

# Real Time Water Quality Deployment Report

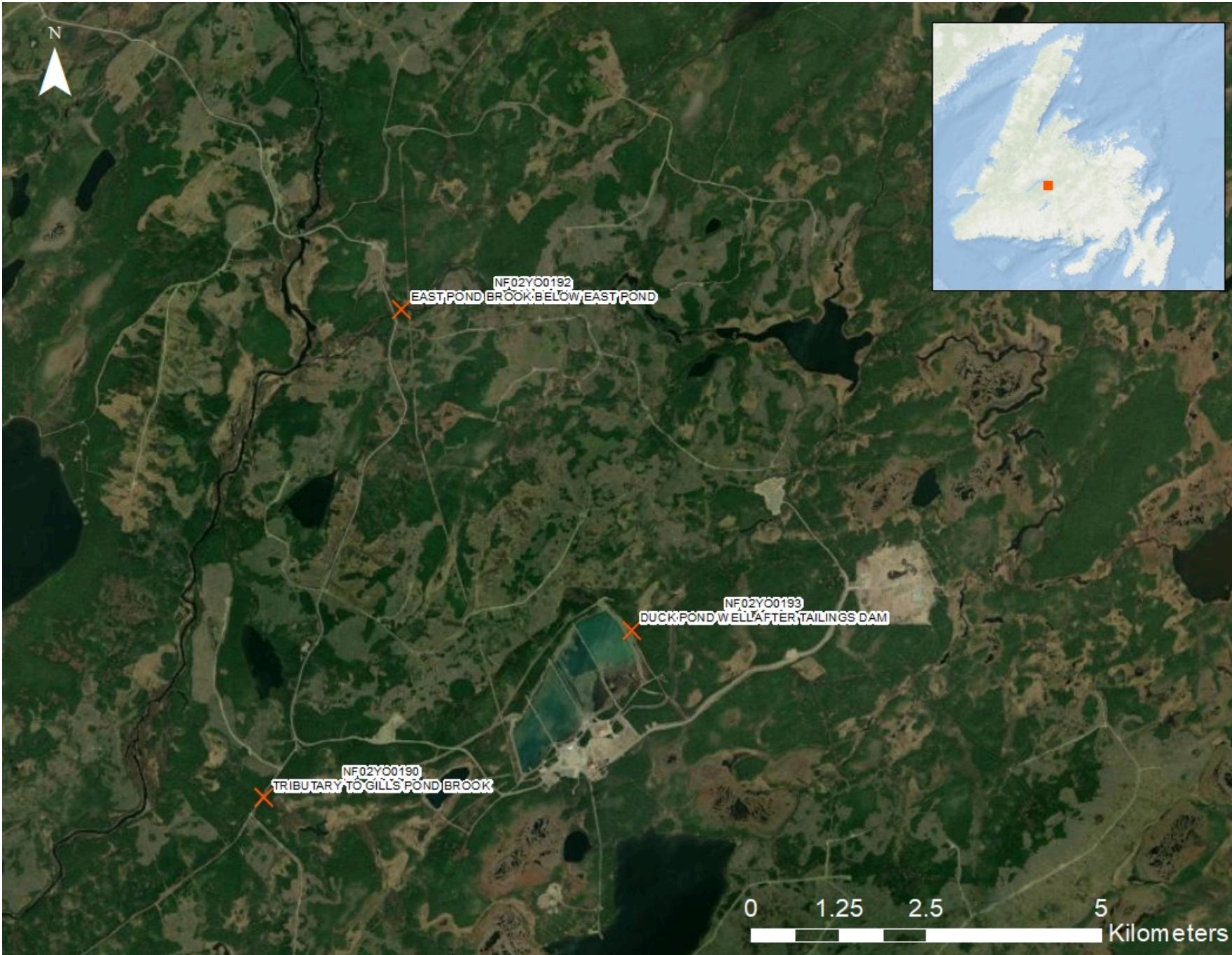
## TECK: Duck Pond Operations

### NF02YO0190 & NF02YO0192

2024-05-22 to 2024-07-29



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



# TECK: Duck Pond Operations

This report will review the water quality data for the following two real-time water quality monitoring stations at TECK Duck Pond Operations: Tributary to Gills Pond Brook and East Pond Brook below East Pond, for the duration of 2024-05-22 through to 2024-07-29.

These stations are 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 [WRMD's website](#).

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

\*New instruments were installed at East Pond Brook below East Pond and Tributary to Gill's Pond Brook on 2024-05-22. Stations were previously equipped with Hydrolab DS5s which were upgraded to Hydrolab HL7s.

# 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. With the exception of water quantity data (stage), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Corrected data can be obtained upon request.

