Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

July 25, 2018 to September 25, 2018

Government of Newfoundland & Labrador
Department of Municipal Affairs and Environment
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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2018-07-25 to 2018-09-25

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Tributary to Gills Pond Brook station and East Pond Brook below East Pond stations are abbreviated as TGPB and EPB stations, respectively.
- In the following figures, two lines are indicated on the TGPB flow panel: a blue line indicating flow at the gauging station and a pink line indicating volumetric discharge into TGPB upstream of the station.
- Hydrometric data included in this report is provisional and used only for illustrative purposes. Corrected and finalized data may be retrieved from the Water Survey of Canada website (http://www.ec.gc.ca/rhc-wsc/)*.

Maintenance and Calibration of Instrument

- As part of the Quality Assurance and Quality Control protocol (QAQC), 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.
    - Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.
    - At the end of a deployment period, a freshly cleaned and calibrated QAQC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

Table 1: Qualitative QAQC Ranking

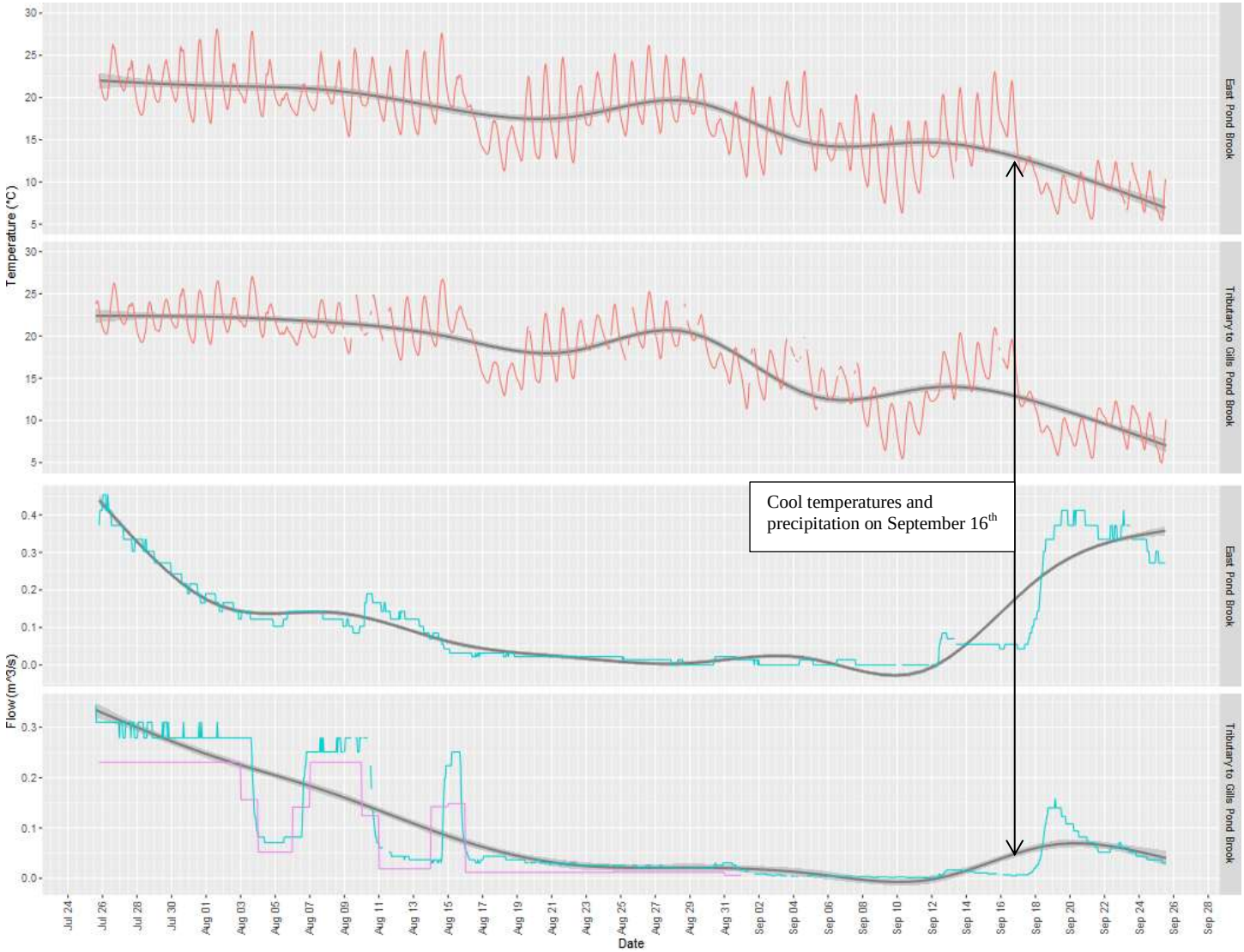
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Tributary to Gills Pond Brook	July 25, 2018	Deployment	Excellent	Excellent	Good	NA	NA
	September 25, 2018	Removal	Excellent	Good	Excellent	Excellent	Excellent
East Pond Brook below East Pond	July 25, 2018	Deployment	Excellent	Marginal	Good	Excellent	Excellent
	September 25, 2018	Removal	Good	Excellent	Fair	Excellent	Excellent

