Real-Time Water Quality Deployment Report

Rattling Brook Network

November 15, 2019 to January 14, 2020

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 monitor the real-time web pages consistently.
- On January 14th 2020 Rattling Brook Big Pond water quality sonde was removed for winter months.
- Rattling Brook below Plant Discharge experienced transmission failure from December 23rd to January 8th due to battery depletion.
- The handheld for the QA/QC sonde failed during removal and rankings unavailable for Below Bridge and Big Pond.
- 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

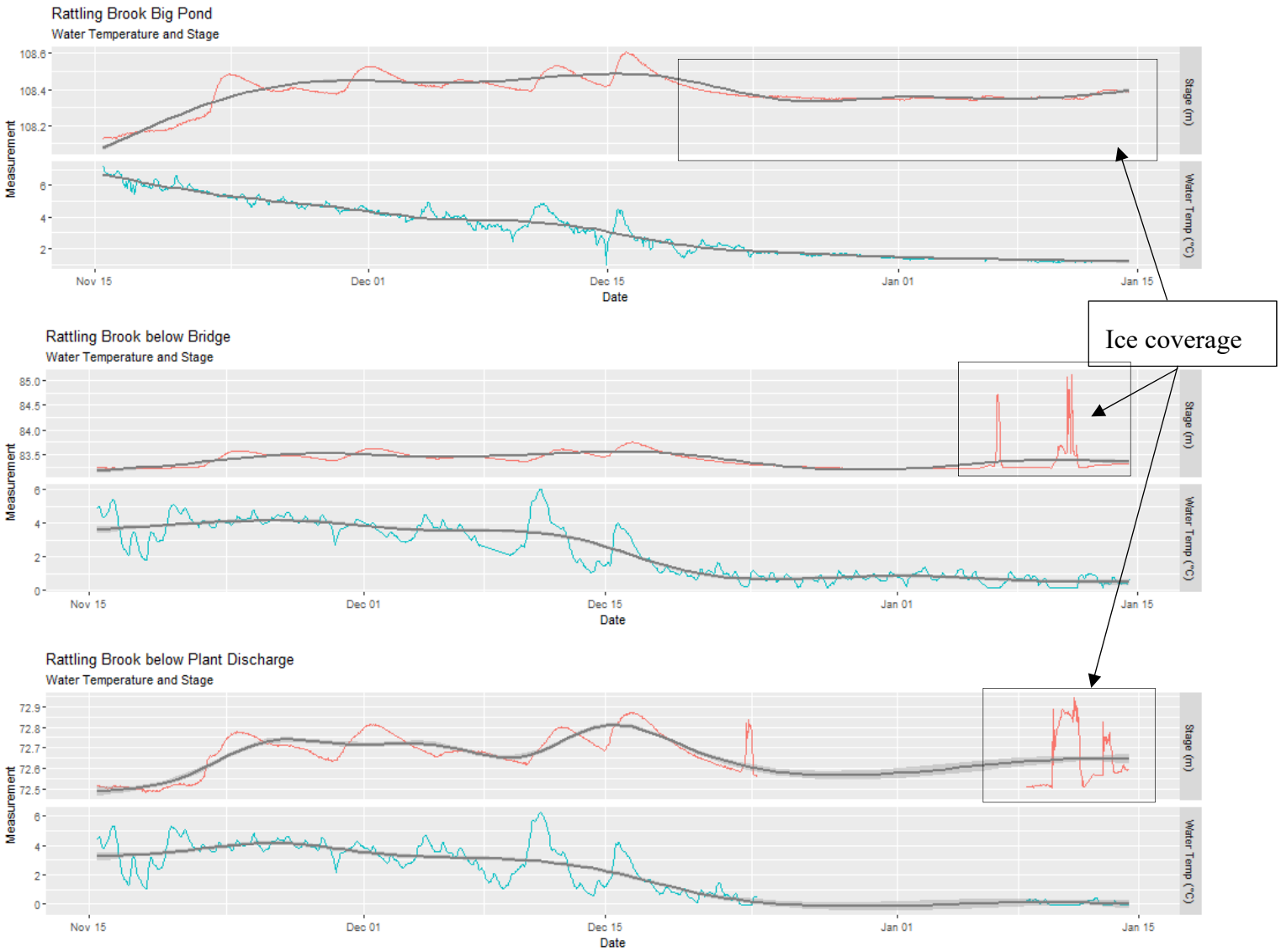
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	November 15	Deployment	Excellent	Good	Good	Excellent	Good
	January 14	Removal	N/A	N/A	N/A	N/A	N/A
Rattling Brook below Bridge	November 15	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	January 14	Removal	N/A	N/A	N/A	N/A	N/A
Rattling Brook below Plant Discharge	November 15	Deployment	Excellent	Poor	Excellent	Excellent	Good
	January 14	Removal	Excellent	Fair	Excellent	Fair	Excellent