Parameter	Excellent	Good	Fair	Marginal	Poor
Dissolved oxygen	$\leq \pm 0.3 \text{ mg/L}$	$\leq \pm 0.31 - 0.5 \text{ mg/L}$	$\leq \pm 0.51 - 0.8 \text{ mg/L}$	$\leq \pm 0.81 - 1 \text{ mg/L}$	$> \pm 1 \text{ mg/L}$
pH	$\leq \pm 0.2 \text{ units}$	$\leq \pm 0.21 - 0.5 \text{ units}$	$\leq \pm 0.51 - 0.8 \text{ units}$	$\leq \pm 0.81 - 1 \text{ units}$	$> \pm 1 \text{ units}$
Specific Conductance	$\leq \pm 3 \mu\text{S}/\text{cm}$ or $\leq \pm 3\%$ , whichever is greater	$\leq \pm 3.1 - 10 \mu\text{S}/\text{cm}$ or $\leq \pm 3.1 - 10\%$ , whichever is greater	$\leq \pm 10 - 15 \mu\text{S}/\text{cm}$ or $\leq \pm 10.1 - 15\%$ , whichever is greater	$\leq \pm 15.1 - 20 \mu\text{S}/\text{cm}$ or $\leq \pm 15.1 - 20\%$ , whichever is greater	$> \pm 20 \mu\text{S}/\text{cm}$ or $> \pm 20\%$ , whichever is greater
Turbidity	$\leq \pm 2$ turbidity units or $\leq \pm 5\%$ , whichever is greater	$\leq \pm 2.1 - 5$ turbidity units or $\leq \pm 5.1 - 10\%$ , whichever is greater	$\leq \pm 5.1 - 8$ turbidity units or $\leq \pm 10.1 - 15\%$ , whichever is greater	$\leq \pm 8.1 - 10$ turbidity units or $\leq \pm 15.1 - 20\%$ , whichever is greater	$> \pm 10$ turbidity units or $> \pm 20\%$ , whichever is greater
Water Temperature	$\leq \pm 0.2^\circ\text{C}$	$\leq \pm 0.21 - 0.5^\circ\text{C}$	$\leq \pm 0.51 - 0.8^\circ\text{C}$	$\leq \pm 0.81 - 1^\circ\text{C}$	$> \pm 1^\circ\text{C}$

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 parameters recorded by the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality.

There are a few circumstances which may cause QA/QC rankings below excellent, including the placement of the QA/QC sonde in relation to the field sonde, the amount of time each sonde was given to stabilize before readings were recorded, and deteriorating performance of one of the sensors.

The temperature sensor on any sonde is the most important. 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 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.

## QAQC Rankings

Station	Parameter	Deployment Rank	Grab Sample Rank	Removal Rank
East Pond Brook	Dissolved Oxygen (mg/l)	Excellent		Good
East Pond Brook	pH	Good	Excellent	Good
East Pond Brook	Specific Conductivity ( $\mu\text{S}/\text{cm}$ )	Good	Fair	Good
East Pond Brook	Temperature ( $^\circ\text{C}$ )	Excellent		Excellent
East Pond Brook	Turbidity (NTU)	Excellent	Excellent	Excellent
Tributary to Gill's	Dissolved Oxygen (mg/l)	Excellent		Good
Tributary to Gill's	pH	Good	Excellent	Good
Tributary to Gill's	Specific Conductivity ( $\mu\text{S}/\text{cm}$ )	Good	Good	Poor
Tributary to Gill's	Temperature ( $^\circ\text{C}$ )	Excellent		Excellent
Tributary to Gill's	Turbidity (NTU)	Excellent	Excellent	Excellent

All parameters at East Pond Brook were rated as excellent or good, except for the grab sample specific conductivity, which was rated as fair. This discrepancy may be attributed to insufficient equilibration time for the sonde or the time gap between the field measurement and grab sample analysis. All parameters at Tributary to Gills Pond Brook were rated as excellent or good, except for specific conductivity during removal, which was rated as poor. This was caused by a malfunctioning conductivity sensor, leading to inaccurate field data during removal.

# Water Temperature



Water temperature is a critical parameter for wildlife, as many organisms cannot regulate their own body temperatures and instead depend on surrounding air and water conditions. Water temperature can be influenced by industrial inputs or alterations to natural environments, such as the removal of trees and vegetation, which eliminates the protective canopy they provide. Additionally, water temperature impacts other monitored parameters, including dissolved oxygen and specific conductivity. For this deployment, water temperature data was collected from May 22, 2024, to July 29, 2024.

## East Pond Brook Below East Pond      Tributary to Gill's Pond Brook

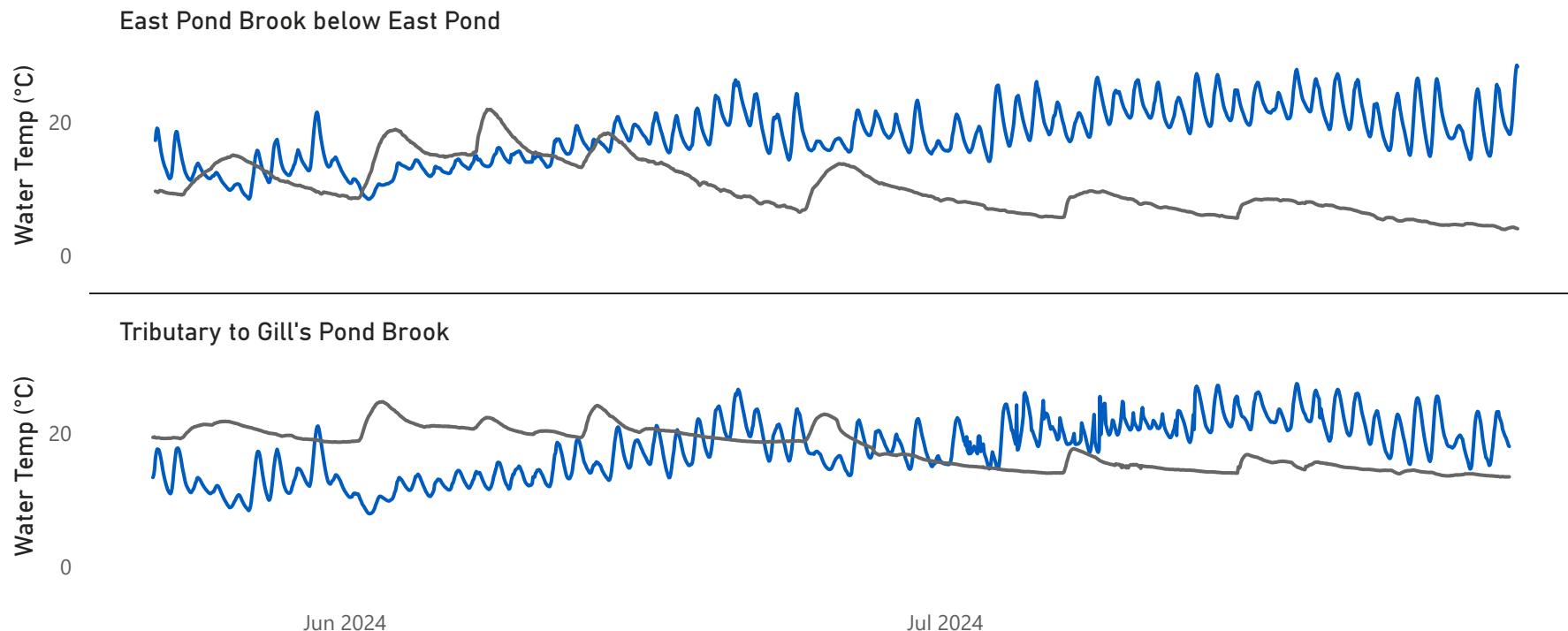
18.04	17.99	17.59	17.69
Average	Median	Average	Median
8.44	28.57	7.93	27.47
Minimum	Maximum	Minimum	Maximum

