Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

August 16, 2017 to November 16, 2017

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

Newfoundland Labrador

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General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- In this deployment report, Tributary to Gills Pond Brook and East Pond Brook stations will be abbreviated as TGPB and EPB, respectively.
- A pH sensor failure at TGPB occurred almost immediately after deployment; however, the lack of a suitable replacement instrument meant that the instrument had to remain deployed until replacement equipment could be made available.
- 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

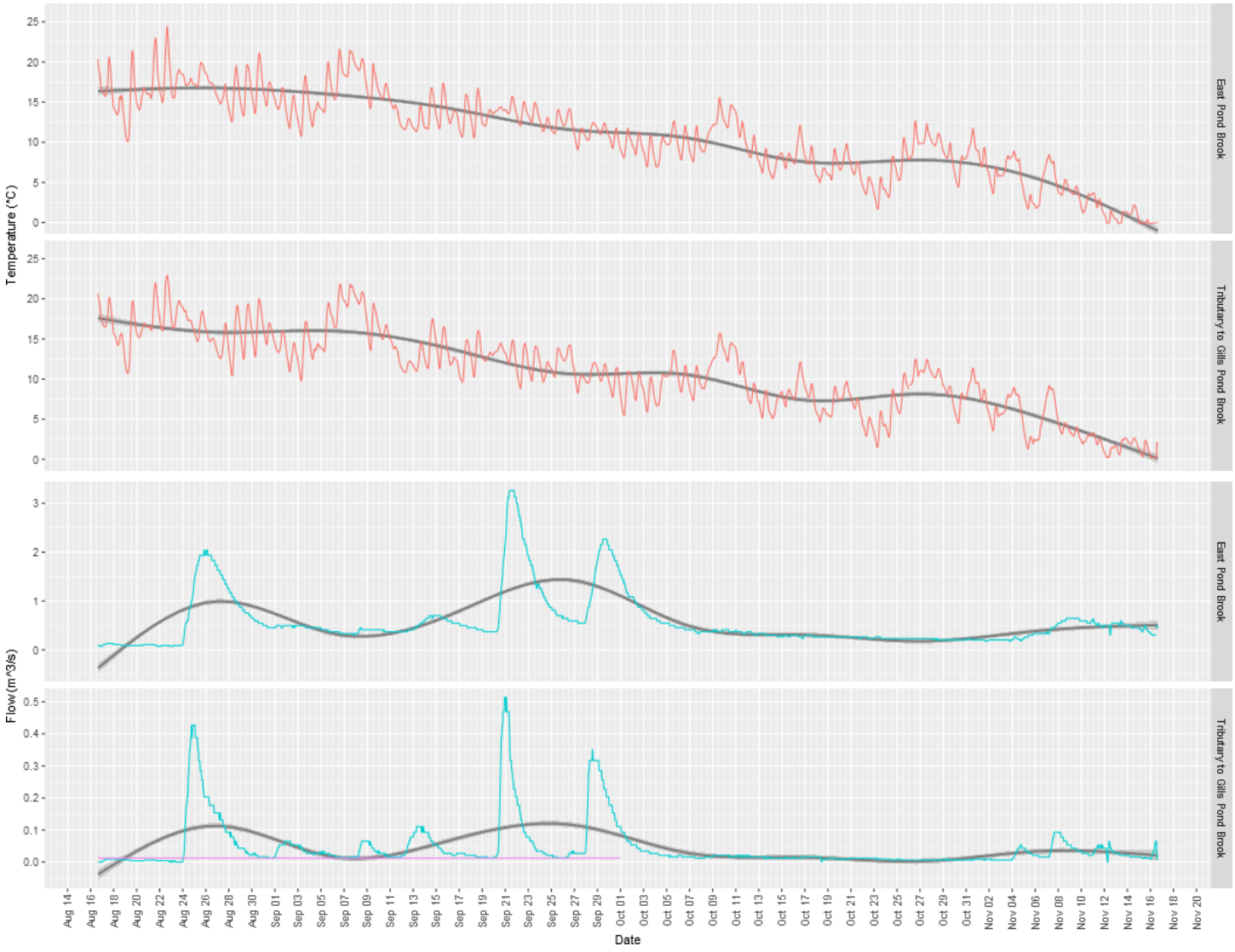
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Tributary to Gills Pond Brook			Excellent	NA	Excellent	Excellent	Excellent
			Excellent	NA	Good	Marginal	Excellent
East Pond Brook			Excellent	Good	Good	Excellent	Excellent
			Poor	Fair	Excellent	Poor	Marginal

- At deployment, a pH sensor failure at TGPB station resulted in no QAQC ranking for the deployment period. A “Marginal” ranking was achieved for dissolved oxygen during removal at TGPB station. This may be due to slight variation in placement between the QAQC and Field sondes as both readings were within expected range.
- QAQC rankings were unusually negative for EPB station during removal. This may be related to a longer than usual deployment period allowing mud and silt to accumulate on sensor surfaces to a degree where readings were impacted. Several days of turbidity data were removed from EPB station.

