Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

July 6, 2017 to August 16, 2017

Newfoundland Labrador

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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General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Throughout the deployment report, East Pond Brook below East Pond and Tributary to Gills Pond Brook stations will be referred to as EPB and TGPB, respectively.
- Dissolved oxygen data at EPB was removed from 2017-08-07 15:30 onwards due to poor data. Turbidity data was dropped in its entirety from TGPB station due to a sensor failure.
- 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

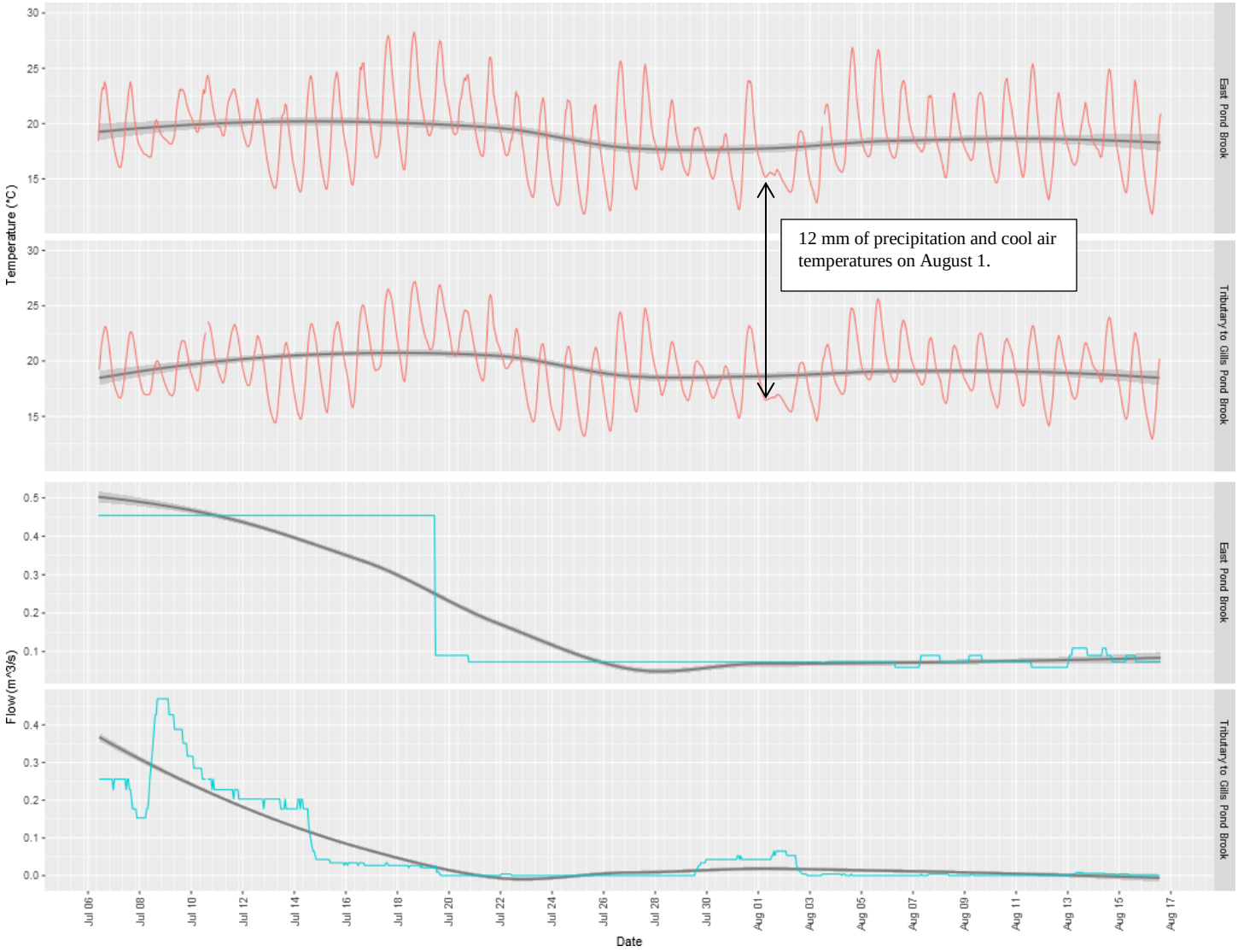
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
East Pond Brook below East Pond	July 6, 2017	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	August 16, 2017	Removal	Excellent	Fair	Excellent	Poor	Excellent
Tributary to Gills Pond Brook	July 6, 2017	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	August 16, 2017	Removal	Excellent	Excellent	Excellent	Excellent	Poor

- A “Poor” QAQC ranking was achieved for dissolved oxygen during removal at EPB station. This may be due to accumulation of biofouling on the sensor during the deployment or a loss of calibration.
- A “Poor” QAQC ranking was achieved for turbidity during removal at TGPB station. This was likely due to a failure of the sensor during the deployment.

