Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

May 15, 2018 to July 25, 2018

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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2018-05-15 to 2018-07-25

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Effluent discharge from the polishing pond of the tailings management area is indicated on Tributary to Gill's Pond Brook flow graphs. Due to differing reporting periods, however, the effluent trace is only presented until the end of May 2018. A complete record will be presented in the 2018 annual report.
- 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.

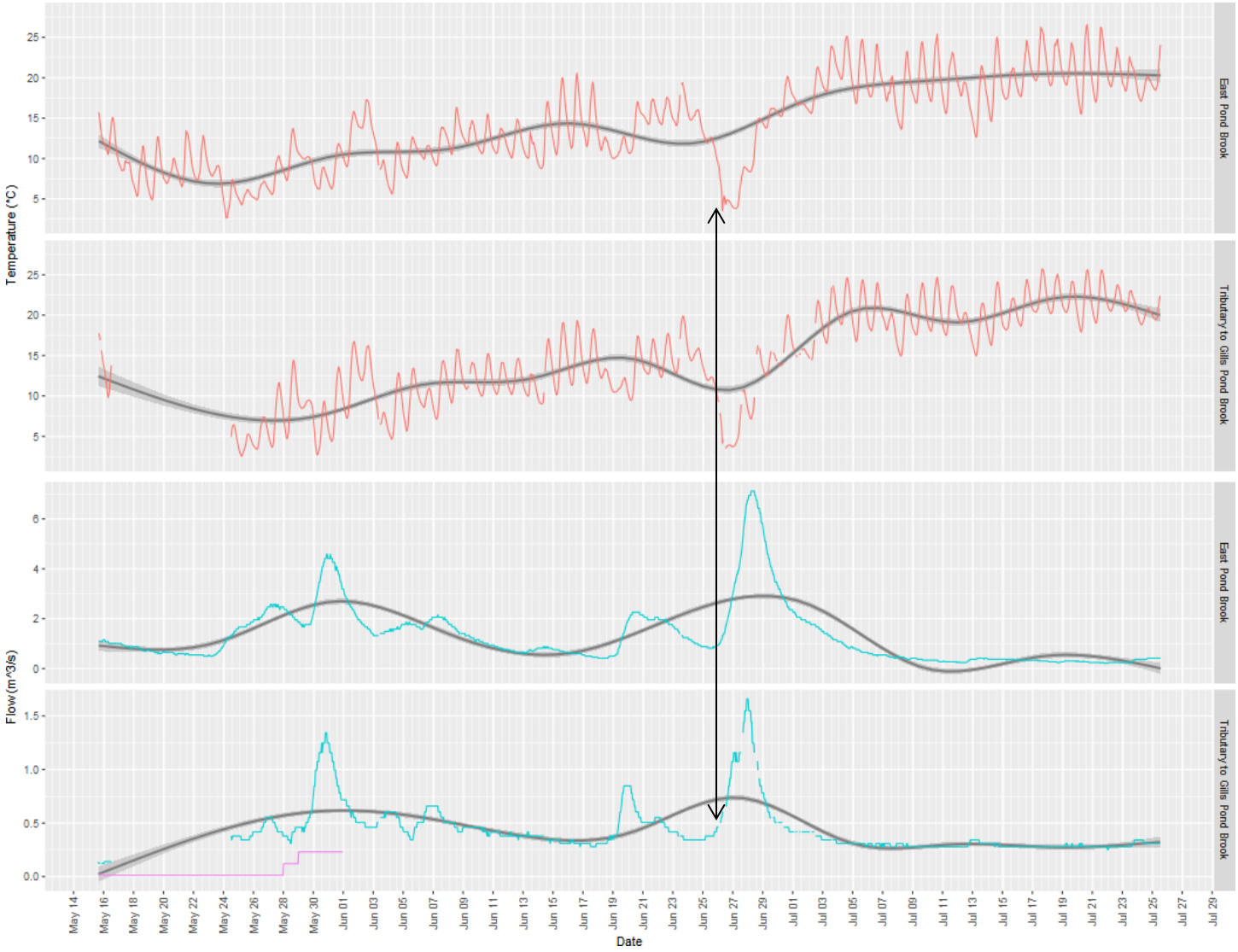
Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Tributary to Gills Pond Brook	May 15, 2018	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	July 25, 2018	Removal	Excellent	Excellent	Good	Excellent	Excellent
East Pond Brook	May 15, 2018	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	July 25, 2018	Removal	Excellent	Excellent	Good	Good	Excellent

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	14.17	13.94	2.63	26.57
Tributary to Gills Pond Brook	14.78	14.68	2.54	25.75

- Water temperature increased gradually during this deployment period with a mid-deployment cooling period from June 25th to June 27th. During this time, air temperatures dropped to near 0°C with nearly 25 mm of precipitation.