- 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	10.90	11.33	-0.15	24.47
Tributary to Gills Pond Brook	10.74	10.89	0.19	22.93

- Water temperature began to decline at both stations shortly after mid-August and into mid-November, as expected. Intermittent warming trends were observed concurrently with warm air temperatures.
- During removal time, partial ice coverage was noted at both stations, with a larger percentage of ice coverage found at TGPB than EPB station (5/10 vs 2/10).

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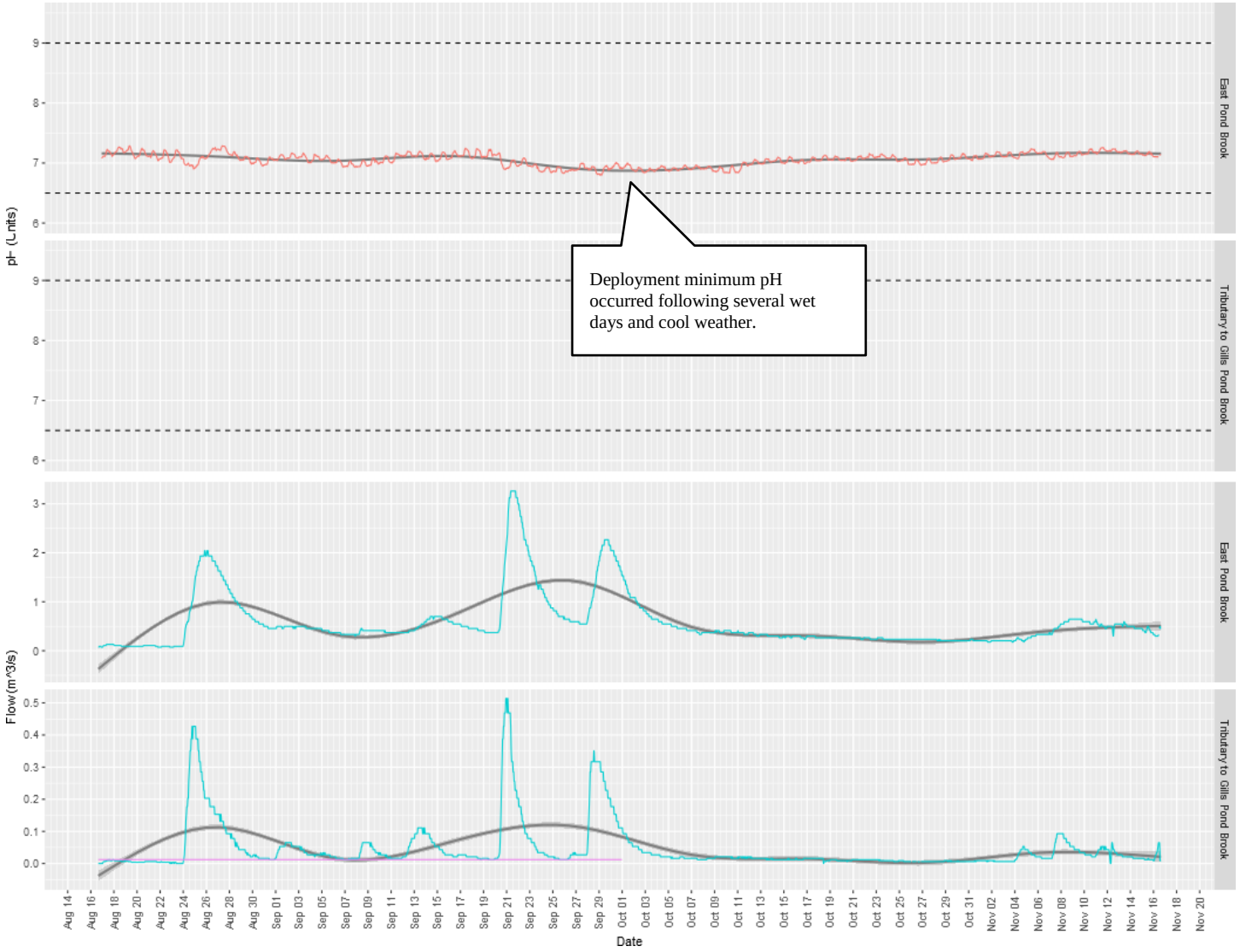
pH

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	7.06	7.07	6.80	7.29

- pH at EPB station slowly declined towards the middle of the deployment period before slowly increasing once again into the second half of the deployment period.