- All comparison rankings were ‘Fair’ to ‘Excellent’ with the exception of pH sensor during deployment at Below Discharge which ranked ‘Poor’. The field value was 5.05 while the QA/QC value was 6.33 the grab sample was 6.73. Possibly a result of not allowing enough time to pass for the sensor to regulate in the water body. The sensor did improve to ‘Fair’ ranking during removal.

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
Big Pond	3.13	2.81	0.98	7.18
Below Bridge	2.47	2.44	0.15	6.02
Below Plant Discharge	2.51	2.82	-0.04	6.23

- Seasonal stratification can be observed at Big Pond. Stations displayed small diurnal variations, typical of shallow water streams and ponds during winter months.

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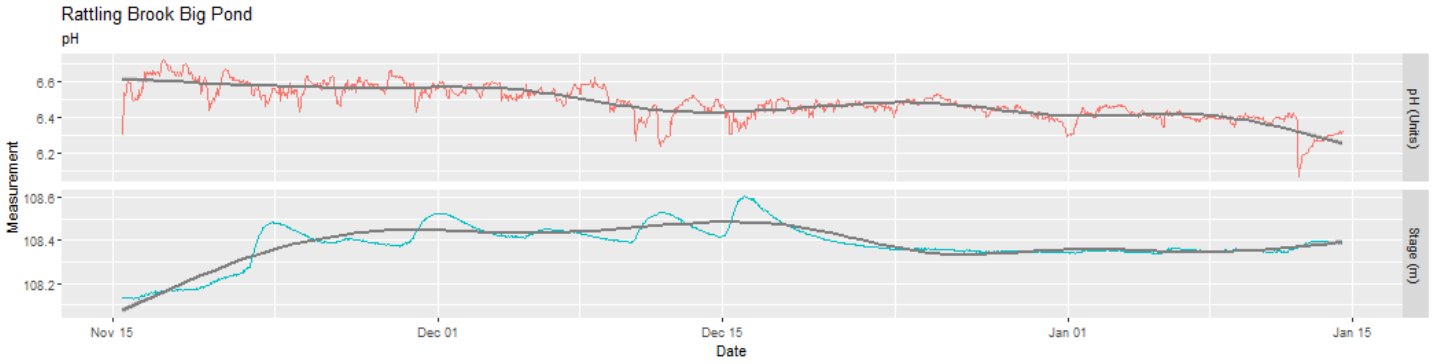
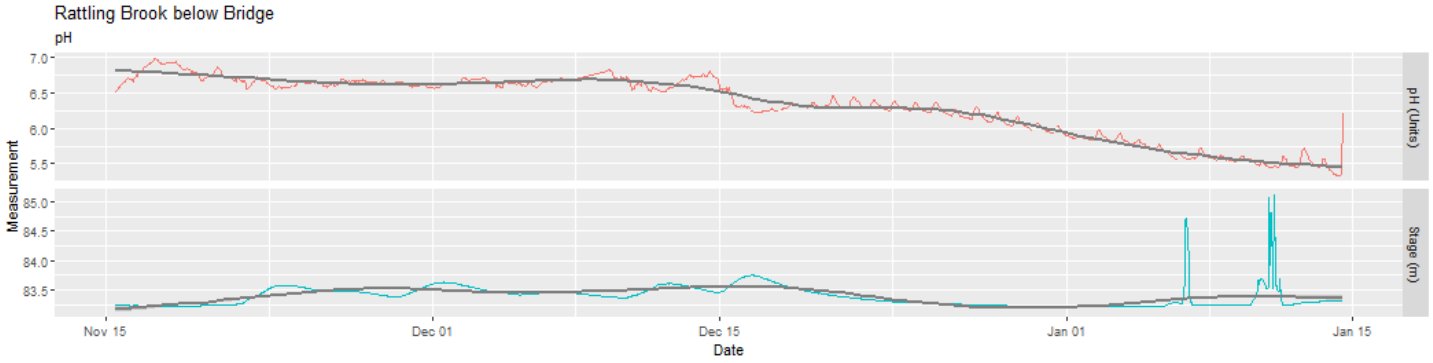
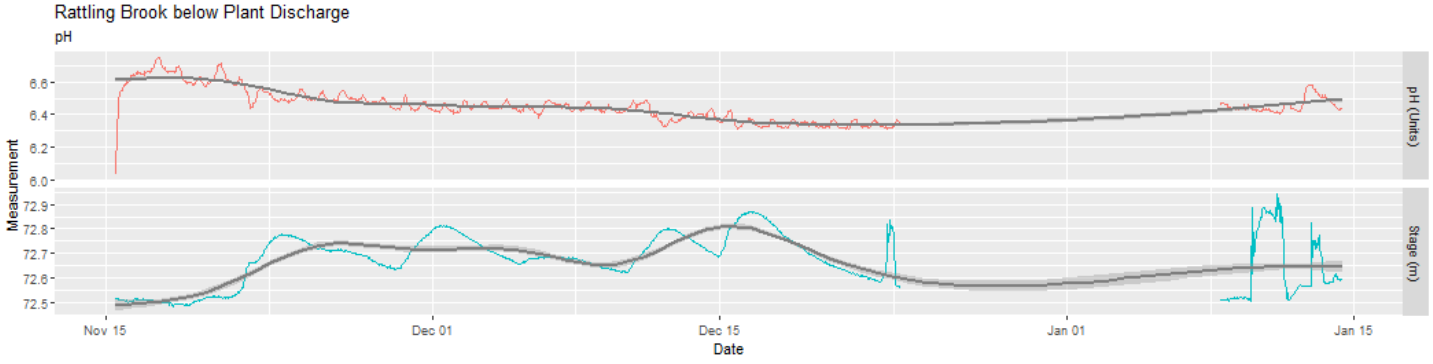
pH