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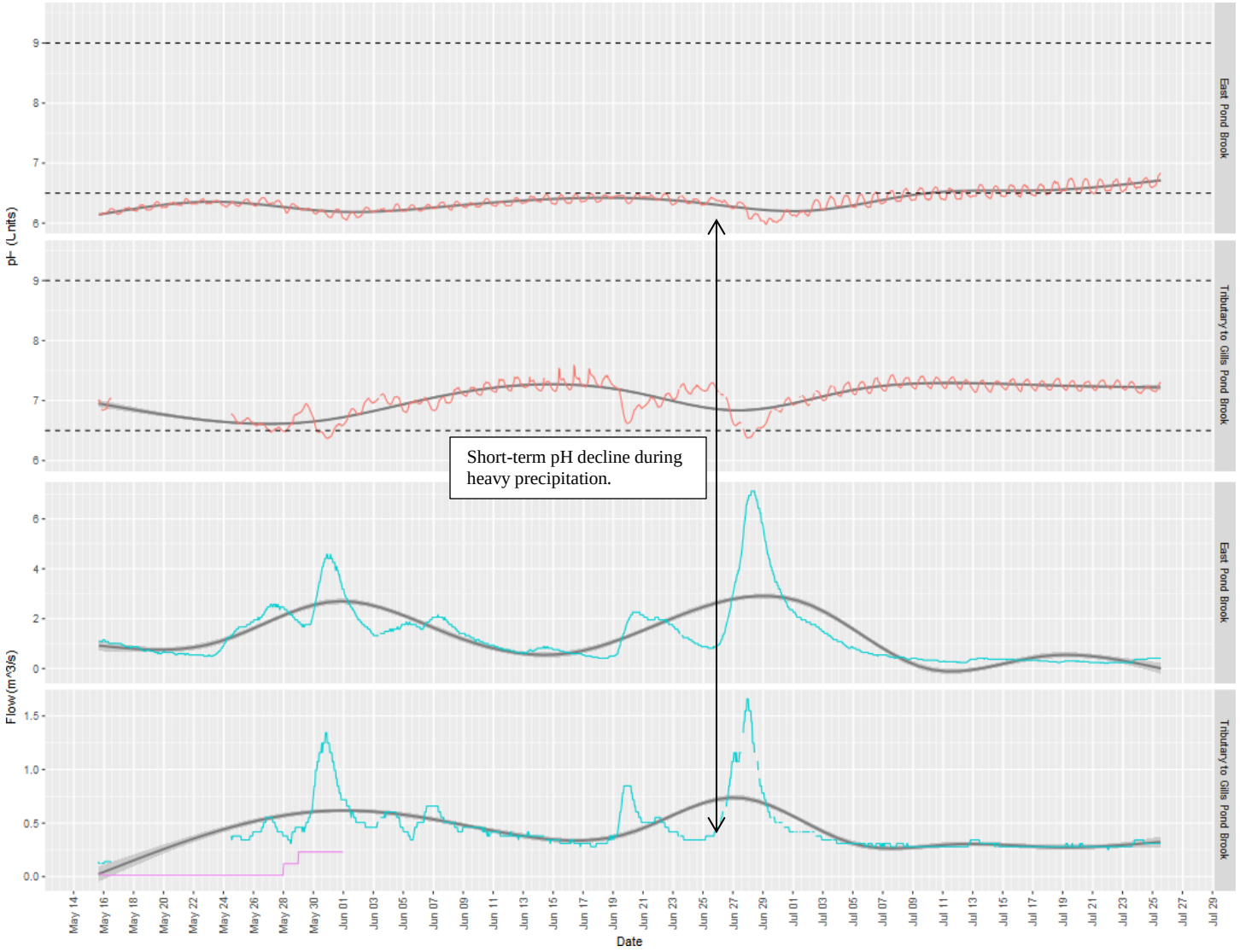
pH

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	6.37	6.35	5.98	6.83
Tributary to Gills Pond Brook	7.07	7.16	6.37	7.59

- pH values at EPB and TGPB were near the lower end of the CCME guidelines for the protection of cold water biota for this deployment period. A slow rise was observed at EPB station while pH was mostly stable at TGPB. This differing trend may be due to pH control efforts in the tailings management and polishing ponds.