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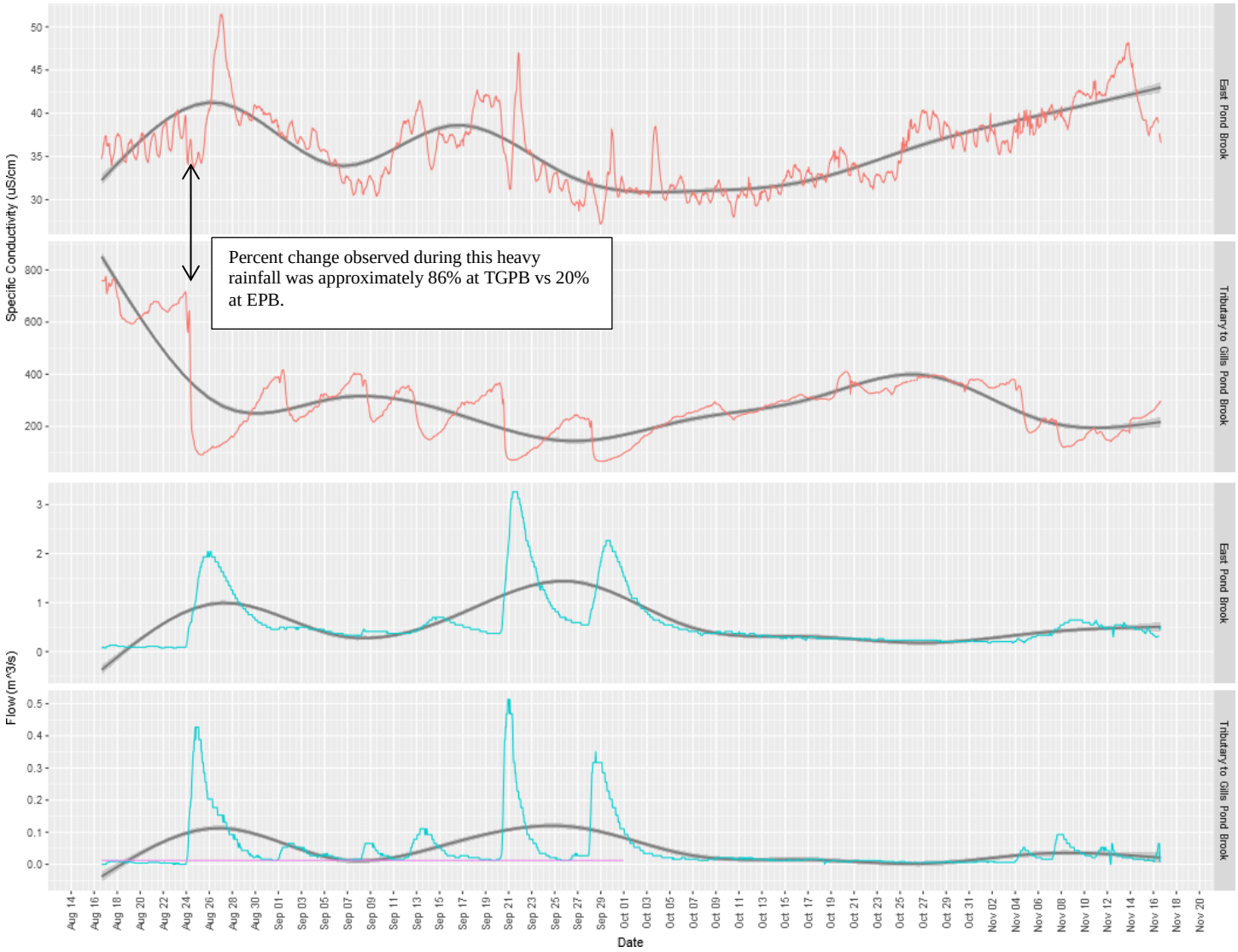
Specific Conductivity

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	36.0	36.1	27.2	51.5
Tributary to Gills Pond Brook	289.3	272.0	65.8	775.0

- Heavy precipitation from August 23rd – to 26th highlights the difference in dissolved solid content between EPB and TGPB stations. TGPB station exhibits significant fluctuation in conductivity due to the high concentration of dissolved solids present in effluent from Duck Pond Operations and the strong diluting effect of fresh rainfall. Conductivity variation at EPB, however, is much less substantial due to the relatively comparable level of dissolved solids in EPB water and rainwater.

