Real-Time Water Quality Report
Teck: Duck Pond Operations

East Pond Brook

Deployment Period
June 29th, 2023 to August 23, 2023

Newfoundland Labrador

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

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General

This report will review the water quality data for the following real-time water quality monitoring station at TECK Duck Pond: East Pond Brook below East Pond, for the duration of June 29, 2023 through to August 23, 2023.

This station is a part of the Real-Time Water Quality Network. The stations are maintained by the Department of Environment and Climate Change, Water Resources Management Division (WRMD). WRMD staff are responsible for the maintenance and calibration of the water quality instruments deployed at these sites. The data recorded by the real-time water quality stations is available on the real-time website (Real Time Water Quality Monitoring Program - Environment and Climate Change (gov.nl.ca)).

For the purposes of this report, air temperature and total precipitation data were used from the weather station located in Millertown. The data was retrieved from https://climate.weather.gc.ca/.

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

	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

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 this period are summarized in Table 2.

Note: East Pond Brook experienced transmission and power issues during this deployment. The sonde was removed for maintenance August 23/23, No field sonde reading was taken at that time. Power issues also resulted in sporadic loss of internally logged data during this period. During the removal phase a new Deployment Cable was installed along with the replacement sonde, for the next deployment period.

Table 2 Instrument performance rankings

Station	**Date**	**Action**	**Comparison Ranking**				
			Temp	**pH**	**Sp. Cond.**	**DO**	**Turbidity**
East Pond Brook below East Pond	June 29, 2023	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	August 23, 2023	Removal	Not Ranked	Not Ranked	Not Ranked	Not Ranked	Not Ranked

Results

Water Temperature

Water Temperature is a crucial factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation.

The water temperature at East Pond Brook ranged from 17.10°C to 28.07°C (Table 3). Water temperatures were fairly stable through July, but temperature data is not available for August. Daily fluctuations are observed with higher temperatures during the day and lower temperatures at night.

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.

Table 3. Statistical temperature data for East Pond Brook from June 29, 2023 to August 23, 2023.