- A problem with the QAQC sonde during deployment at Tributary to Gills Pond Brook means that Dissolved Oxygen and Turbidity rankings could not be computed.

Data Interpretation

Temperature

Water Temperature is a major 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.



Station	Mean	Median	Min	Max
East Pond Brook	17.11	17.73	5.41	28.10
Tributary to Gills Pond Brook	17.35	18.50	4.95	27.01

- Water temperature declined throughout most of this deployment period from the deployment high observed in early August at both stations. The largest decline observed occurred between September 16th and 17th during cool temperatures and precipitation. This decline appears to clearly delineate the beginning of a fall season as the magnitude of diurnal cycling in temperature was notably reduced afterwards.

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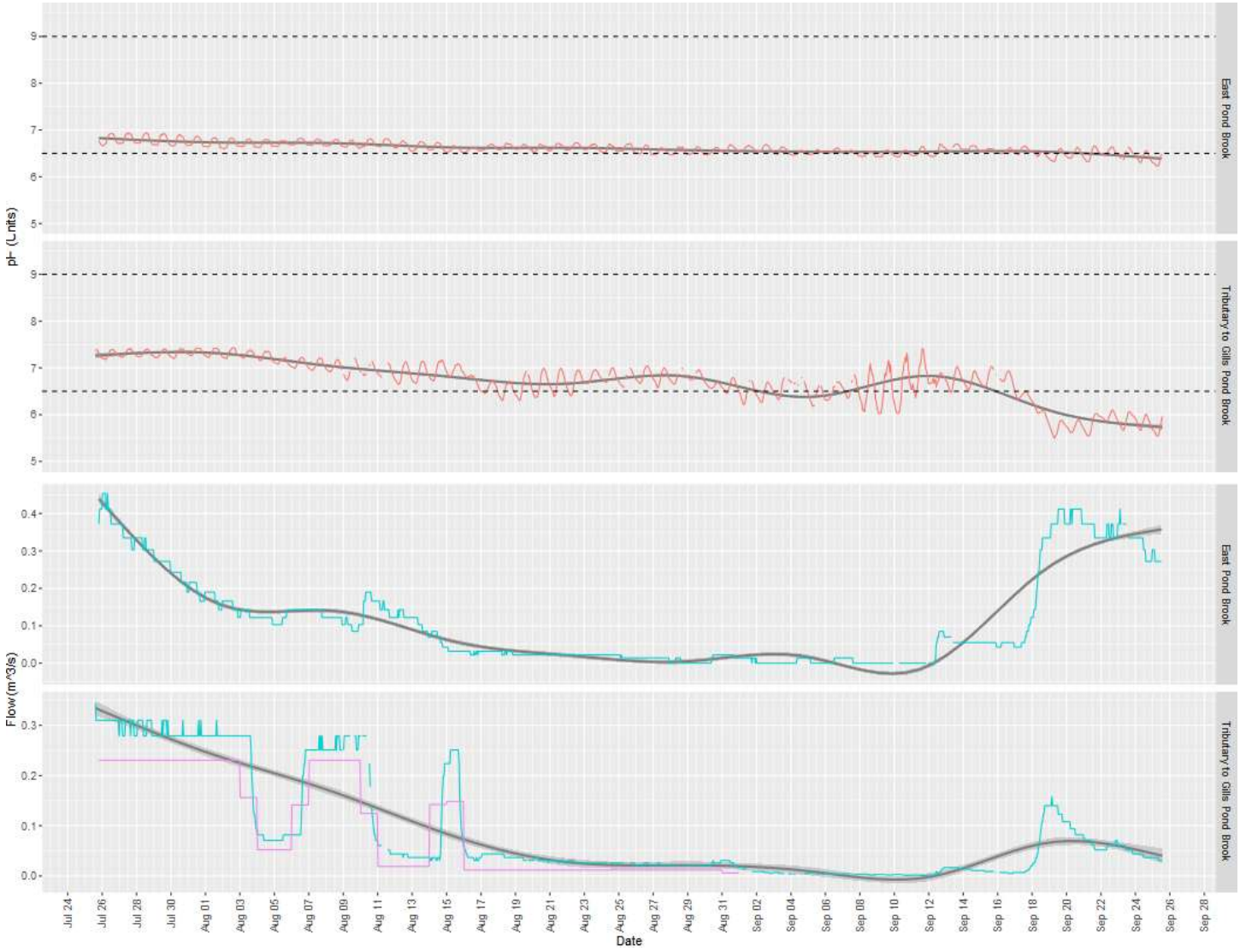
pH