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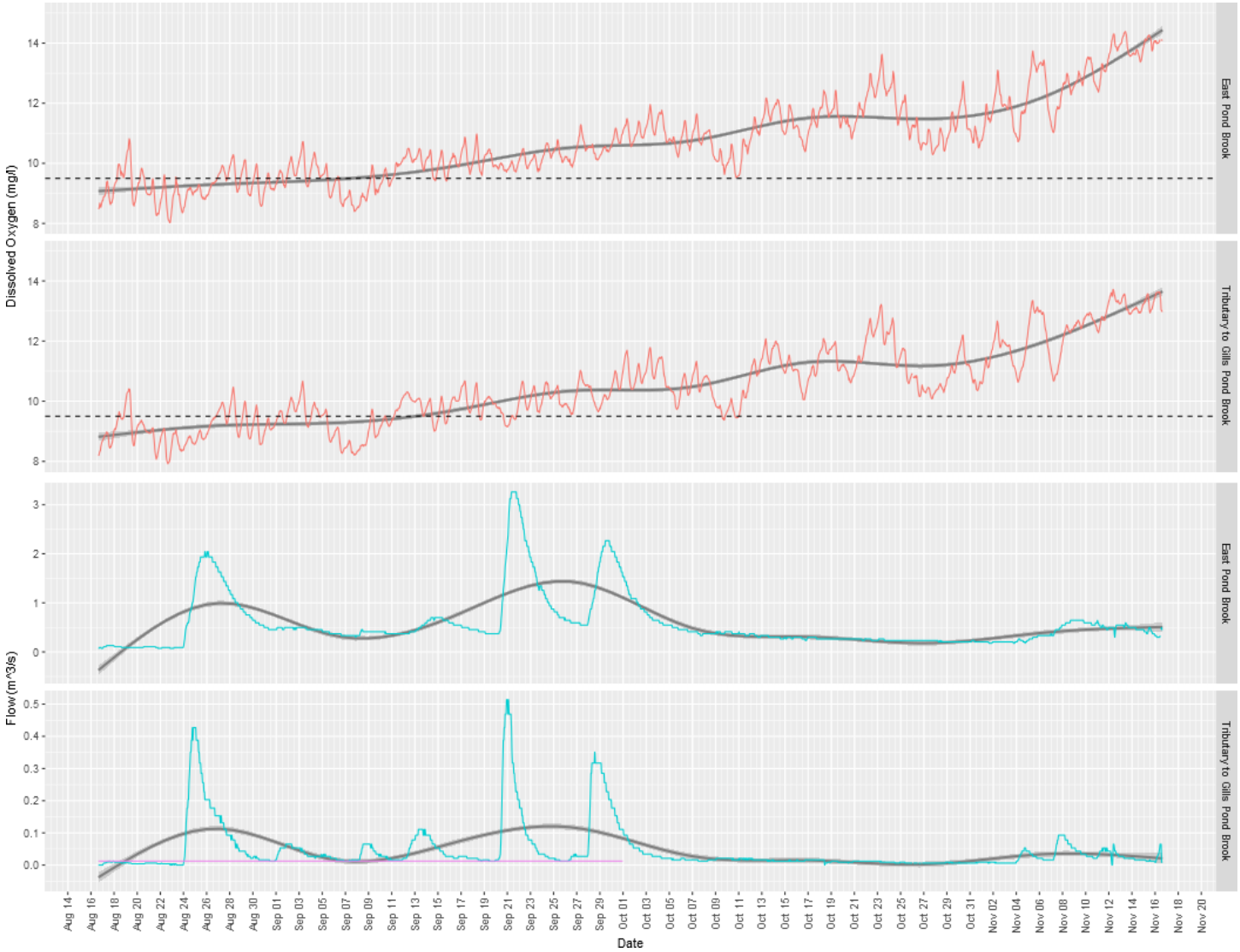
Dissolved Oxygen

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	10.74	10.54	8.03	14.39
Tributary to Gills Pond Brook	10.51	10.33	7.92	13.72

- A steady rise in dissolved oxygen levels is observed through the deployment period as water temperatures cooled into mid-November. By mid-September, most DO values were recorded above the CCME guideline of 9.5 mg/l for the protection of all stages of aquatic life.