- At East Pond Brook, the minimum water temperature recorded was 8.44°C on June 2, 2024, and the maximum was 28.57°C on July 29, 2024.

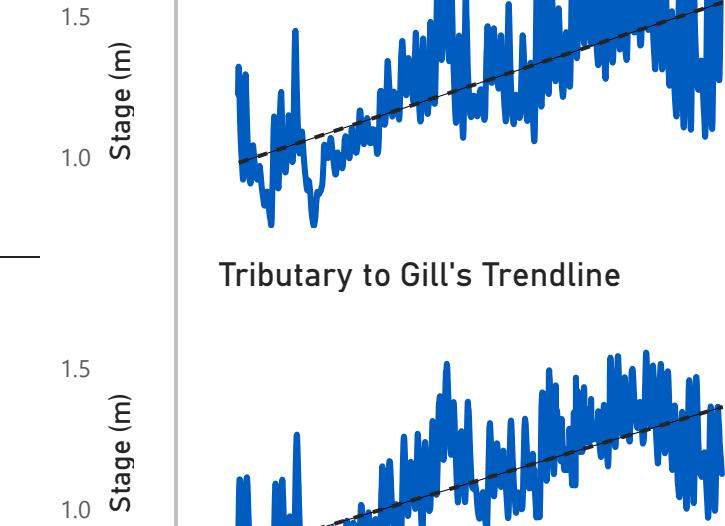
- At the Tributary to Gill's Pond Brook, the minimum water temperature recorded was 7.93°C on June 2, 2024, and the maximum was 27.47°C on July 18, 2024.

Water temperatures typically decrease overnight and increase during the day. East Pond Brook, a fast-flowing waterway with minimal canopy cover, experiences greater temperature fluctuations. In contrast, the Tributary to Gill's Pond Brook is narrower and largely shaded by tree canopy during the summer, which helps moderate water temperature. Temperatures at both stations displayed the expected warming trend from spring to summer

● Water Temp (°C) ● Stage (m)



East Pond Brook Trendline



# pH



## East Pond Brook Below East Pond      Tributary to Gill's Pond Brook

6.82	6.78	6.87	6.81
Average	Median	Average	Median
6.38	7.97	6.27	7.51
Minimum	Maximum	Minimum	Maximum

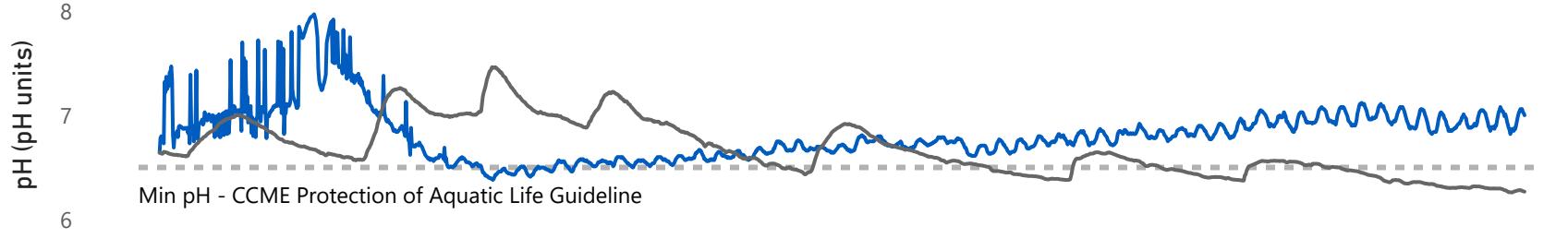
pH relates to the free hydrogen ions in water and it is a measure of acidity in water. The Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. Their freshwater guidelines recommend a minimum pH of 6.5 and a maximum pH of 9.0; however, many rivers in Newfoundland and Labrador are naturally more acidic due to the local geology. Water parameter maps can be found on the Water Resources Management website.