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
Big Pond	6.48	6.47	6.07	6.72
Below Bridge	6.42	6.58	5.57	6.98
Below Plant Discharge	6.46	6.45	6.03	6.75

- pH values tend to show little variability during the fall/winter season with peaks and falls based on water level. The pH data remained within the site specific guidelines (5.67-6.56 pH Units).

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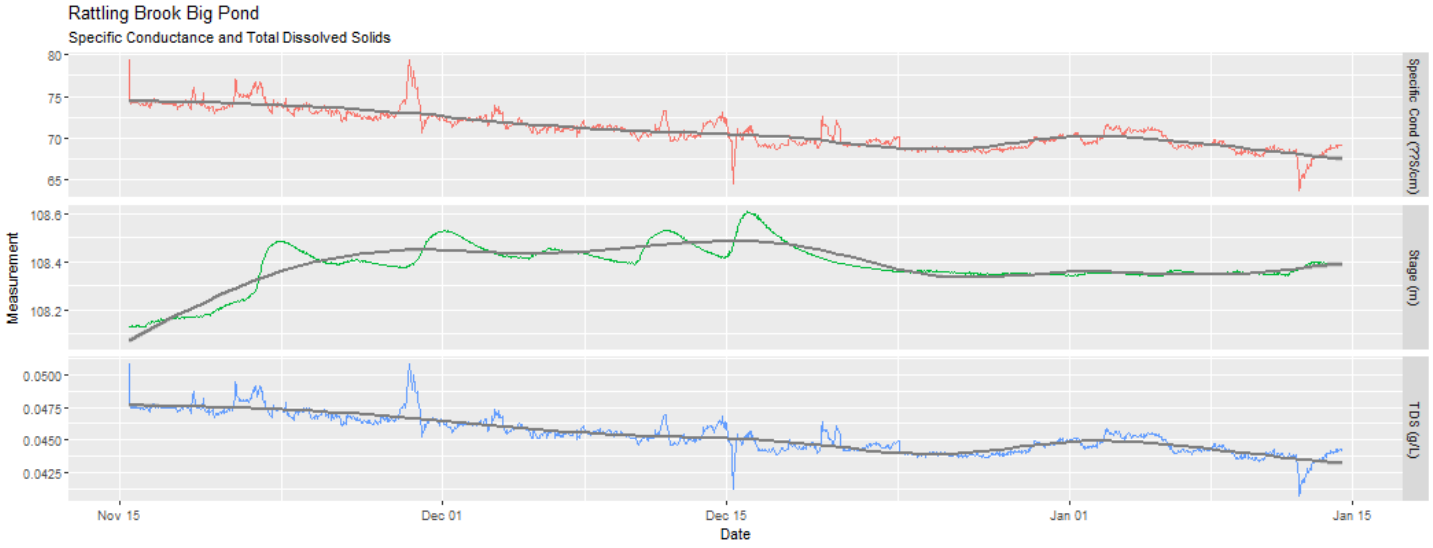
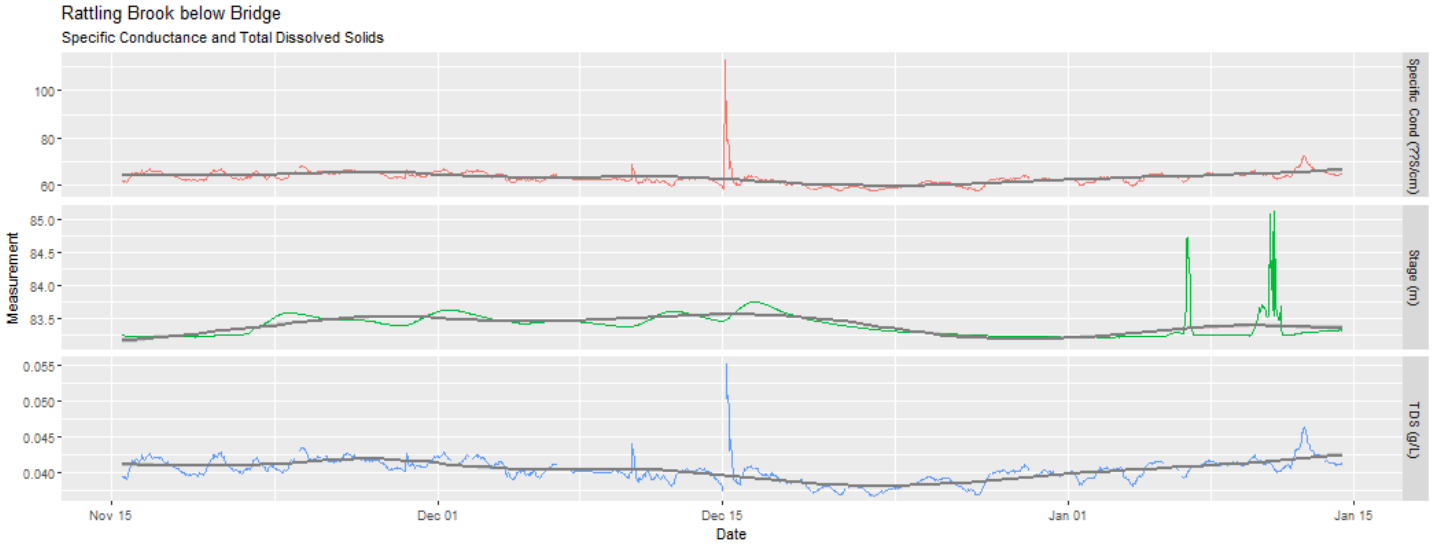
Specific Conductivity

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.