pH is used to give an indication of the acidity or basicity of a solution. A pH of 7 denotes a neutral solution while lower values are acidic and higher values are basic. Technically, the pH of a solution indicates the availability of protons to react with molecules dissolved in water. Such reactions can affect how molecules function chemically and metabolically.



Station	Mean	Median	Min	Max
East Pond Brook	6.61	6.60	6.23	6.94
Tributary to Gills Pond Brook	6.72	6.77	5.50	7.43

- pH levels at both stations declined during this deployment period – a steady decline was observed at EPB whereas pH rose and fell several times at TGPB. This difference may be related to the size difference between both rivers: EPB, a larger river, may buffer against precipitation-related pH changes more readily than the smaller TGPB.
- Near the end of the deployment period, both rivers were found to be near the lower end of CCME guidelines for pH. This could be due to sensor drift or the expected reduction in pH at this time of year.

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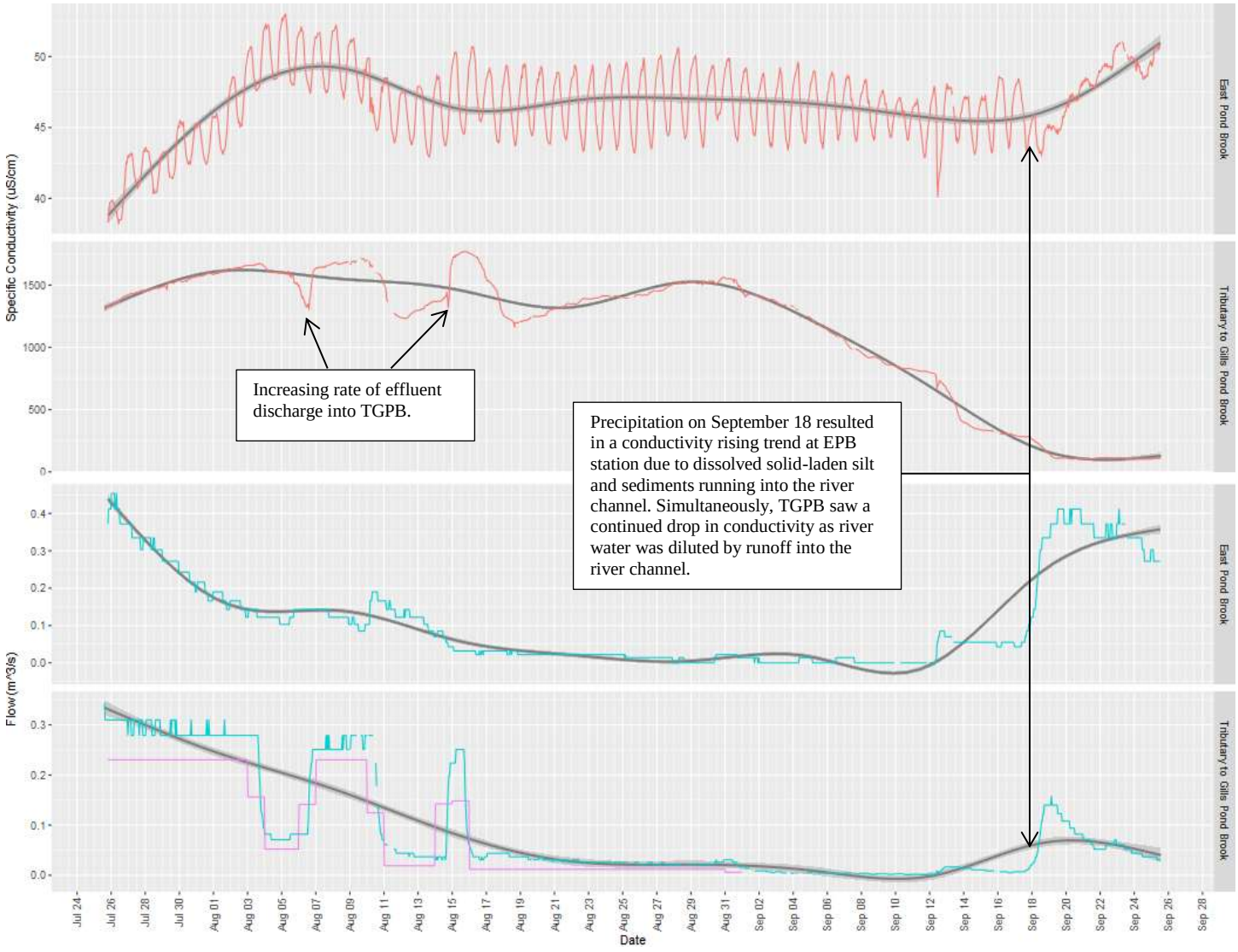
Specific Conductivity

Conductivity relates to the ease of passing an electric charge – or resistance – 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.



Station	Mean	Median	Min	Max
East Pond Brook	46.6	46.9	38.2	53.0
Tributary to Gills Pond Brook	1142.0	1366.0	102.0	1771.0

- Specific conductivity shows a strong diurnal cycle at EPB station and a more steady state at TGPB station. TGPB station also shows a more substantial response to effluent discharge than to precipitation-related stage level rises as indicated by the arrows above.
- A precipitation event on September 18th illustrated how EPB and TGPB rivers react differently to the relative difference in the ionic strength of river water and precipitation (as explained in the figure above).