Station	Max	Min	Median	Mean
East Pond Brook	28.07	17.10	21.26	21.66

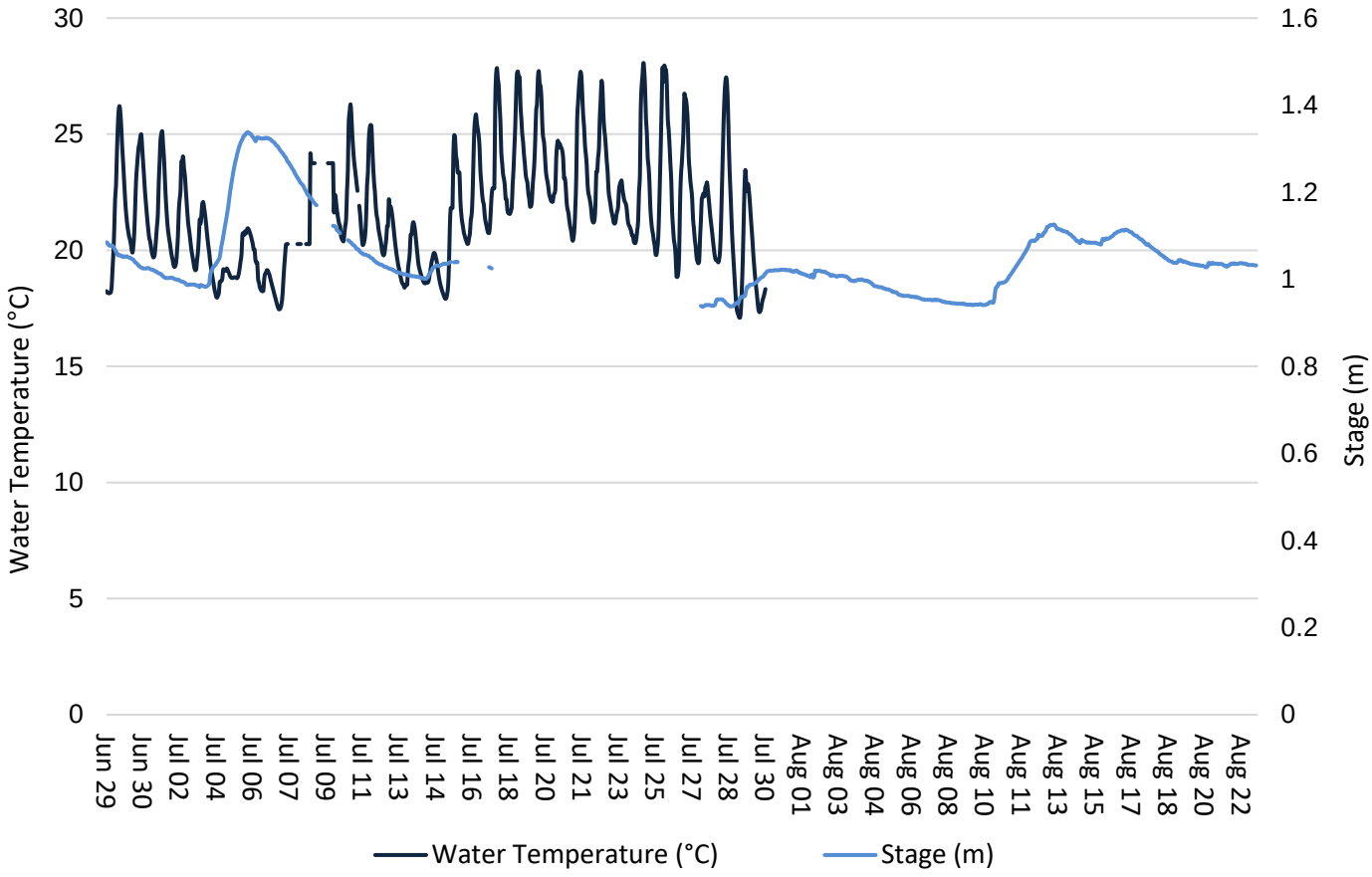

Figure 1 Water Temperature and Stage Level at East Pond Brook.

pH

pH indicates the acidity or alkalinity of a solution. A value of 7.00 pH units denotes a neutral solution. Lower values are acidic, and higher values are basic. pH at East Pond Brook ranged from 6.35 pH units to 6.91 pH units during July. Data was unavailable for most of August due to station issues.

pH is influenced by precipitation runoff and tends to decrease as stage increases. During periods of drier or colder weather, water levels decline and pH increases slightly as dissolved ions are not as diluted. pH levels at both locations fluctuated daily and during stage events. Daily fluctuations can be caused by the respiration and photosynthesis of aquatic plants and algae, which become more abundant during the spring and summer seasons.

The CCME guideline noted on the pH graph is a range by which to compare pH levels across Canada. It does not indicate the health of the brook. Due to the soil composition and natural geology of Newfoundland and Labrador, many of the brooks and waterways in the province have naturally lower pH ranges. East Pond Brook pH values hovered around the minimum guideline during July.

Stage Level data is raw data. This data has not been corrected. Corrected and finalized data, can be retrieved from the Environment Climate Change Canada, Water Survey of Canada website https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html

Table 4. Statistical pH data for East Pond Brook for June 29, 2023 to August 23, 2023.