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	18.99	18.80	11.78	28.28
Tributary to Gills Pond Brook	19.48	19.34	12.91	27.18

- Water temperatures were stable over the deployment time-frame, regardless of flux between day and night.

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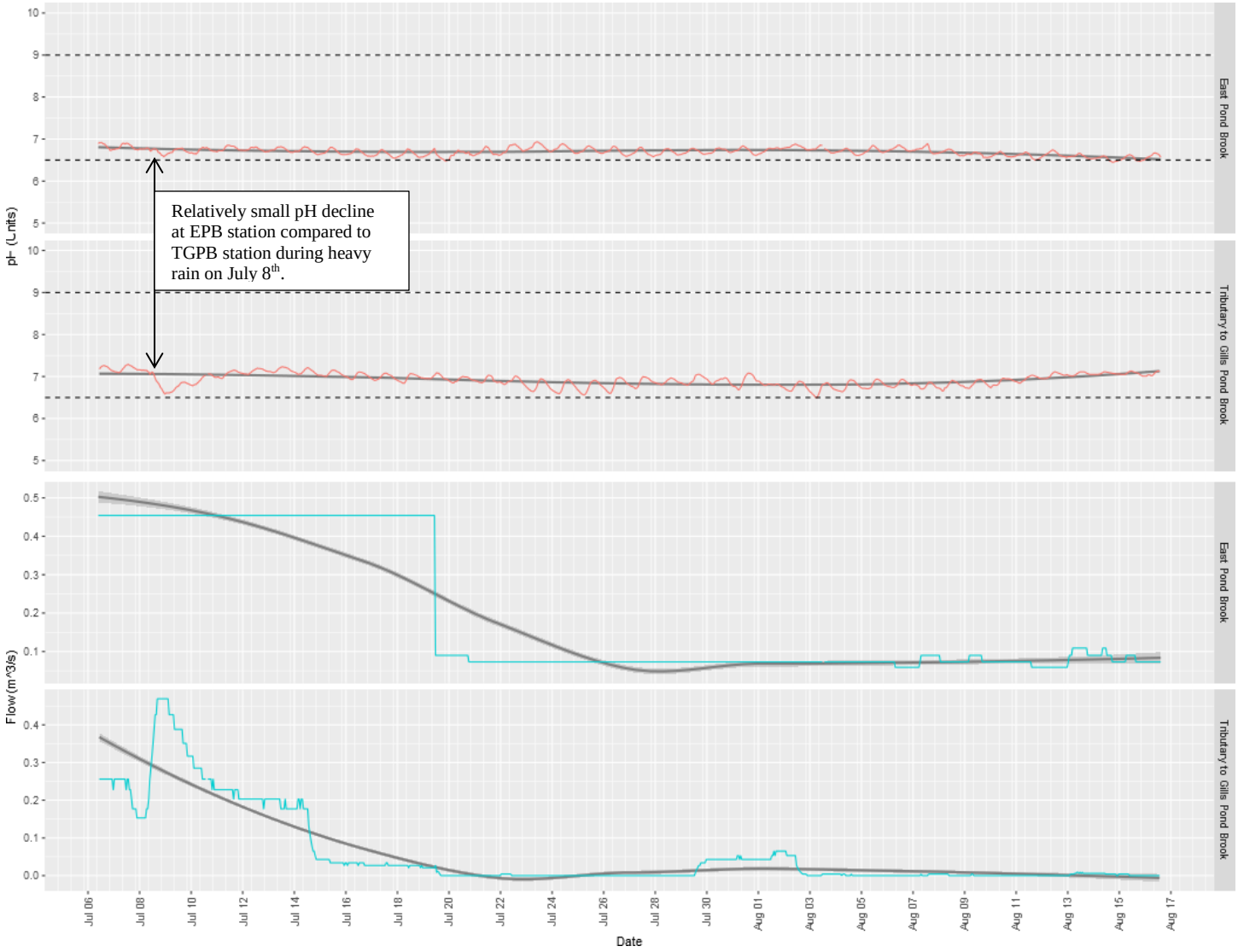
pH

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	6.70	6.70	6.45	6.93
Tributary to Gills Pond Brook	6.92	6.93	6.49	7.29

- Throughout the deployment period, daily cycling in pH is obvious, however, only slight trends are observed over the course of the deployment period – slightly downward at EPB and slightly upward at TGPB near the end of the deployment period. These trends may be the result of precipitation occurring on August 1st.