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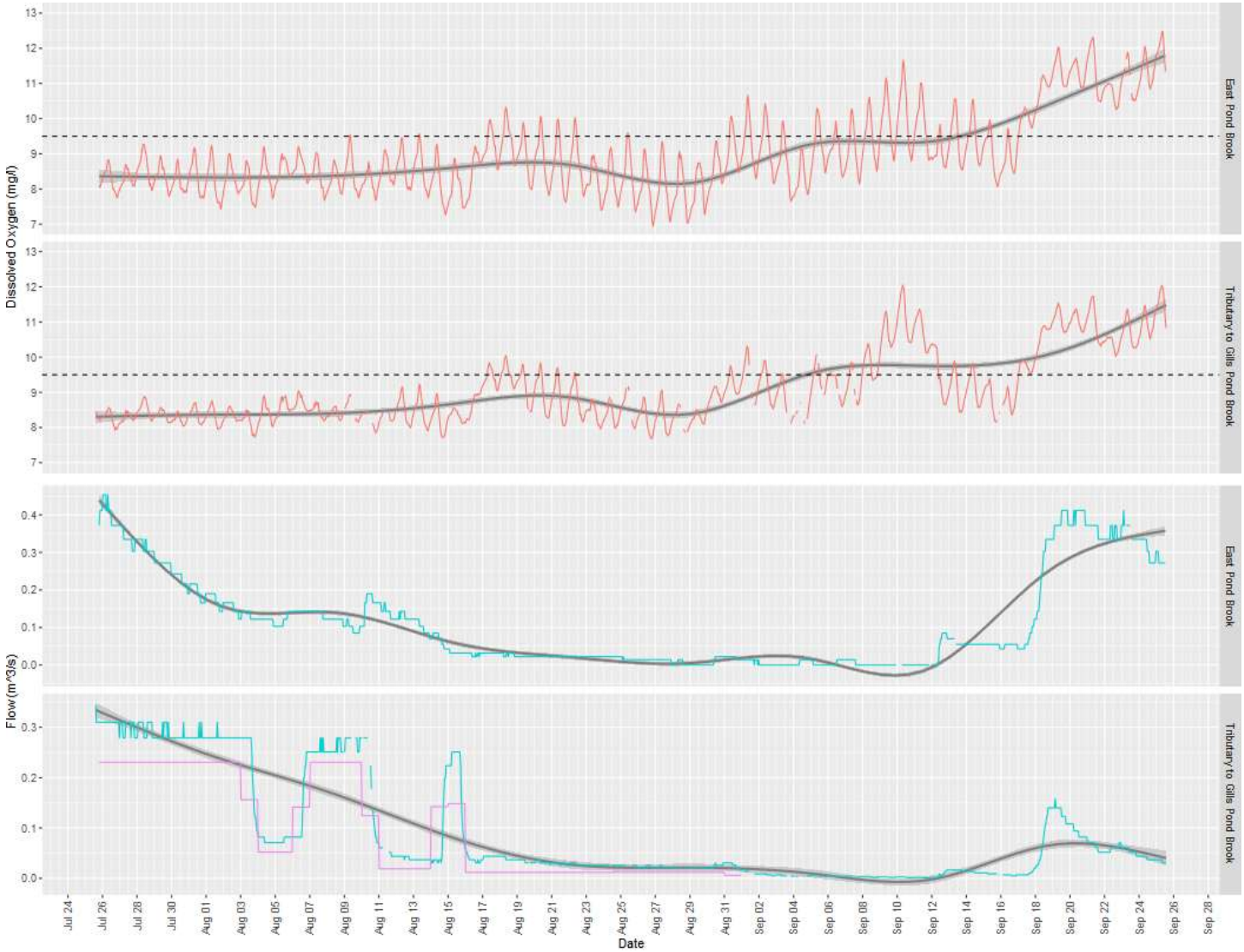
Dissolved Oxygen

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The concentration of oxygen in water depends on many factors, especially temperature – the saturation of oxygen in water is inversely proportional to water temperature. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.



Station	Mean	Median	Min	Max
East Pond Brook	9.01	8.76	6.94	12.49
Tributary to Gills Pond Brook	9.09	8.73	7.68	12.05

- Dissolved oxygen levels are often linked to water temperatures – as water temperatures decrease, dissolved oxygen concentrations increase. This effect is observed from August 30th onwards as temperatures began to fall at a rapid pace. By September 17th-18th, dissolved oxygen levels were found to be consistently above the upper CCME guideline of 9.5 mg/l dissolved oxygen.