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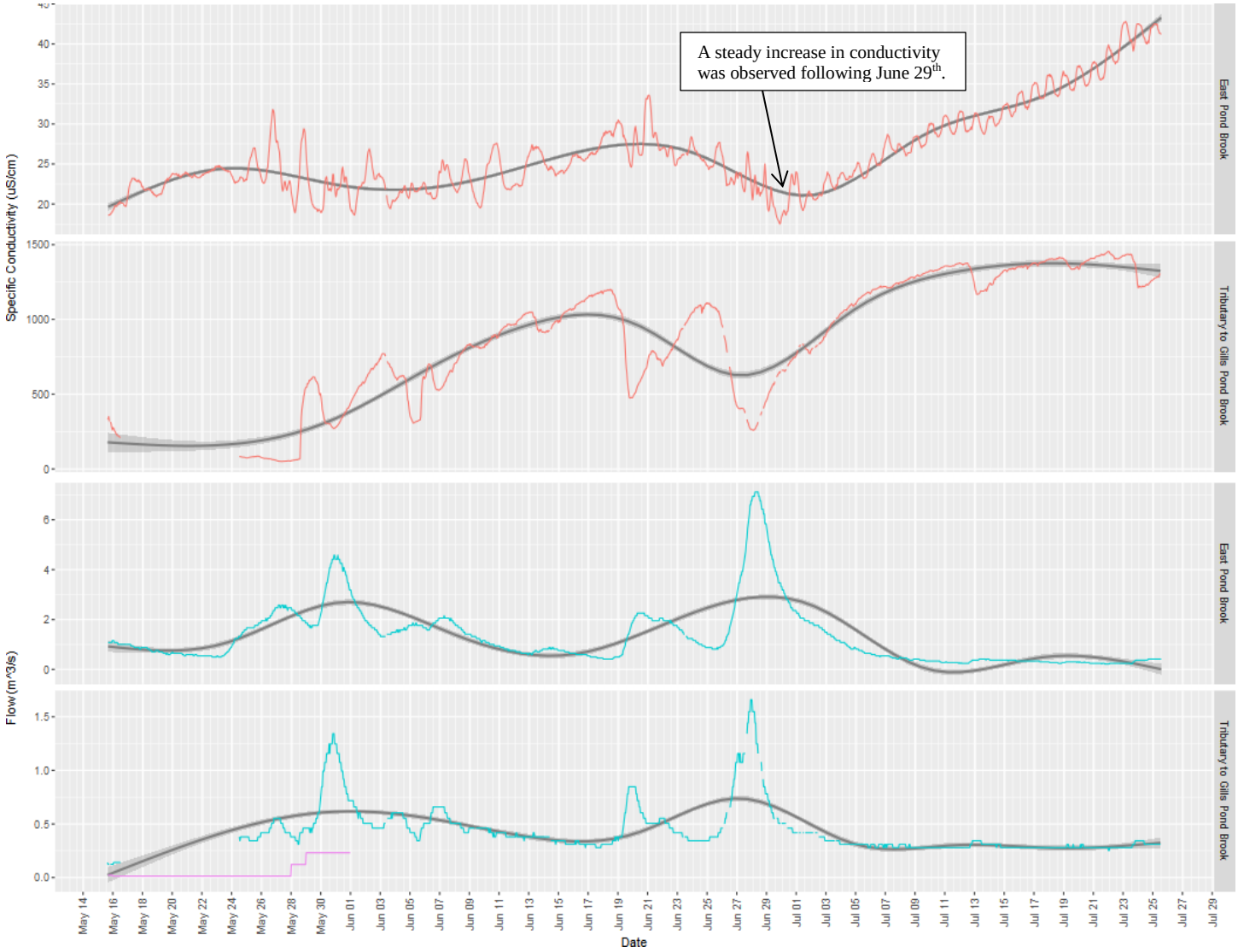
Specific Conductivity

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	26.3	24.7	17.5	42.8
Tributary to Gills Pond Brook	897.8	967.0	50.0	1455.0

- Specific conductivity increased at both water quality stations during this deployment period. At EPB station, conductivity values are noted to steadily increase with reduced variability after June 25th to June 27th.