The min pH at East Pond Brook, 6.38 pH units, occurred on 2024-06-08, and the max pH, 7.97 pH units, occurred on 2024-05-30. The min pH at Tributary to Gill's Pond Brook, 6.27 pH units, occurred on 2024-07-12 and the max pH, 7.51 pH units, occurred on 2024-05-23. Daily fluctuations are common due to changes in temperature and respiration of aquatic plants, especially during the summer.

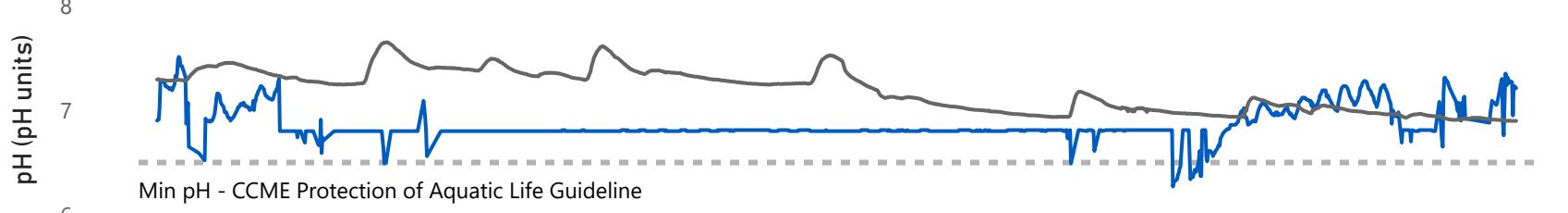
At the start of the deployment period, pH levels at East Pond Brook fluctuated as the new instrument adjusted to the environment. Once stabilized, the pH showed regular diurnal patterns and remained relatively steady, aside from a slight upward drift. In contrast, pH levels at the Tributary to Gill's Pond Brook were intermittently erratic due to issues with the new instrument's pH sensor, leading to data spikes and dips (this data was excluded from the statistical analysis). Throughout the deployment period, pH at both locations generally stayed within CCME guidelines.

● pH (pH units) ● Stage (m)

### East Pond Brook below East Pond



### Tributary to Gill's Pond Brook

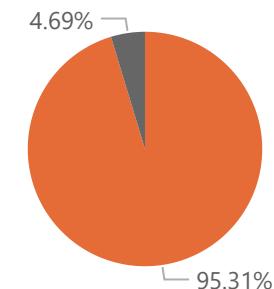


Jun 2024

Jul 2024

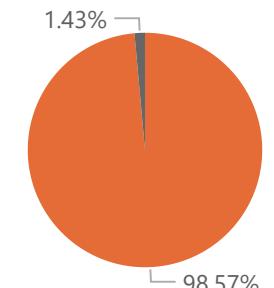
### East Pond Brook below East Pond

● Within Guidelines ● Below Guidelines



### Tributary to Gill's Pond Brook

● Within Guidelines ● Below Guidelines



# Specific Conductivity



## East Pond Brook Below East Pond    Tributary to Gill's Pond Brook

18.49	16.60	245.71	229.85
Average	Median	Average	Median
10.60	31.30	68.40	708.50
Minimum	Maximum	Minimum	Maximum

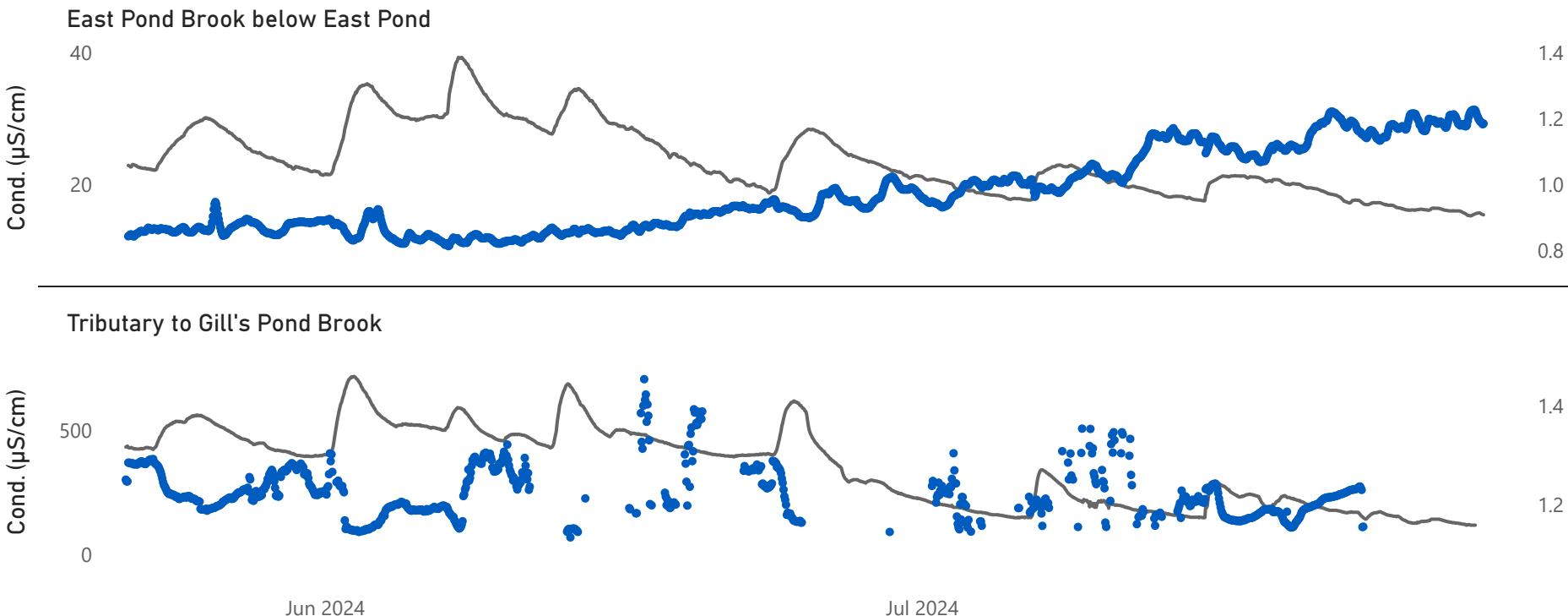
Conductivity measures the ability of an electric charge to pass through a solution. Pure water has low conductivity, while water containing dissolved ions exhibits higher conductivity. Specific conductivity and precipitation are correlated, as rainwater generally has lower conductivity than surface water, causing temporary dilution during precipitation events. Specific conductance data for this deployment period was collected from May 22, 2024, to July 29, 2024:

- At East Pond Brook, the minimum specific conductance was 10.60  $\mu\text{S}/\text{cm}$ , recorded on June 7, 2024, and the maximum was 31.30  $\mu\text{S}/\text{cm}$ , recorded on July 29, 2024.
- At the Tributary to Gill's Pond Brook, the minimum specific conductance was 68.40  $\mu\text{S}/\text{cm}$ , recorded on June 13, 2024, while the maximum was 708.50  $\mu\text{S}/\text{cm}$ , recorded on June 17, 2024.

At East Pond Brook, specific conductivity showed a gradual upward trend during the deployment, likely due to a decrease in water stage. Sharp decreases in conductivity were observed during stage increases, likely corresponding to precipitation events.

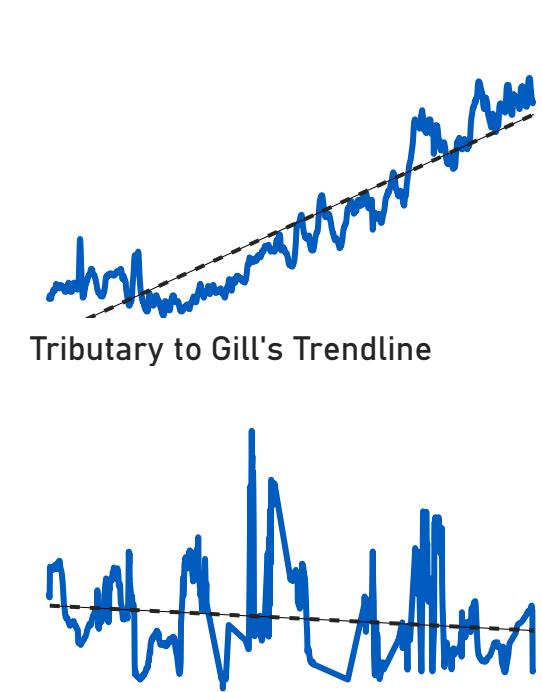
At Tributary to Gill's Pond Brook, specific conductivity exhibited erratic behavior due to a sensor malfunction in the newly deployed instrument. Erroneous and inaccurate data were removed from the dataset, resulting in gaps in the graph. Overall, conductivity at this site showed a slight decline over the deployment period.

● Specific Conductivity ( $\mu\text{S}/\text{cm}$ ) ● Stage (m)