Station	Max	Min	Median	Mean
East Pond Brook	6.91	6.35	6.59	6.59

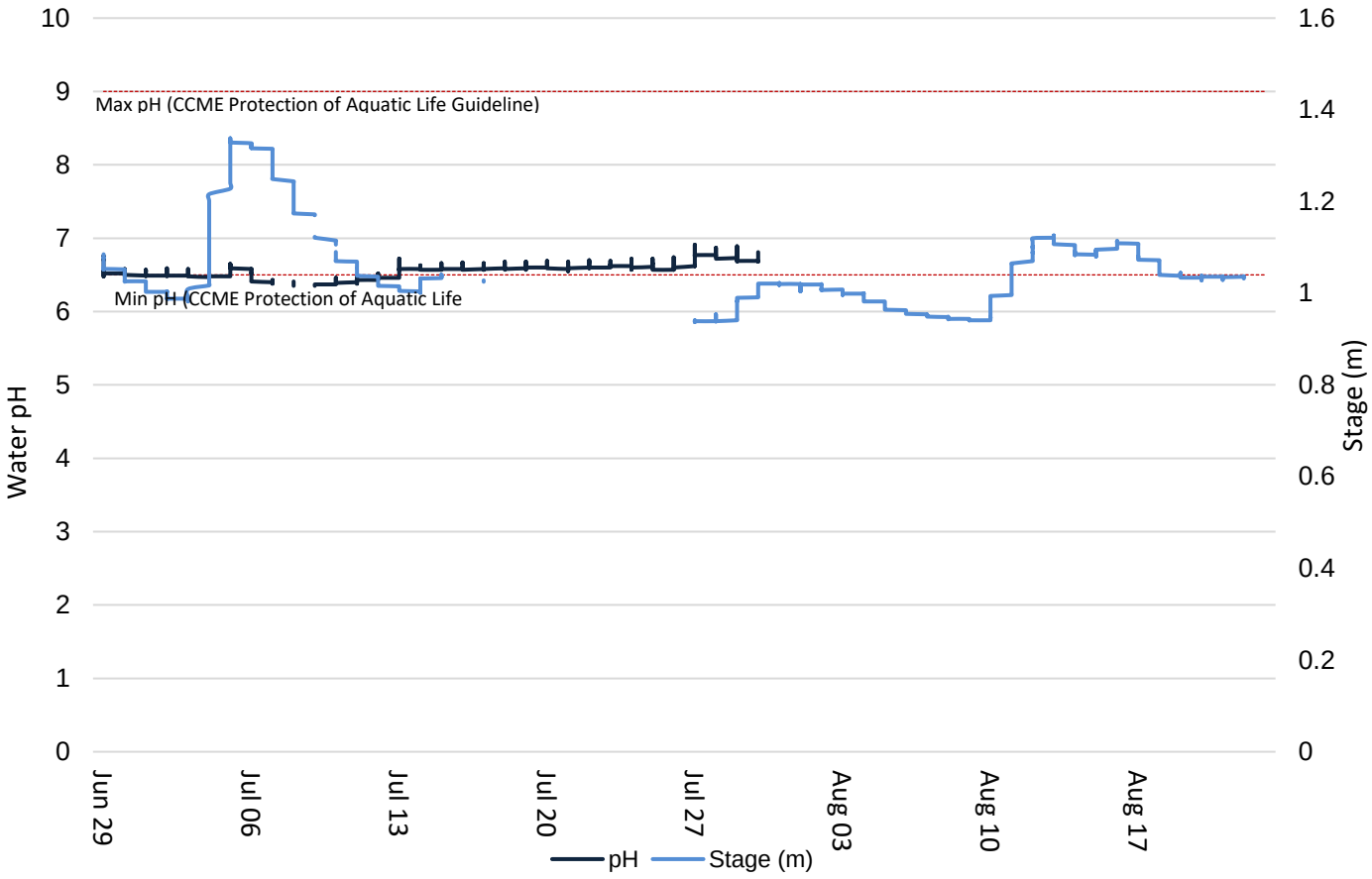

Figure 2. Water pH and Stage at East Pond Brook

Specific Conductivity

Conductivity relates to the ability of an electric charge to pass through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance), while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25°C to allow comparison across variable temperatures.

Conductivity showed an increasing trend throughout the deployment. Specific conductivity at East Pond Brook ranged from 23.0 µS/cm to 36.4 µS/cm in July (Table 5). Data is unavailable for August due to station transmission issues. An increase in stage July 5th corresponded to a decrease in specific conductivity, because rainwater has low specific conductivity and the system becomes diluted.

Stage Level data is raw data. This data has not been corrected. Corrected and finalized data may be retrieved from the Environment Climate Change Canada, Water Survey of Canada website https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html

Table 5. Statistical conductivity data for East Pond Brook for June 29, 2023 to August 23, 2023.