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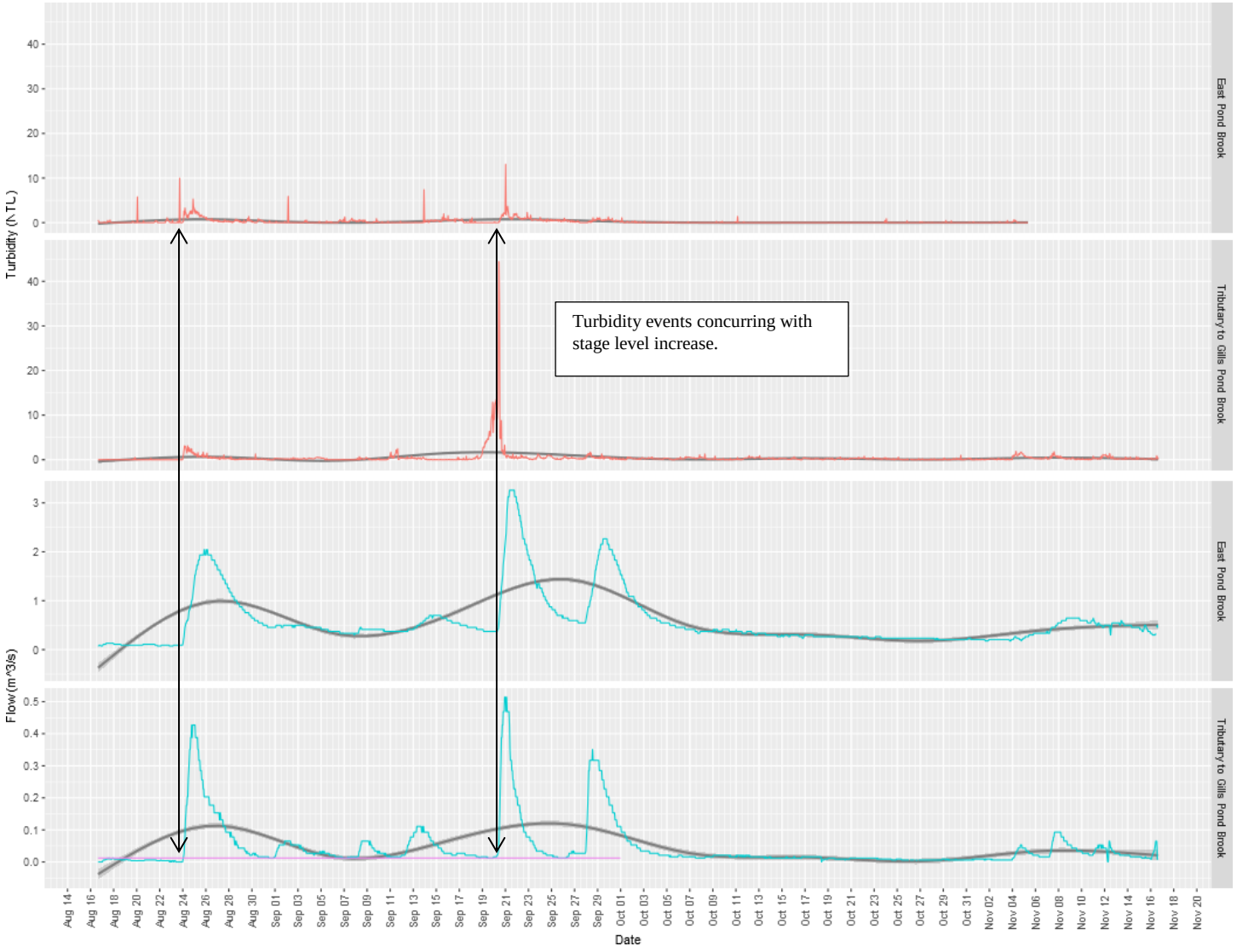
Turbidity

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	0.2	0.0	0.0	13.1
Tributary to Gills Pond Brook	0.4	0.2	0.0	44.4

- Turbidity levels were low at both EPB and TGPB stations over the course of the deployment period. Occasional turbidity events and spikes were encountered with concurrent stage-level rise, suggesting runoff from precipitation.