## East Pond Brook Trendline

## Tributary to Gill's Trendline

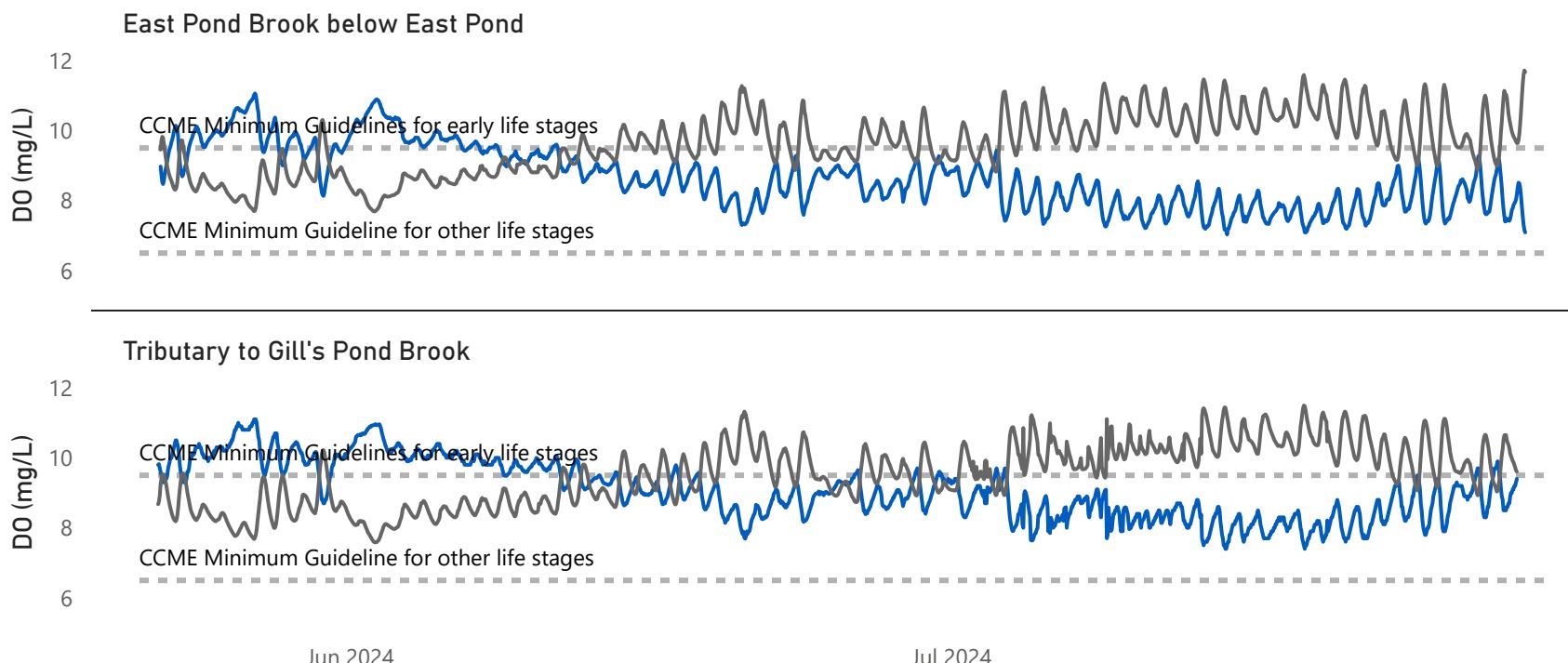


# Dissolved Oxygen



East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
8.65	8.56	9.09	9.03
Average	Median	Average	Median
7.03	11.06	7.40	11.10
Minimum	Maximum	Minimum	Maximum

● DO (mg/L) ● Water Temp. (°C)



Dissolved oxygen (DO) is essential for aquatic life, and the CCME (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guidelines provide benchmarks to assess waterway health. The minimum DO guideline is 9.5 mg/L for early life stages in cold water and 6.5 mg/L for other life stages. DO levels are influenced by water temperature, with colder water able to retain higher DO concentrations.

DO data for this deployment period was collected from May 22, 2024, to July 29, 2024:

- At East Pond Brook, the minimum DO reading was 7.03 mg/L on July 14, 2024, and the maximum was 11.06 mg/L on May 27, 2024.

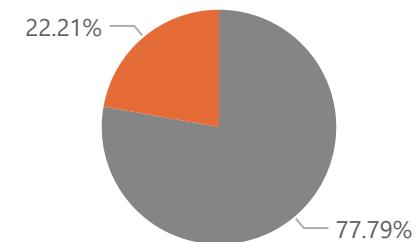
- At the Tributary to Gill's Pond Brook, the minimum DO reading was 7.40 mg/L on July 14, 2024, and the maximum was 11.10 mg/L on May 27, 2024.

Daily fluctuations in DO levels were observed, driven by temperature changes and the respiration of aquatic plants. A clear inverse relationship between water temperature and DO levels was evident, with DO decreasing as water temperatures rose and vice versa.

Throughout the deployment period, DO levels at both stations remained above the minimum guideline of 6.5 mg/L for other life stages. Initially, DO levels were above the 9.5 mg/L guideline for early life stages but gradually fell below the guideline as water temperatures increased and DO levels declined.

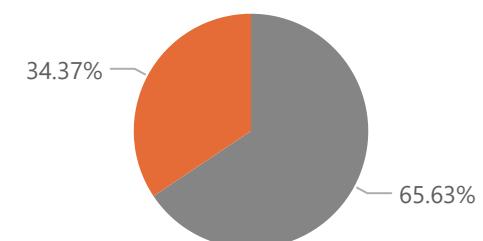
## East Pond Brook Below East Pond

● Below Early Guidelines ● Above Guidelines



## Tributary to Gill's Pond Brook

● Below Early Guidelines ● Above Guidelines



# Turbidity



## East Pond Brook Below East Pond      Tributary to Gill's Pond Brook

0.30	0.00	2.17	0.60
Average	Median	Average	Median
0.00	17.46	0.00	135.50
Minimum	Maximum	Minimum	Maximum

Turbidity, or water cloudiness, often increases during precipitation events when runoff carries silt and debris into the waterbody. Elevated turbidity can block light from reaching aquatic plants, disrupt benthic habitats, and harm fish gills or equipment.