Station	Max	Min	Median	Mean
East Pond Brook	36.4	23.0	27.7	28.7

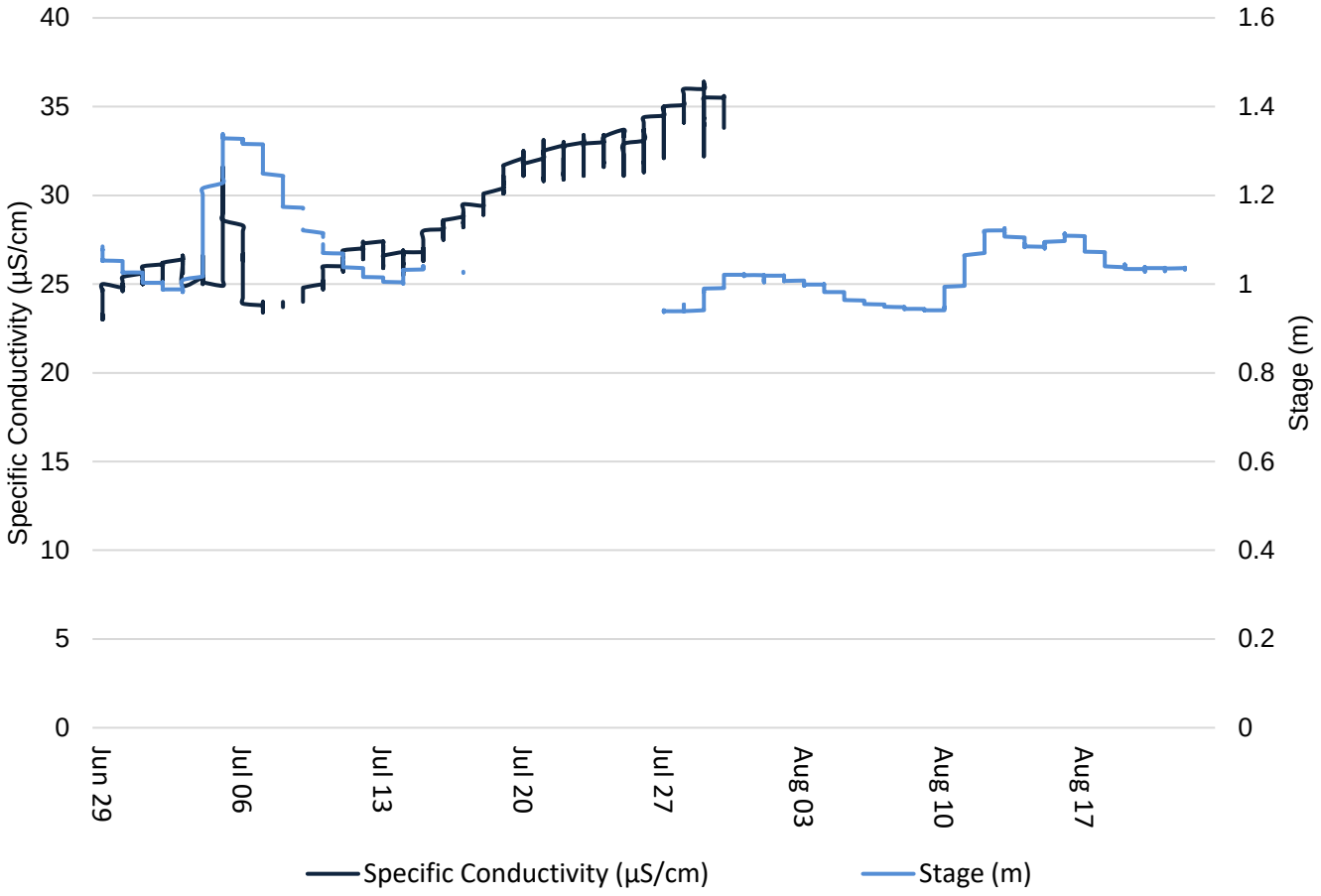

Figure 3. Specific conductivity values at East Pond Brook.

Dissolved Oxygen

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The amount of dissolved oxygen in water depends on several factors, particularly temperature. The saturation of oxygen in water is inversely proportional to water temperature of the water body. Cooler water can hold more dissolved oxygen. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments or riverine pools. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.

East Pond Brook had a minimum dissolved oxygen concentration of 7.09 mg/L, and it had a maximum dissolved oxygen concentration of 8.83 mg/L during July. Data is unavailable for August.

Dissolved oxygen was below the CCME guidelines for the protection of early life stages throughout deployment in July.

Table 6. Statistical Dissolved Oxygen data for East Pond Brook for June 29, 2023 to August 23, 2023.