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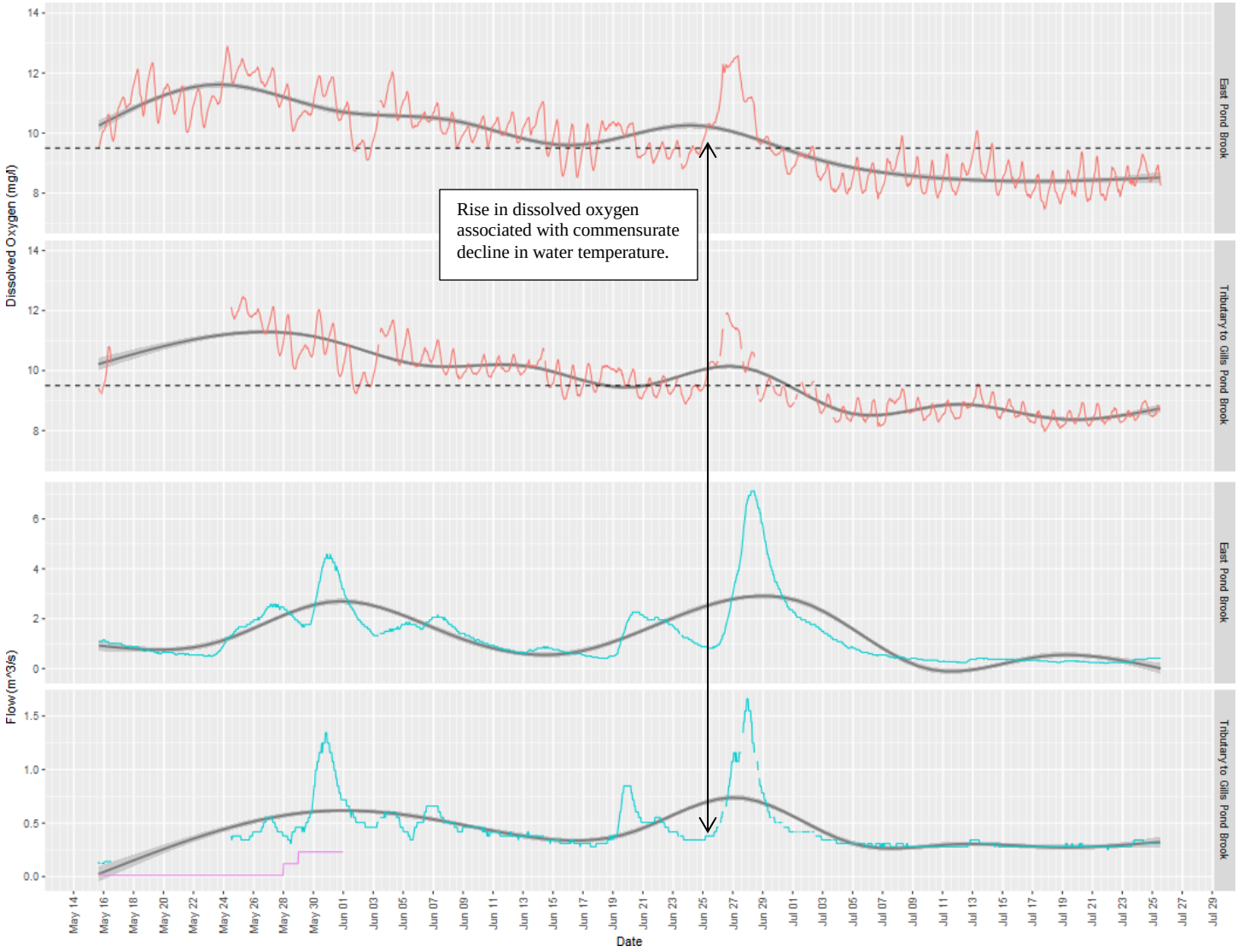
Dissolved Oxygen

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	9.81	9.75	7.47	12.89
Tributary to Gills Pond Brook	9.62	9.47	7.97	12.58

- With rising water temperatures, dissolved oxygen levels are observed to decline throughout the deployment period. A rising trend in dissolved oxygen mirrors a depression in water temperatures from June 25th to June 27th. For both stations, oxygen concentrations tended to fall below the upper CCME Guideline for the protection of early life stage aquatic life in mid-June, as expected.