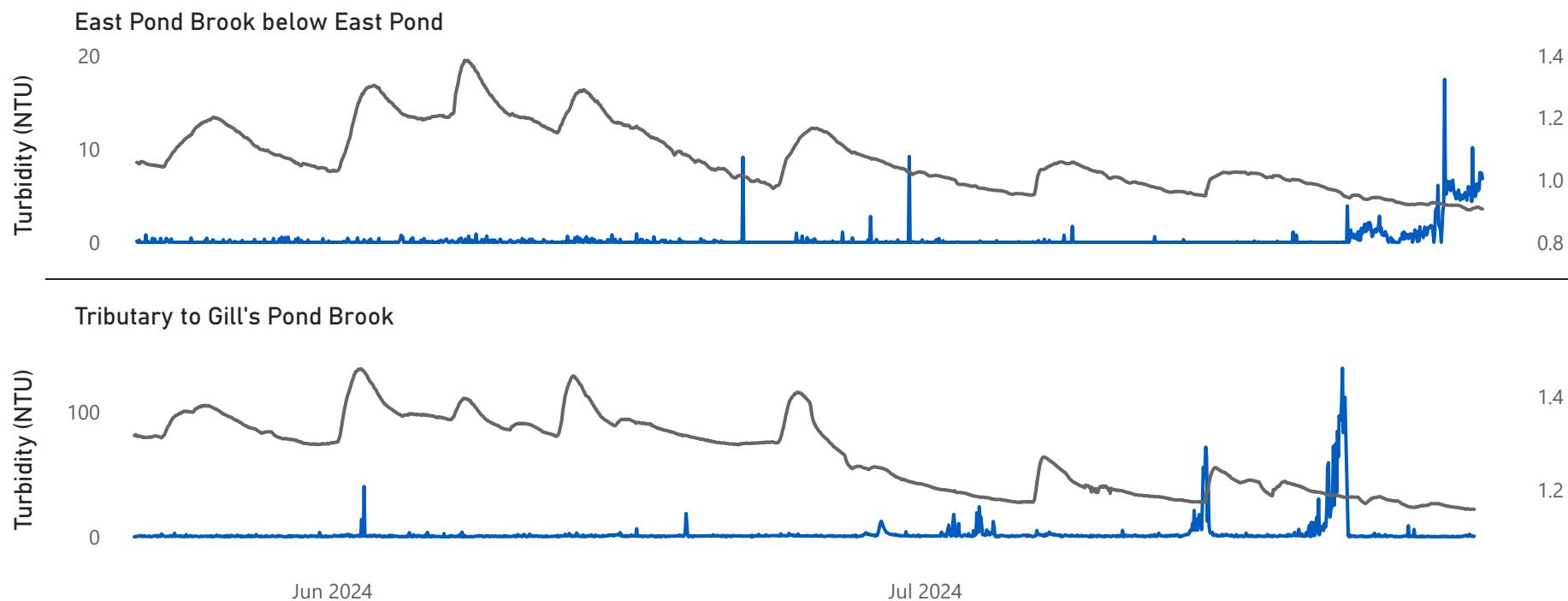
Turbidity data for this deployment period was collected from May 22, 2024, to July 29, 2024:

- At East Pond Brook, turbidity ranged from 0.00 NTU to a maximum of 17.46 NTUs, recorded on July 27, 2024.
- At the Tributary to Gill's Pond Brook, turbidity ranged from 0.00 NTU to a maximum of 135.50 NTUs, recorded on July 22, 2024.

Throughout the deployment, turbidity levels remained low at both stations, with occasional spikes likely caused by precipitation events or sediment passing near the sensor during measurements. In each instance, turbidity levels returned to normal background levels after the spikes.

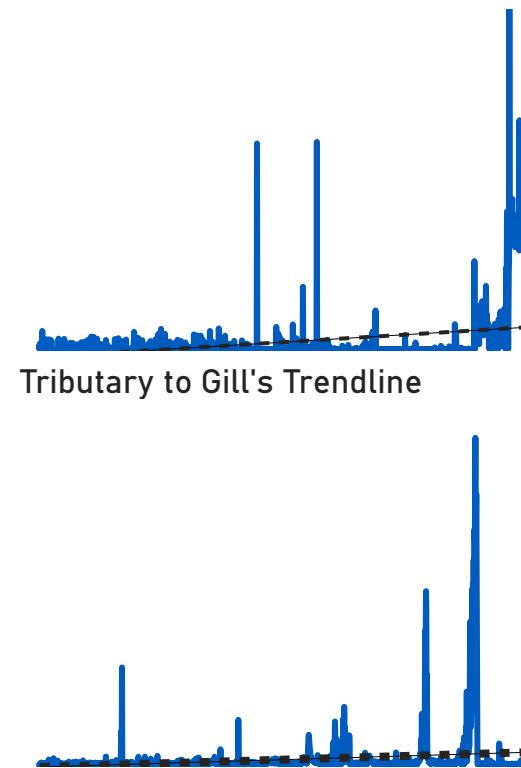
Toward the end of the deployment period, turbidity at East Pond Brook showed an upward trend, likely due to biofouling or debris accumulating around the sensor.

● Turbidity (NTU) ● Stage (m)



## East Pond Brook Trendline

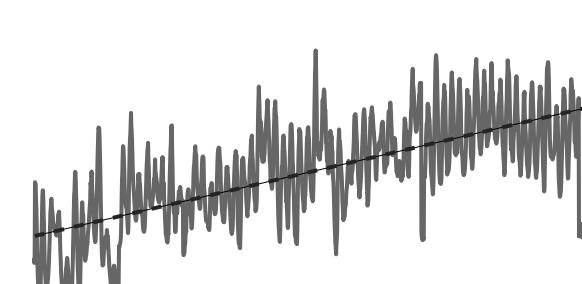
## Tributary to Gill's Trendline



# Meteorological and Hydrometric Data



Air Temperature Trendline



**14.79**

Average (°C)

**2.01**

Minimum (°C)

**14.65**

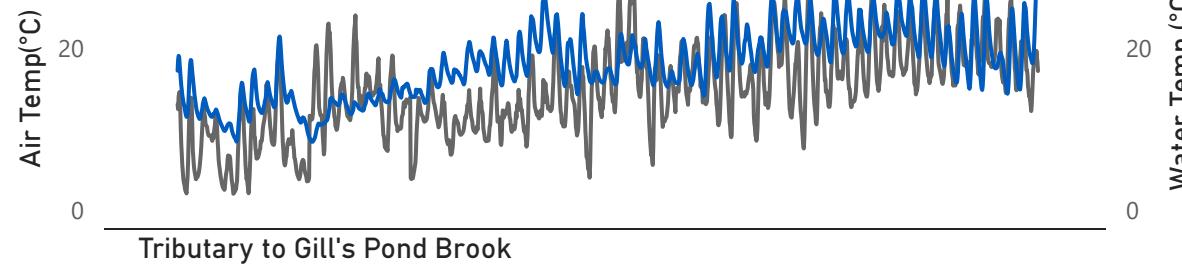
Median (°C)