Station	Max	Min	Median	Mean
Dissolved Oxygen (mg/L)				
East Pond Brook	8.83	7.09	8.13	8.10
Dissolved Oxygen (%Sat)				
East Pond Brook	96.0	85.0	91.5	91.6

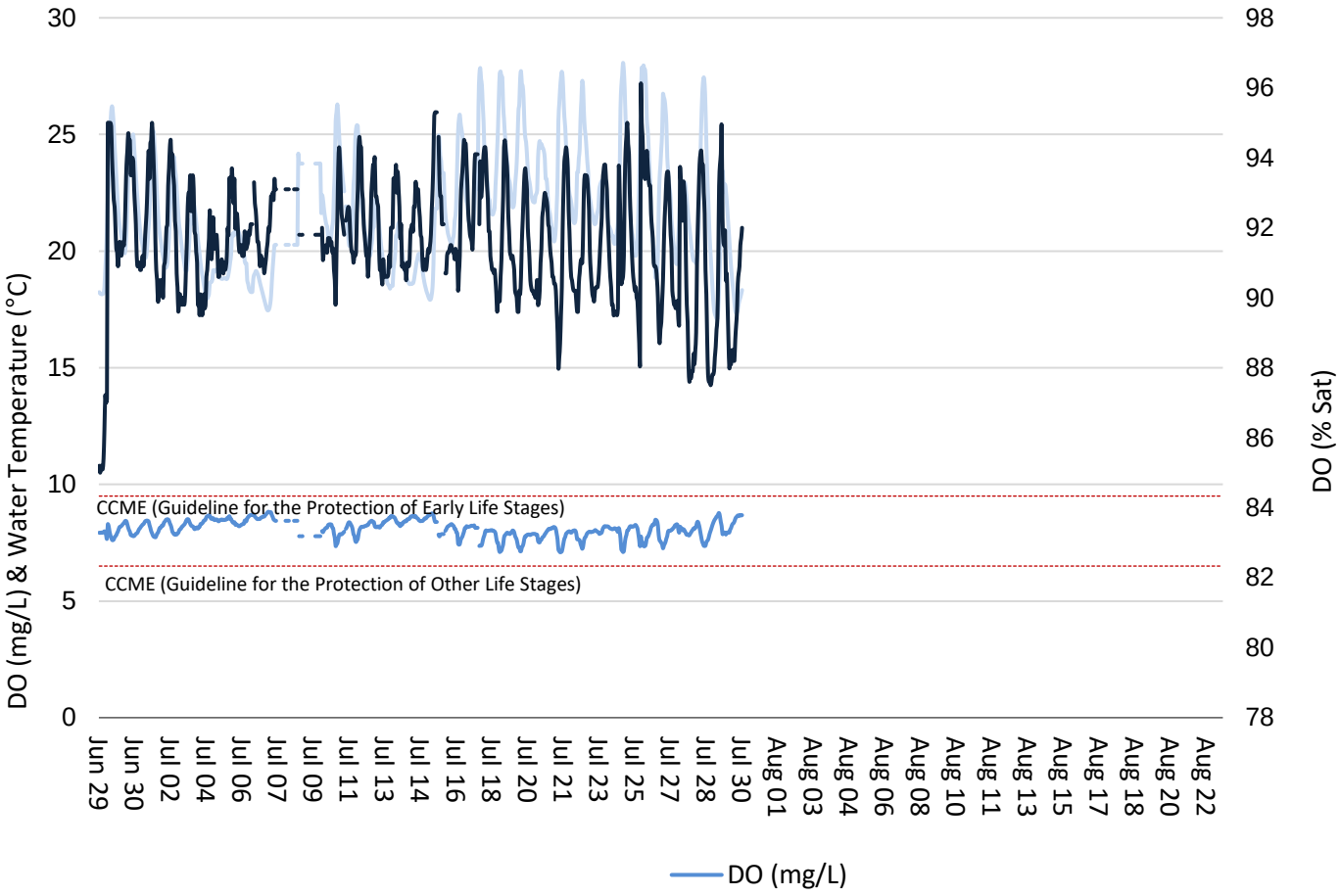

Figure 4. Dissolved oxygen (mg/L & % Sat) and water temperature (°C) values at East Pond Brook

Turbidity

Turbid or cloudy water is typically caused by fine suspended solids, such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, harming plant and phytoplankton growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and sediment can cover critical spawning areas.

Turbidity levels at East Pond Brook during this deployment in July were generally low. Data from July 17th until the end of deployment was removed from East Pond Brook due to sensor malfunction. Higher than normal values of 83.6NTU on July ??? are likely due to debris blocking the sensor.