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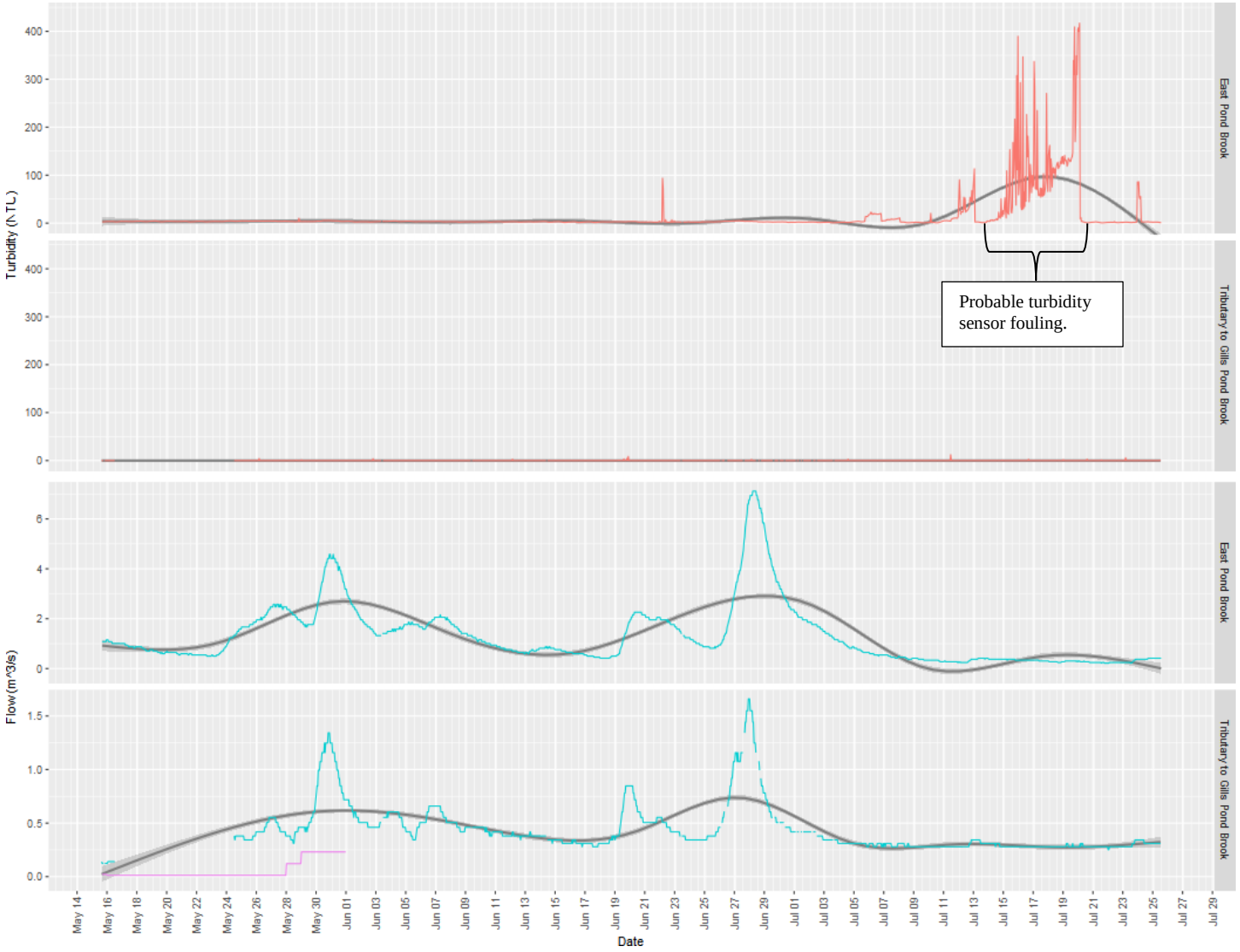
Turbidity

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	13.6	3.1	0.5	417.0
Tributary to Gills Pond Brook	0.0	0.0	0.0	12.2

- Turbidity levels were low during this deployment period at both stations, aside from a period of suspected turbidity sensor fouling at EPB station in mid-July. A linear rise in turbidity followed by a sharp decline often indicates a fouled sensor that was cleared for some reason.

