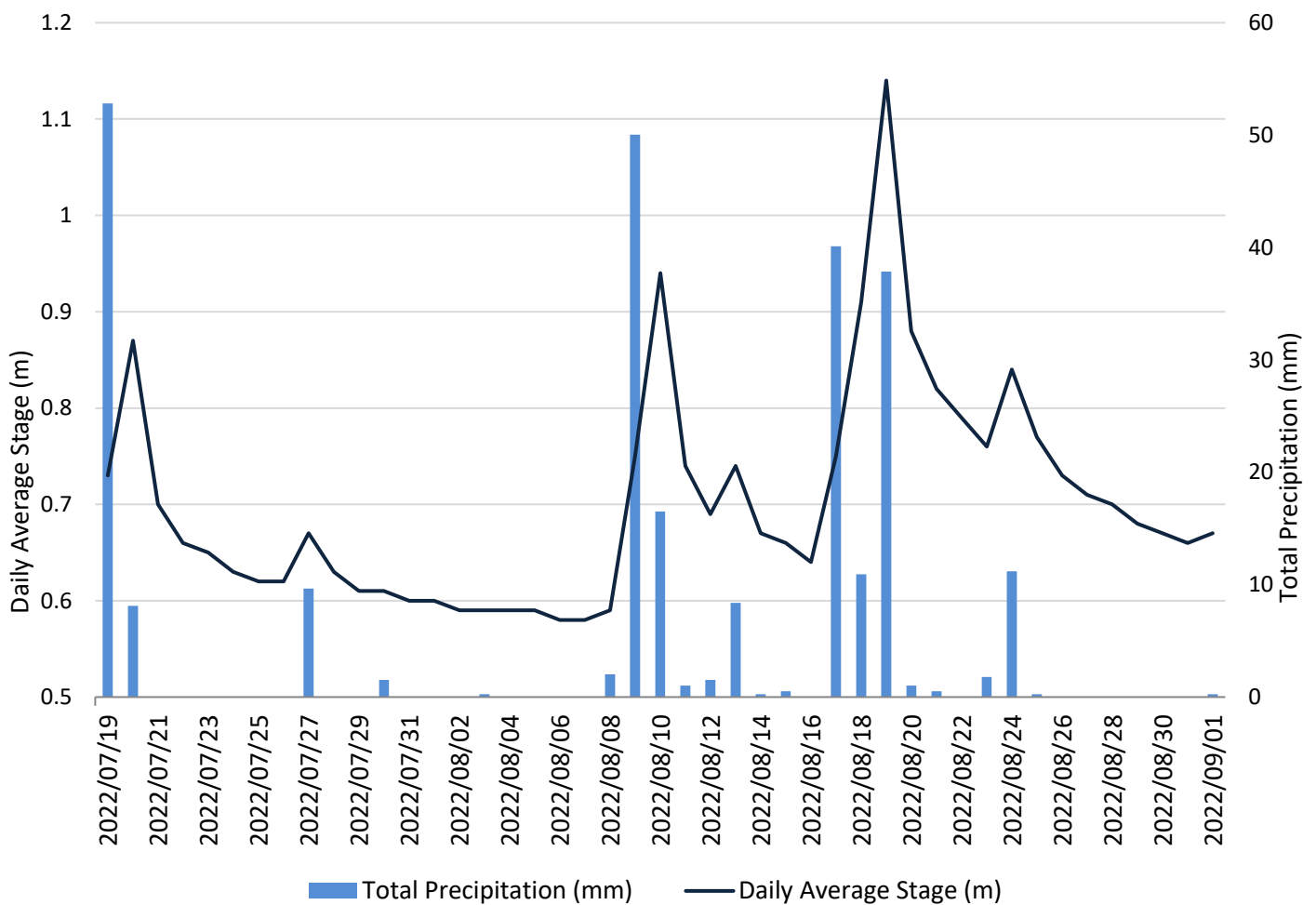


Figure 8 Daily average stage values (m) from Leary's Brook and daily total precipitation values (mm) from Pippy Park weather station.

## Conclusions

In both natural and developed environments, climate and weather conditions can contribute to variations in water quality. Leary's Brook is an urban stream surrounded by heavily developed land, so it is expected that observed and recorded changes in Leary's Brook water quality are related to anthropogenic disturbances or effects.

Precipitation and runoff events during the deployment period led to expected increases in stage, thus influencing the water temperature, DO, turbidity, pH, specific conductance, and TDS. The stage data series has an increasing trend during the deployment period, due to the rainfall events in August. During this deployment period, the median water temperature at the Leary's Brook station was 17.3°C. The median pH for Leary's Brook Station was 6.65. Increased turbidity levels can periodically be associated with upstream disturbances and construction, although most often they are caused by precipitation runoff. Runoff can carry sediments into the brook overland and via storm drains. Specific conductivity had a median value of 716 µS/cm. TDS had a median value of 0.4580 g/mL during the deployment period. Dissolved Oxygen at Leary's Brook had a median of 94% saturation and 8.85 mg/L during the deployment period. Small decreases in DO (mg/L and % Sat) correspond with increases in water temperatures. Dissolved oxygen levels were above the CCME Aquatic Life guidelines for the protection of other life stages during this deployment period.