Stage Level data is raw data. This data has not been corrected. Corrected and finalized data may be retrieved from the Environment Climate Change Canada, Water Survey of Canada website https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html

Table 7. Statistical turbidity data for East Pond Brook for June 29, 2023 to August 23, 2023.

Station	Max	Min	Median	Mean
East Pond Brook	83.8	0.0	0.0	0.7

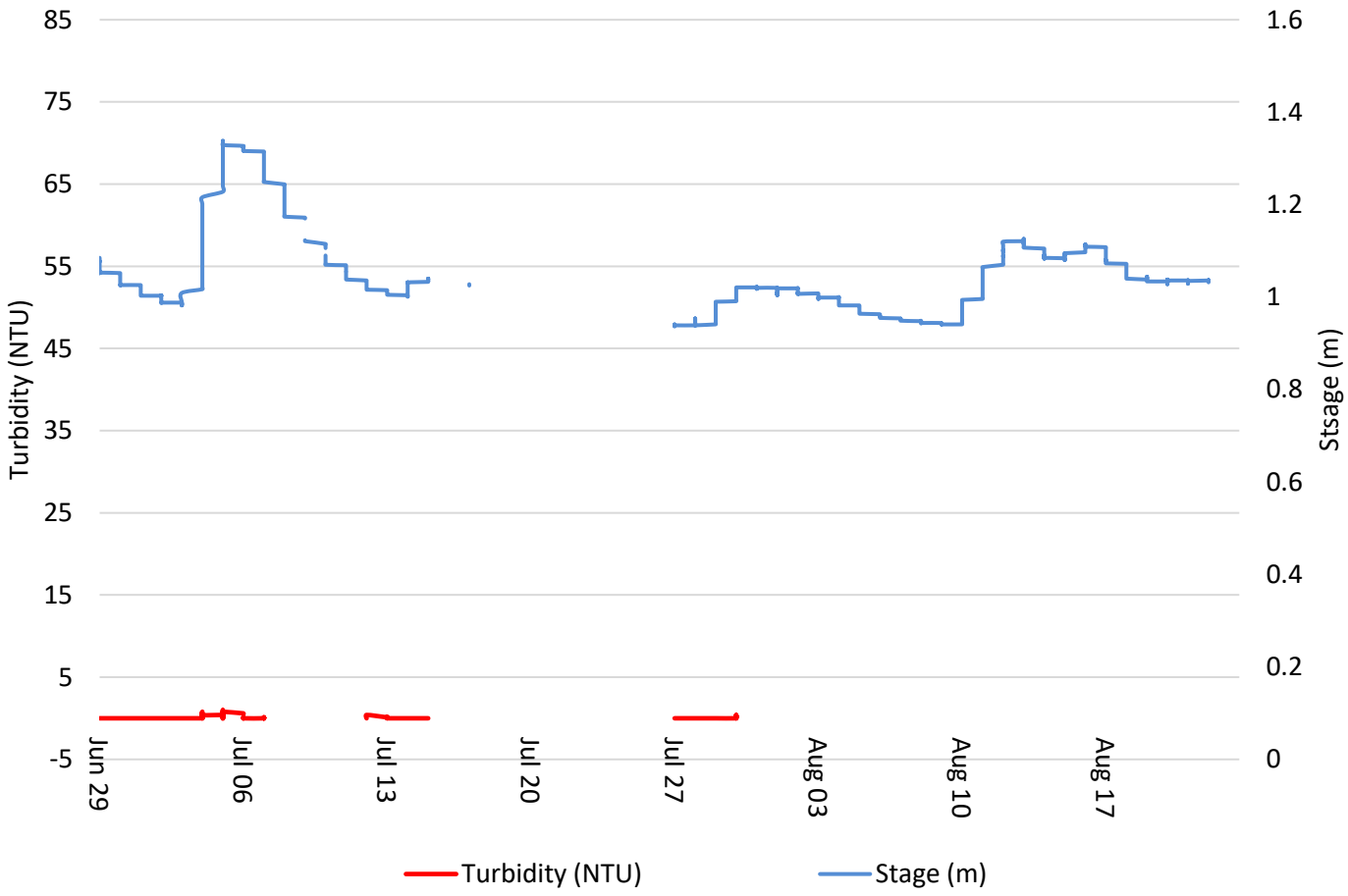

Figure 5. Turbidity (NTU) values at East Pond Brook.