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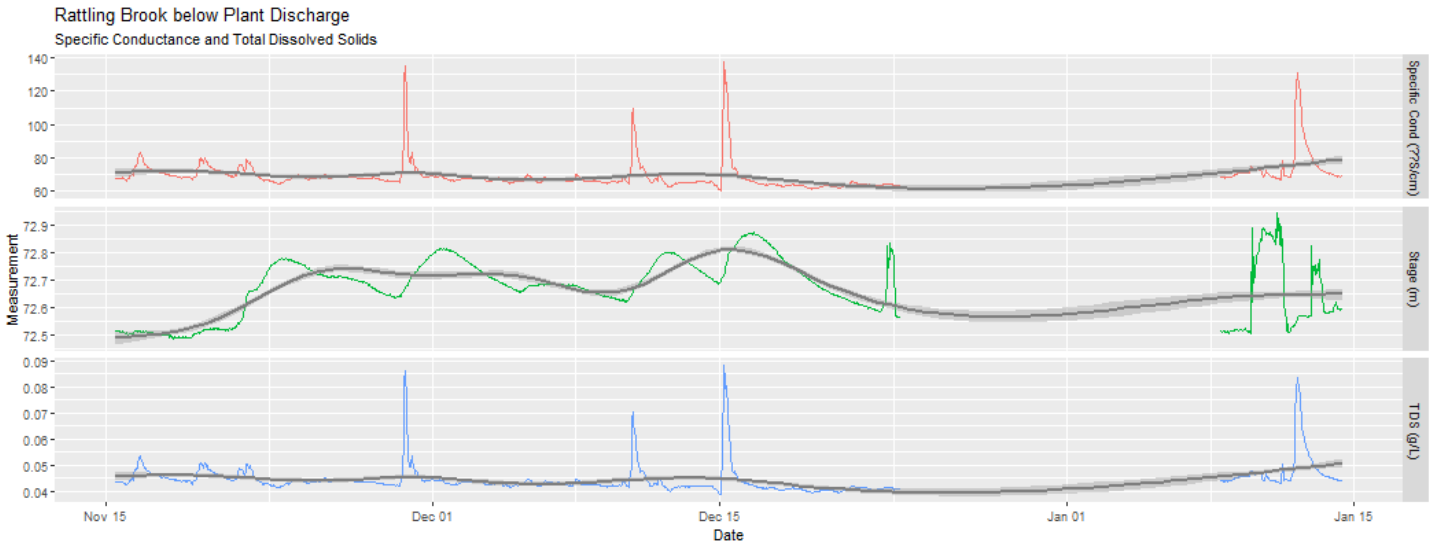

Station	Mean	Median	Min	Max
Big Pond	71.0	70.7	63.7	79.4
Below Bridge	62.8	62.7	57.5	113.2
Below Plant Discharge	69.6	67.9	60.3	137.8

- Conductivity was generally stable at all stations during this deployment.
- Sharp increases in conductivity generally align with changes in stage levels as the system is either diluted by rainfall, or conductivity increases due to runoff into the system.