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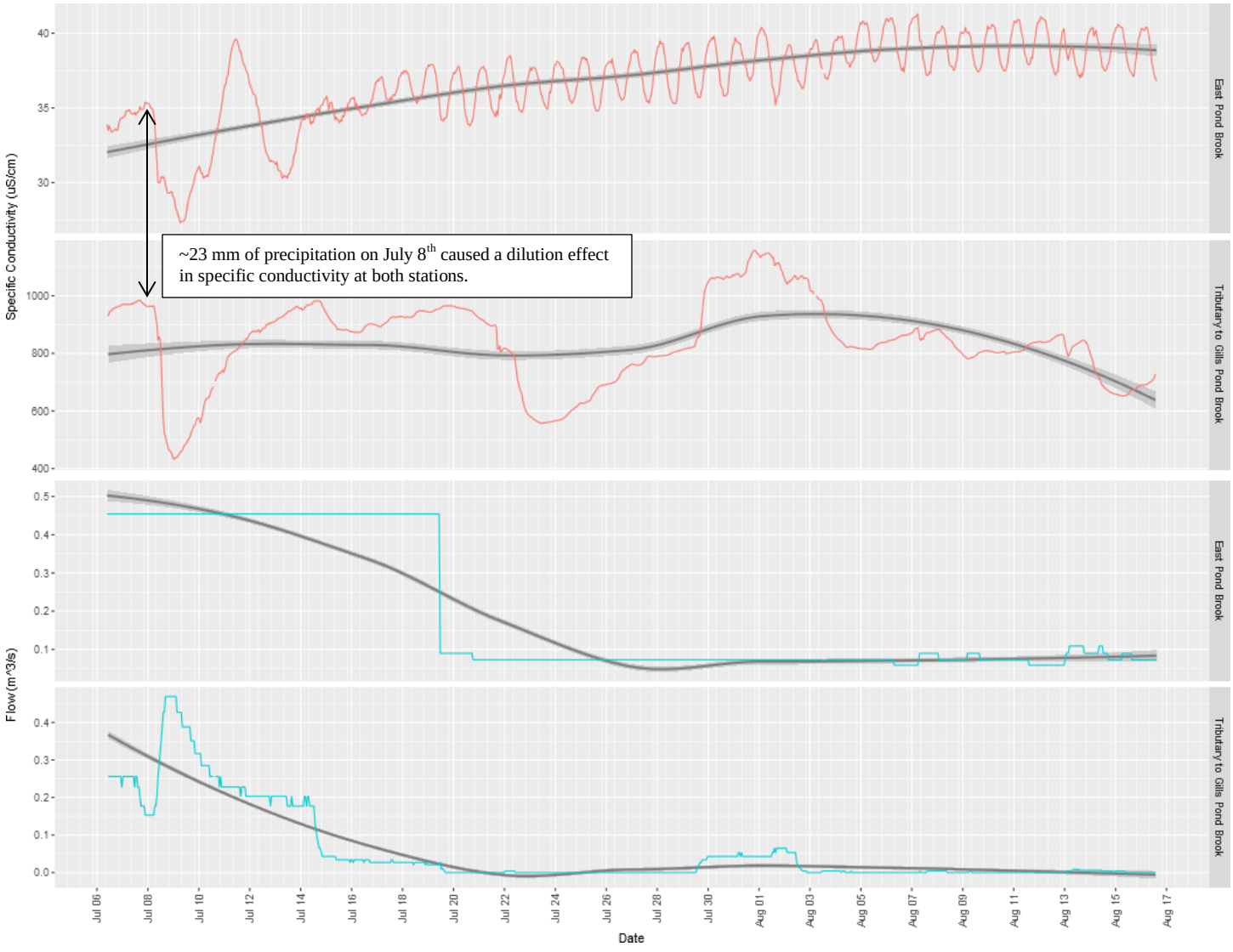
Specific Conductivity

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	36.8	37.4	27.3	41.3
Tributary to Gills Pond Brook	839	845	432	1158

- Specific conductivity characteristics are notably different at EPB and TGPB stations where natural variability drives conductivity at the former and industrial effluent drives conductivity at the latter. A dilution effect is seen at both stations in response to precipitation on July 8th. For the remainder of the month, TGPB conductivity appears to change primarily based on the effluent received from upstream.