Stage and Total Precipitation

Figure 6, below, shows daily total precipitation data from Millertown weather station and the daily average stage at each site.

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.

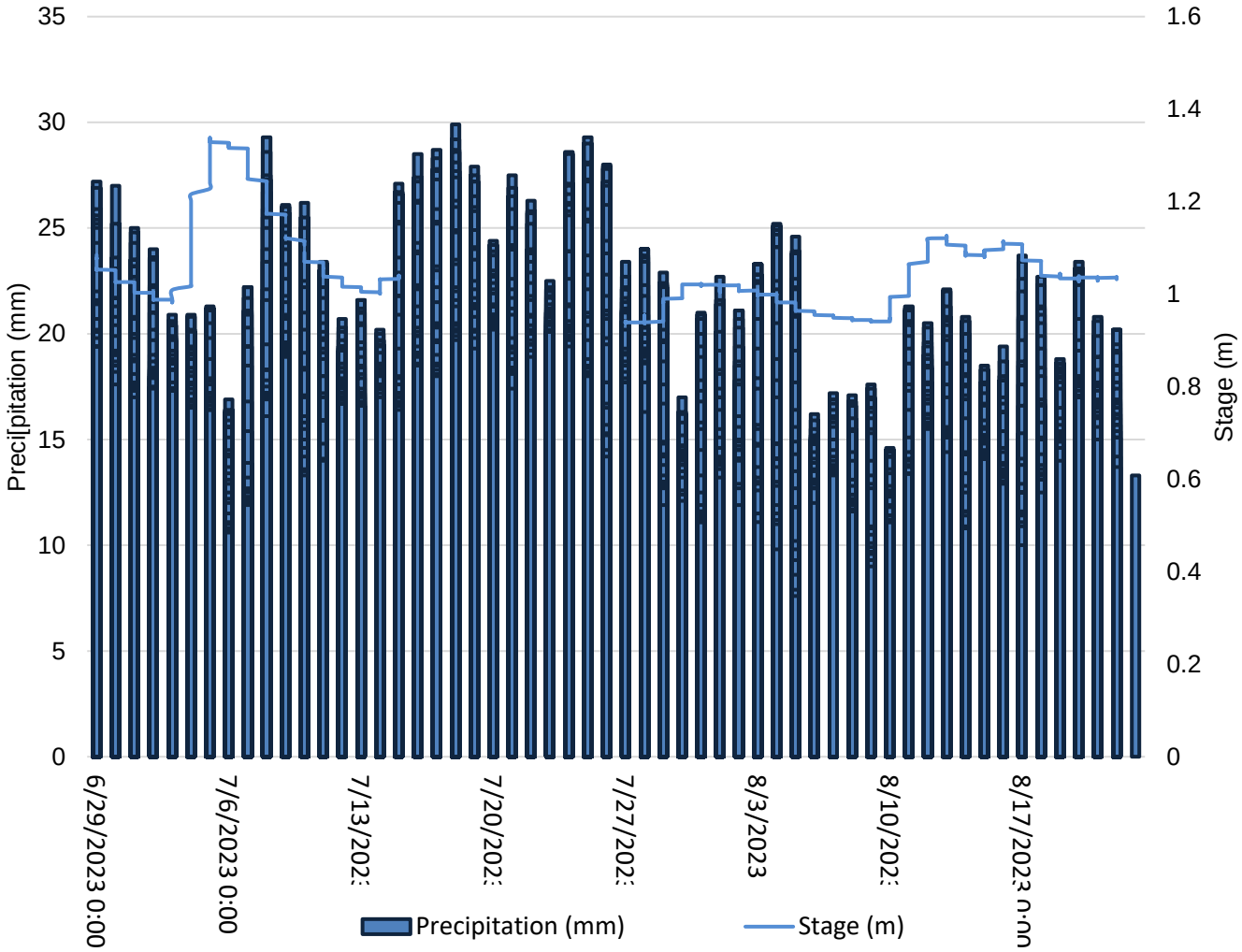

Figure 6 Daily average stage values (m) from East Pond Brook and daily total precipitation values (mm) from Millertown.