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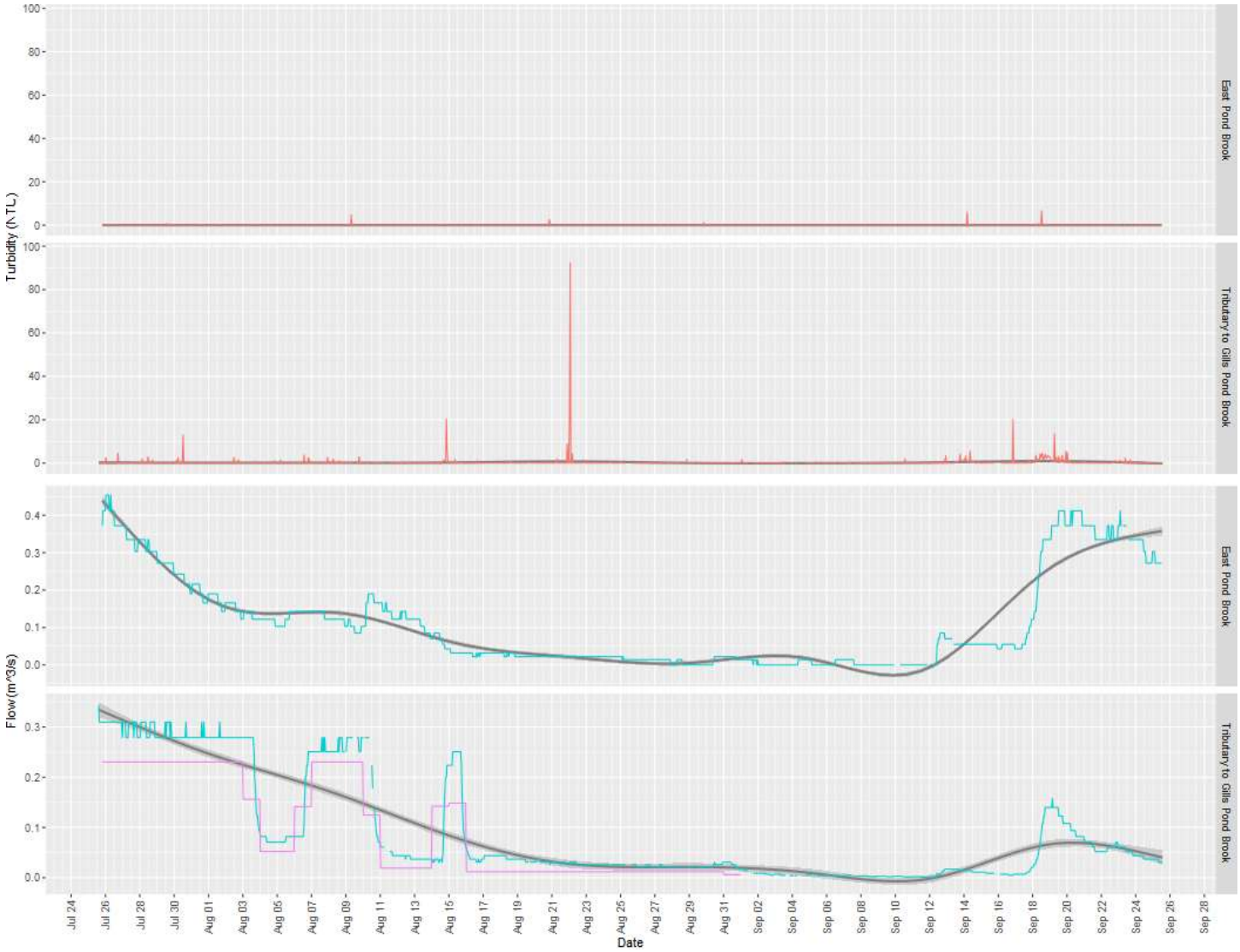
Turbidity

Turbidity 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, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Station	Mean	Median	Min	Max
East Pond Brook	0.0	0.0	0.0	6.7
Tributary to Gills Pond Brook	0.3	0.0	0.0	92.3

- Turbidity levels were generally low during this deployment period with occasional instances of peaks, especially at TGPB. Steady and slow flowing conditions at EPB station means that fewer turbidity events are observed at this station, while small riffles at TGPB station results in turbulent flow, moving sediments and entraining air bubbles that make turbidity events more likely.