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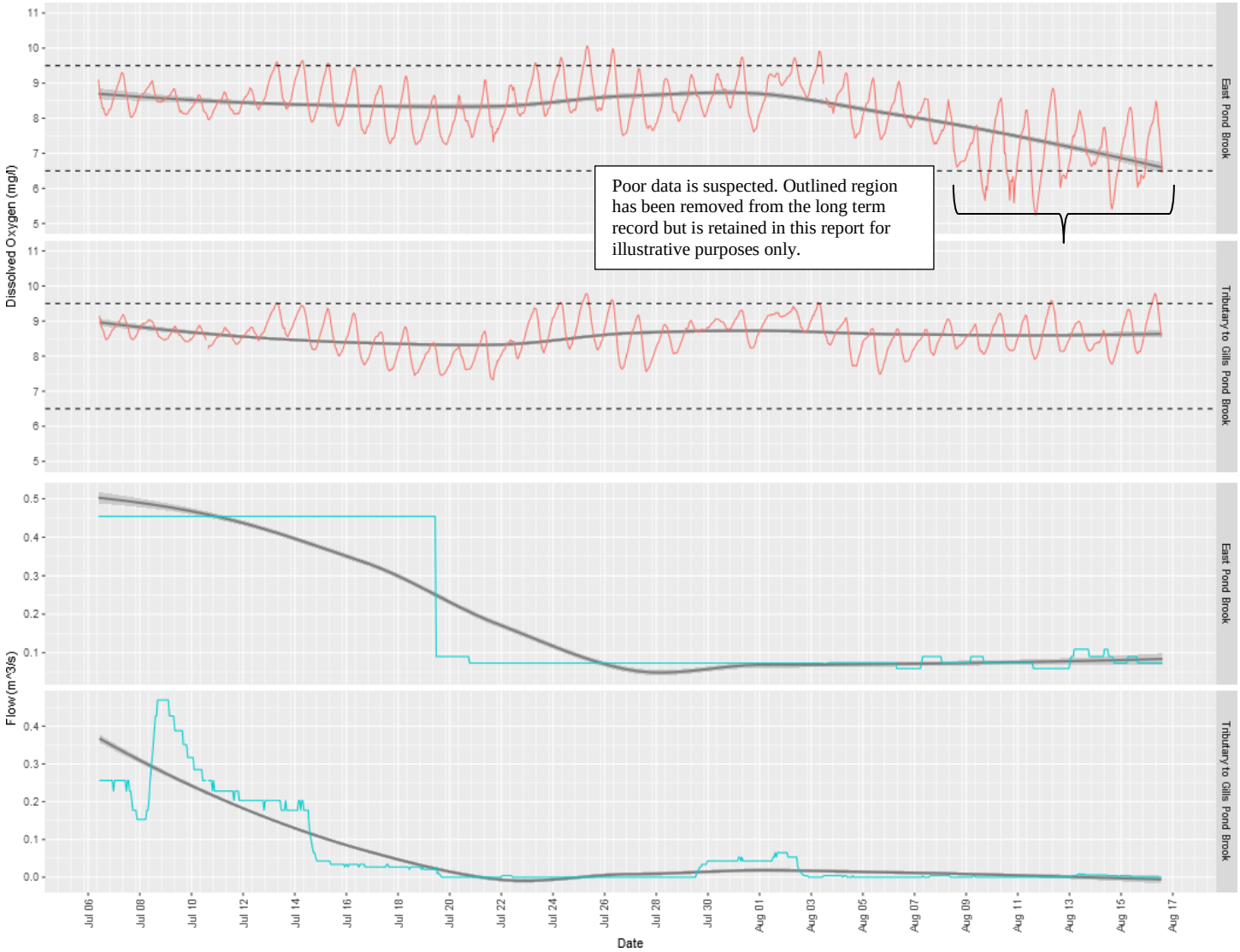
Dissolved Oxygen

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.