**28.23**

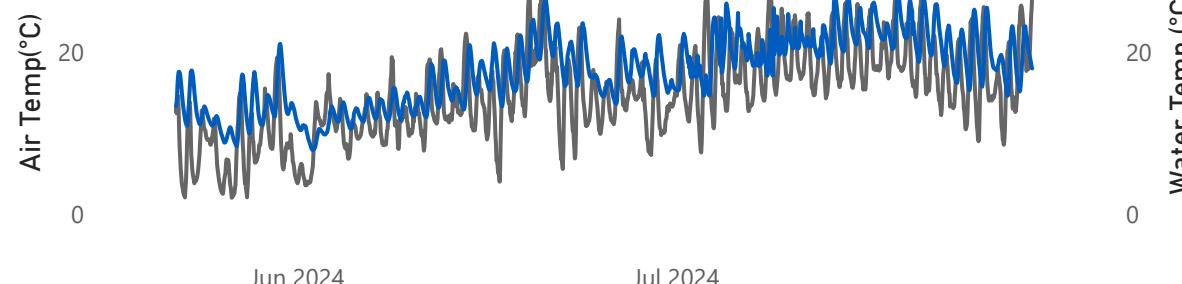
Maximum (°C)

● Air Temperature (°C) ● Water Temperature (°C)

East Pond Brook below East Pond



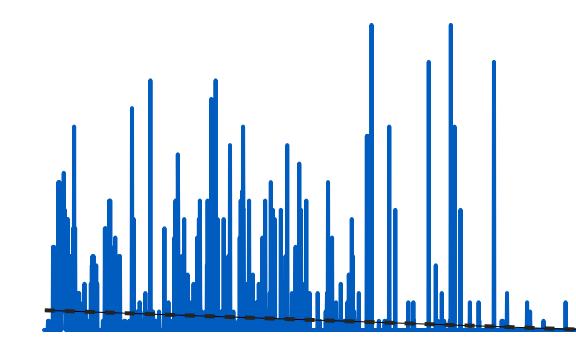
Tributary to Gill's Pond Brook



Jun 2024

Jul 2024

Precipitation Trendline



**0.11**

Average (mm/hr)

**0.00**

Minimum (mm/hr)

**0.00**

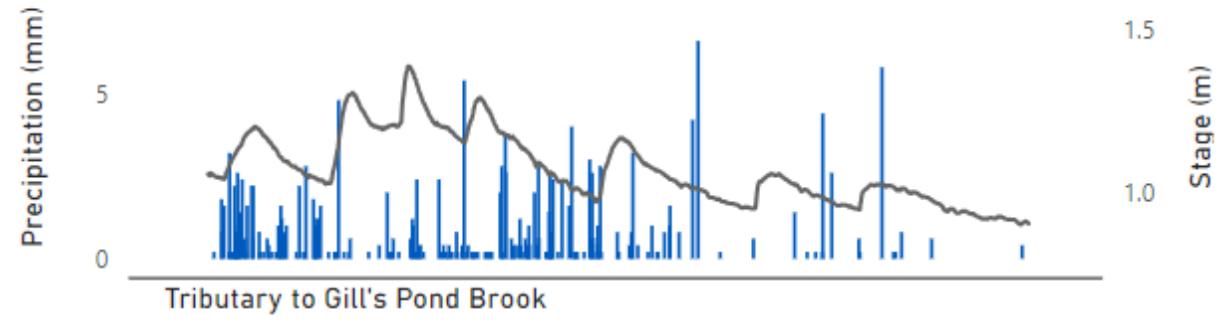
Median (mm/hr)

**6.63**

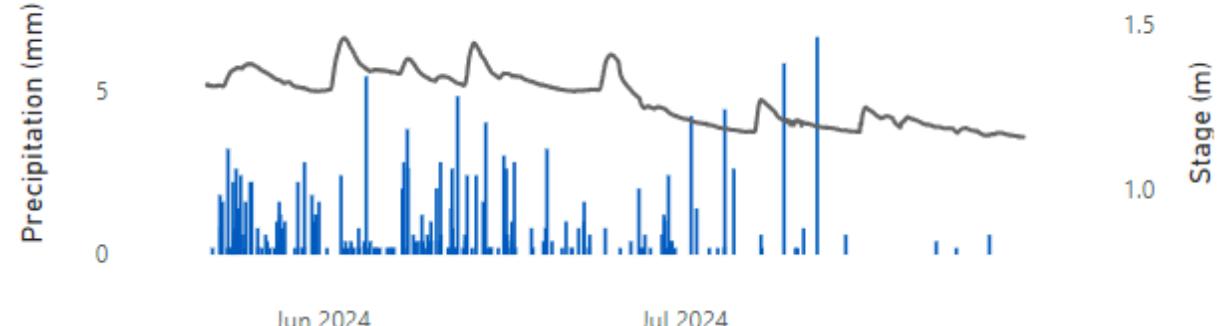
Maximum (mm/hr)

● Precipitation (mm) ● Stage (m)

East Pond Brook below East Pond



Tributary to Gill's Pond Brook



Jun 2024

Jul 2024