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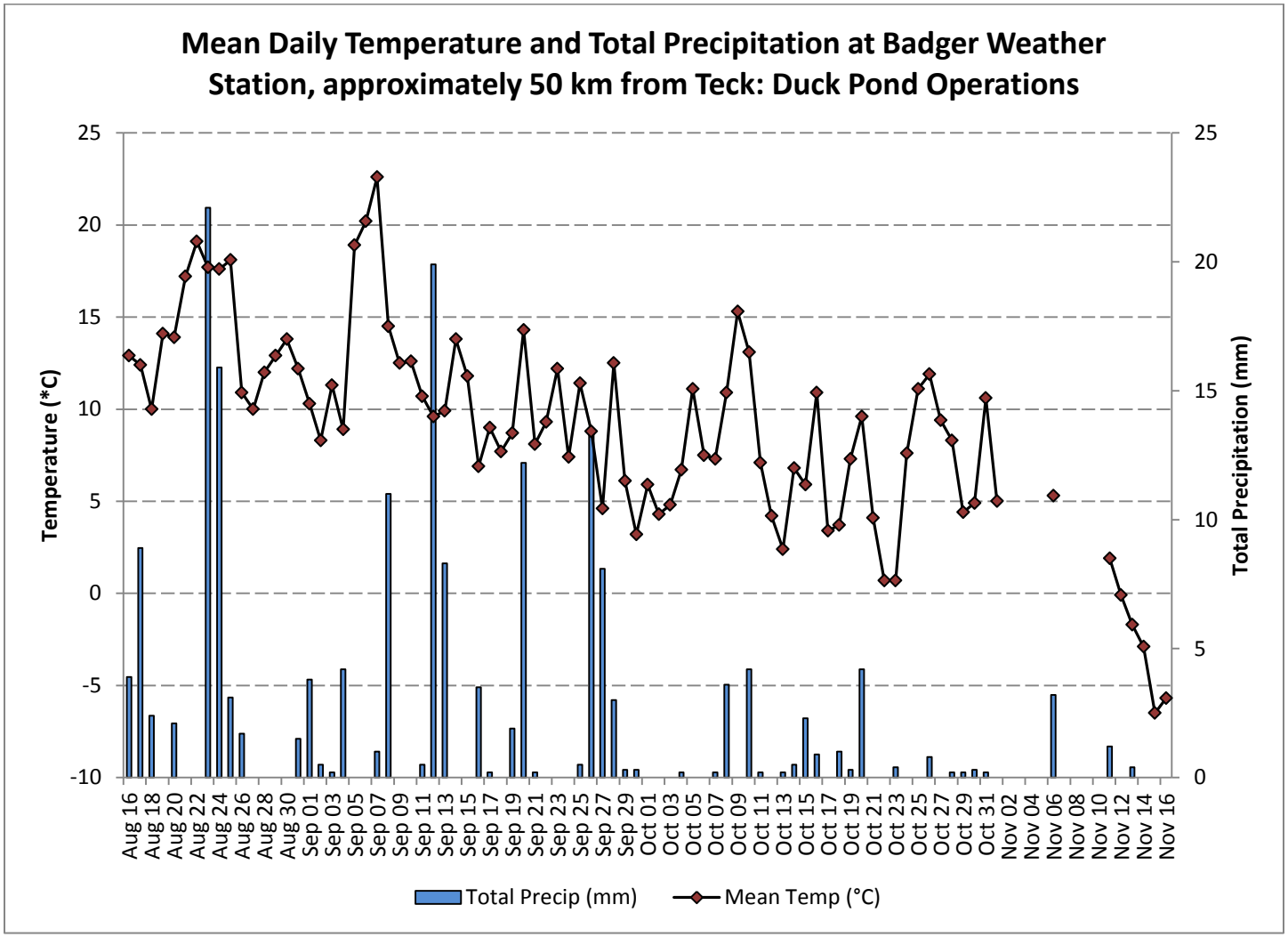
Appendix


Mean Daily Temperature and Total Precipitation at Badger Weather Station, approximately 50 km from Teck: Duck Pond Operations
Temperature (*C)
Total Precipitation (mm)
25
20
15
10
5
0
-5
-10
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
Sep 27
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Oct 01
Oct 03
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Oct 17
Oct 19
Oct 21
Oct 23
Oct 25
Oct 27
Oct 29
Oct 31
Nov 02
Nov 04
Nov 06
Nov 08
Nov 10
Nov 12
Nov 14
Nov 16
Total Precip (mm)
Mean Temp (°C)