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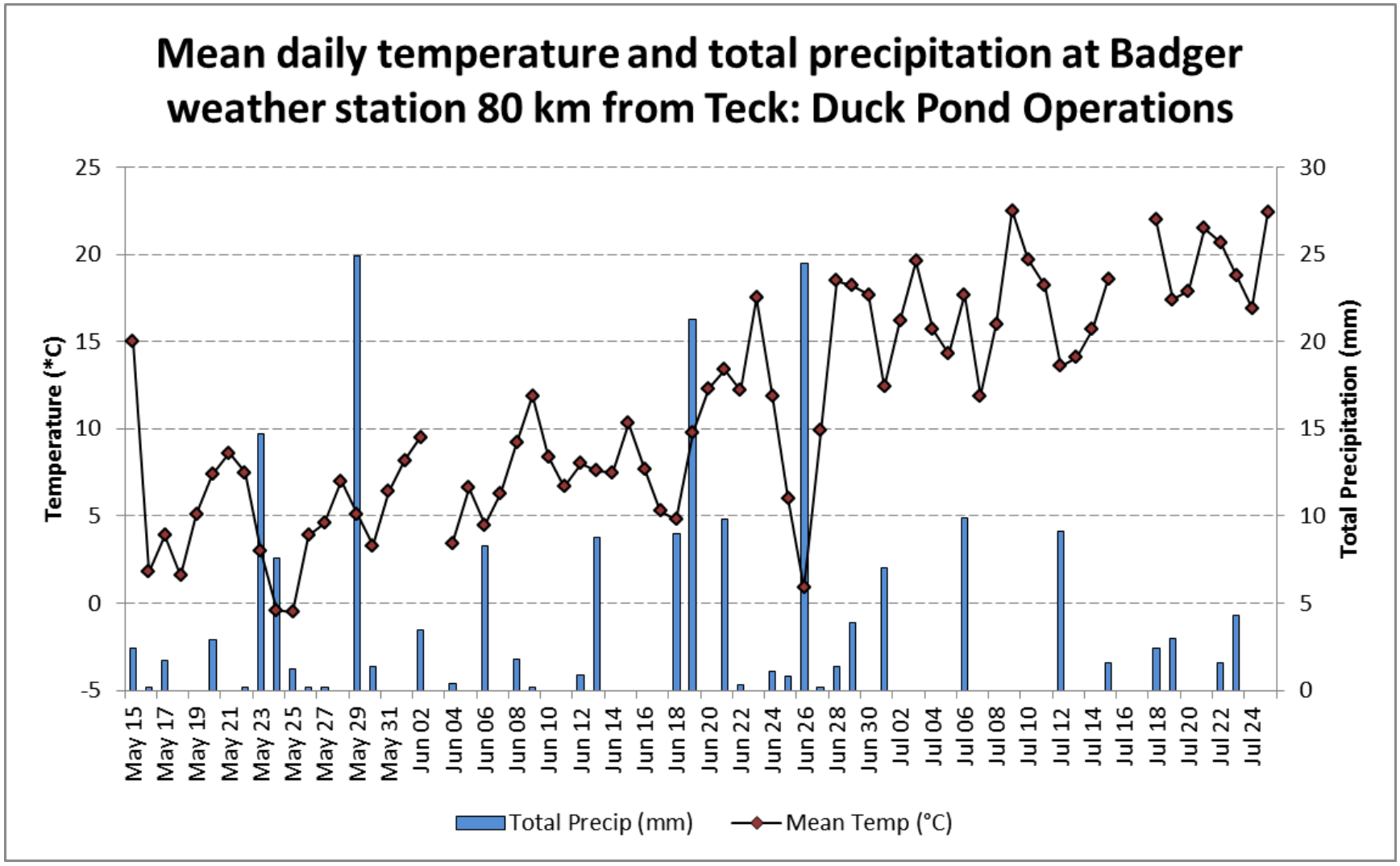
Appendix


Mean daily temperature and total precipitation at Badger weather station 80 km from Teck: Duck Pond Operations
Temperature (*C)
Total Precipitation (mm)
25
20
15
10
5
0
-5
30
25
20
15
10
5
0
May 15
May 17
May 19
May 21
May 23
May 25
May 27
May 29
May 31
Jun 02
Jun 04
Jun 06
Jun 08
Jun 10
Jun 12
Jun 14
Jun 16
Jun 18
Jun 20
Jun 22
Jun 24
Jun 26
Jun 28
Jun 30
Jul 02
Jul 04
Jul 06
Jul 08
Jul 10
Jul 12
Jul 14
Jul 16
Jul 18
Jul 20
Jul 22
Jul 24
Total Precip (mm)
Mean Temp (°C)