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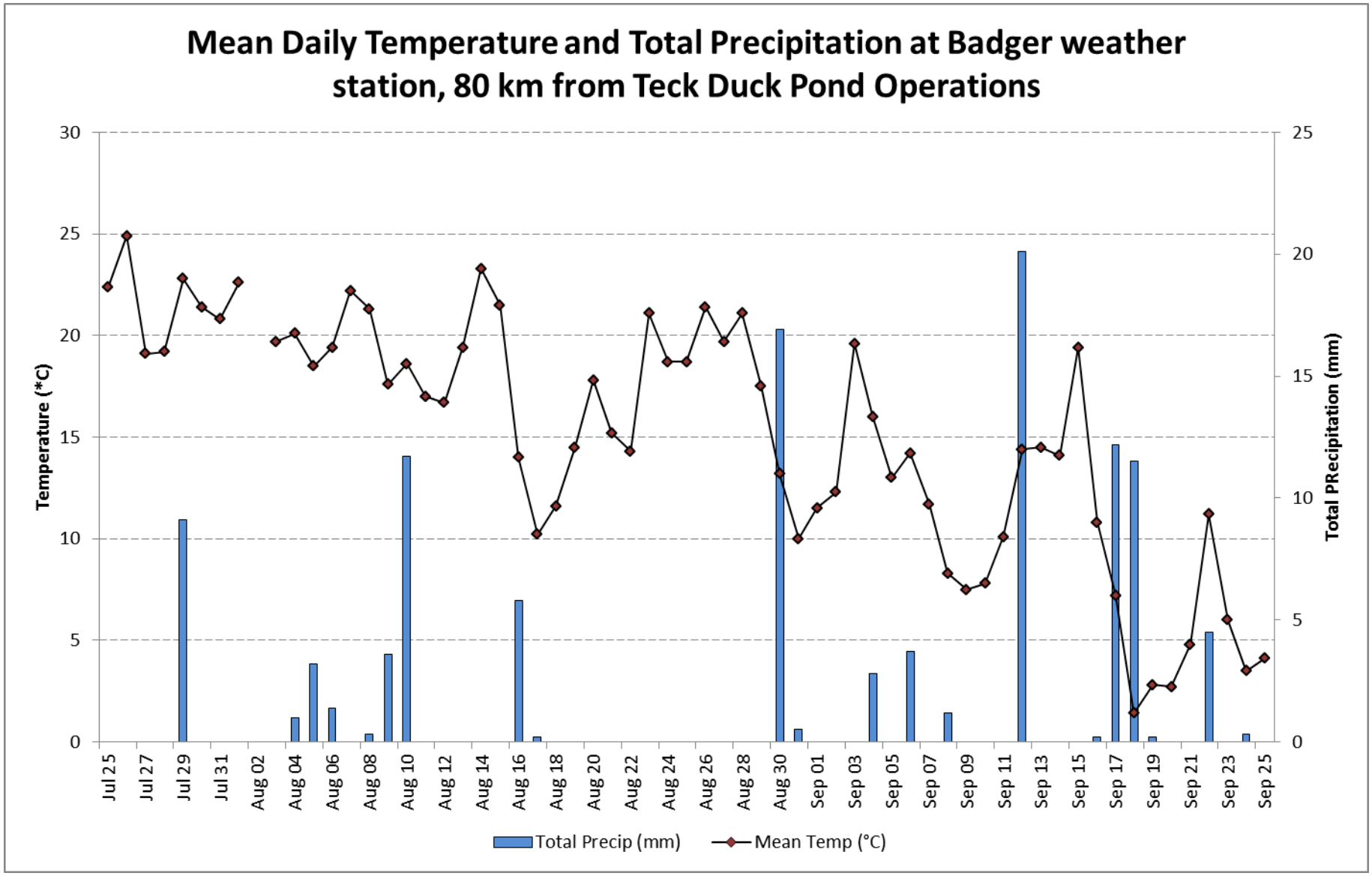
Appendix


Mean Daily Temperature and Total Precipitation at Badger weather station, 80 km from Teck Duck Pond Operations
Temperature (*C)
Total PRecipitation (mm)
30
25
20
15
10
5
0
Jul 25
Jul 27
Jul 29
Jul 31
Aug 02
Aug 04
Aug 06
Aug 08
Aug 10
Aug 12
Aug 14
Aug 16
Aug 18
Aug 20
Aug 22
Aug 24
Aug 26
Aug 28
Aug 30
Sep 01
Sep 03
Sep 05
Sep 07
Sep 09
Sep 11
Sep 13
Sep 15
Sep 17
Sep 19
Sep 21
Sep 23
Sep 25
Total Precip (mm)
Mean Temp (°C)