Variable	Station	Mean	Median	Min	Max
DO (mg/l)	East Pond Brook	NA	8.29	NA	10.07
DO (mg/l)	Tributary to Gills Pond Brook	8.57	8.59	7.33	9.79

- Dissolved oxygen concentrations were mostly above the CCME guideline of 6.5 mg/l DO for the protection of early life stage aquatic life. At this point in the summer, most aquatic organisms have moved beyond their most sensitive stages. Oxygen concentrations depicted in the figure above are within expected ranges.

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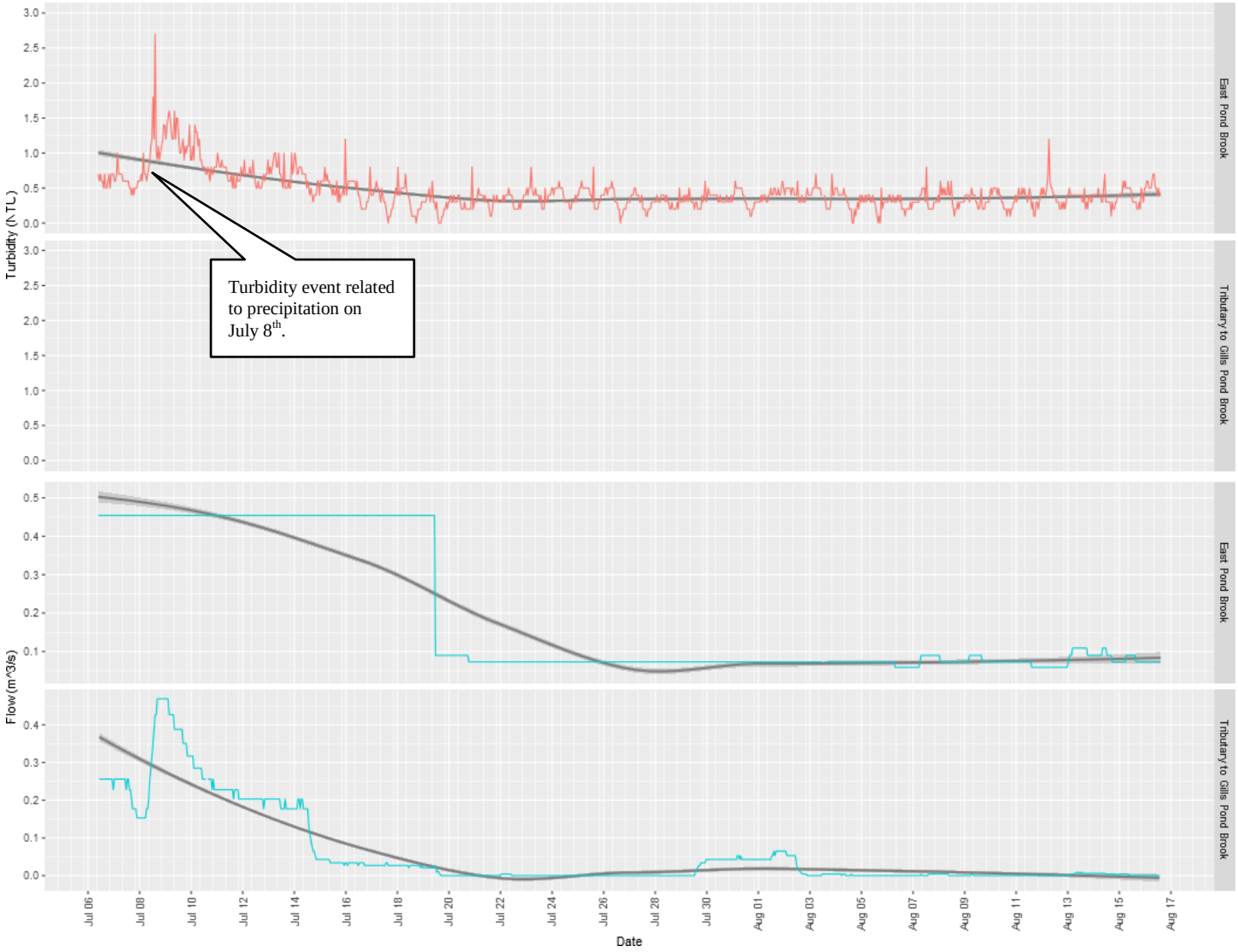
Turbidity

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	0.5	0.4	0.0	2.7

- Turbidity levels were low at EPB station during this deployment period. Some variation appears to exist on a daily basis with slightly higher turbidity levels overnight and decreasing slightly during the day.

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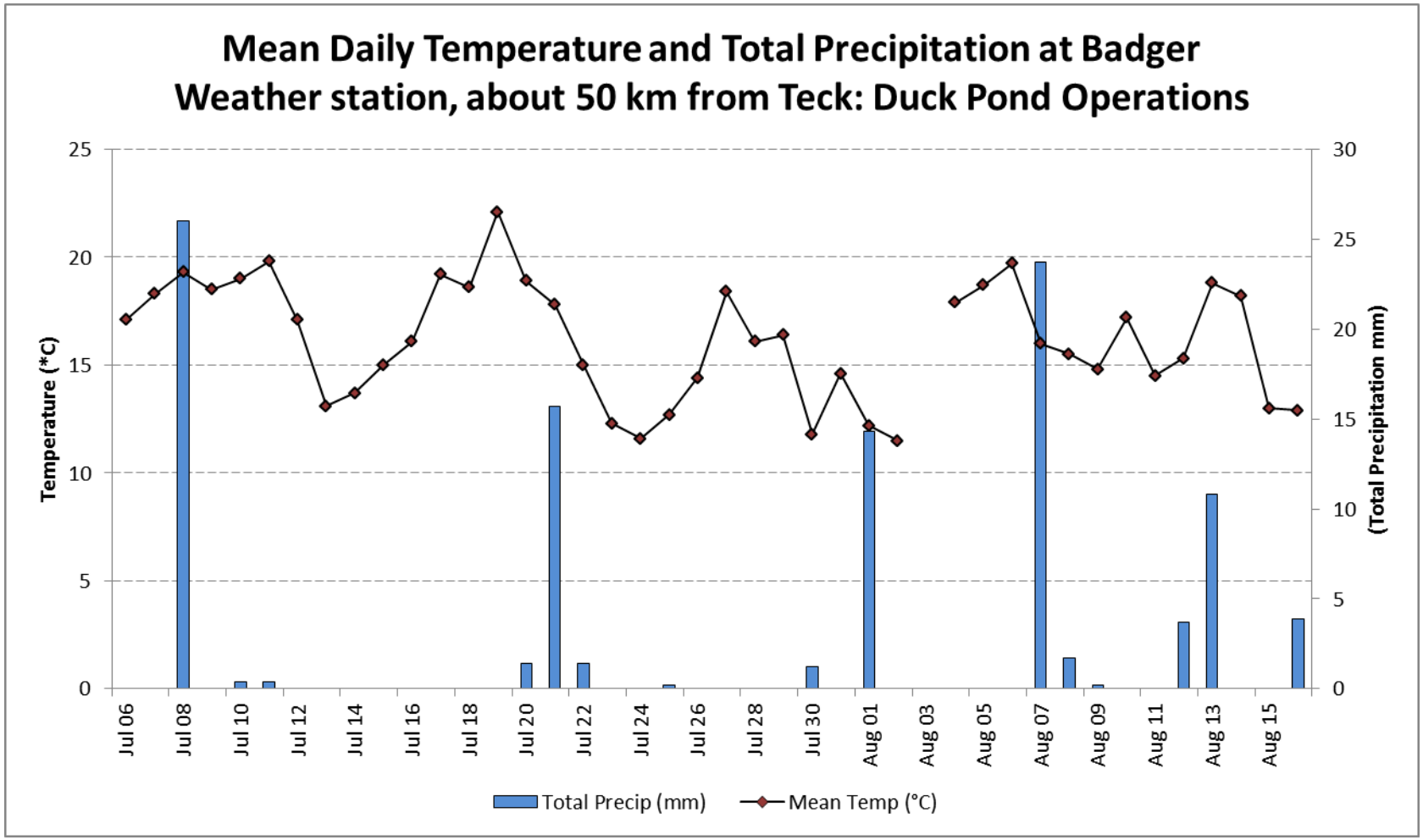
Appendix


Mean Daily Temperature and Total Precipitation at Badger Weather station, about 50 km from Teck: Duck Pond Operations
Temperature (*C)
(Total Precipitation mm)
25
20
15
10
5
0
30
25
20
15
10
5
0
Jul 06
Jul 08
Jul 10
Jul 12
Jul 14
Jul 16
Jul 18
Jul 20
Jul 22
Jul 24
Jul 26
Jul 28
Jul 30
Aug 01
Aug 03
Aug 05
Aug 07
Aug 09
Aug 11
Aug 13
Aug 15
Total Precip (mm)
Mean Temp (°C)