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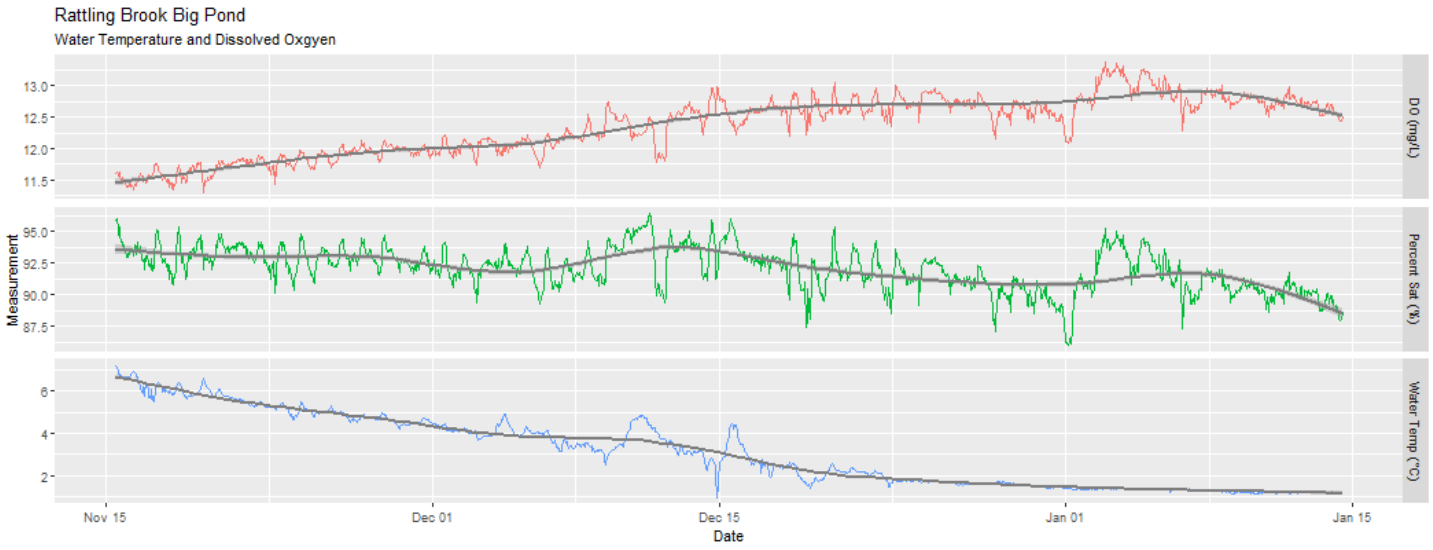
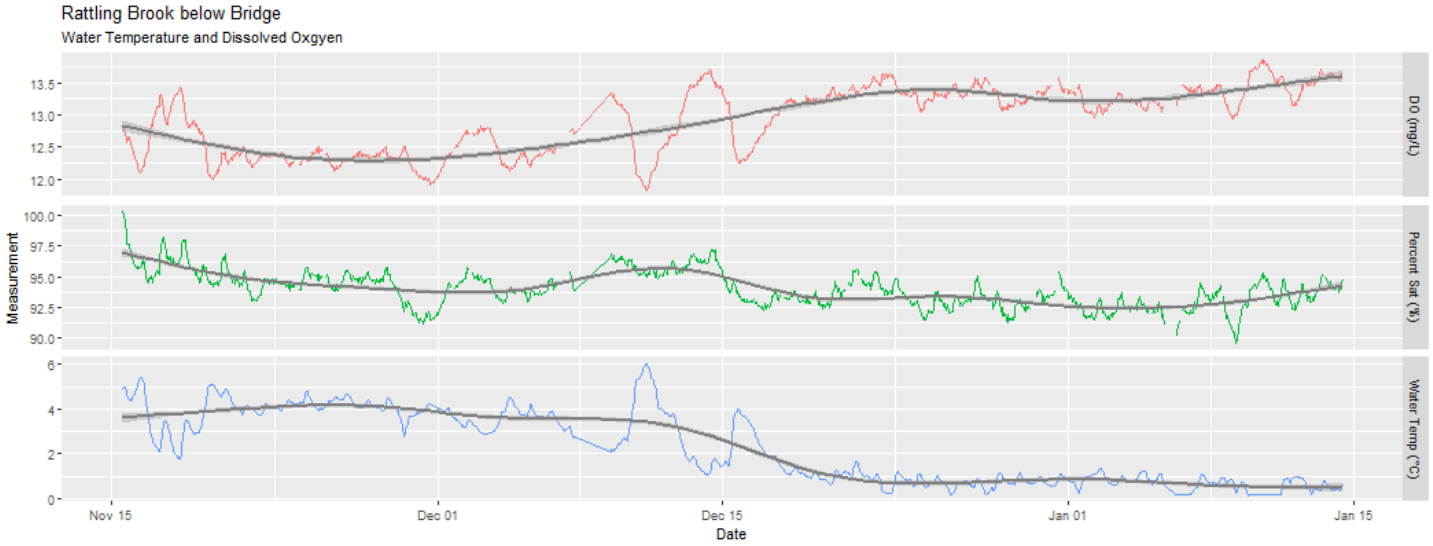
Dissolved Oxygen

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 oxidation reactions.





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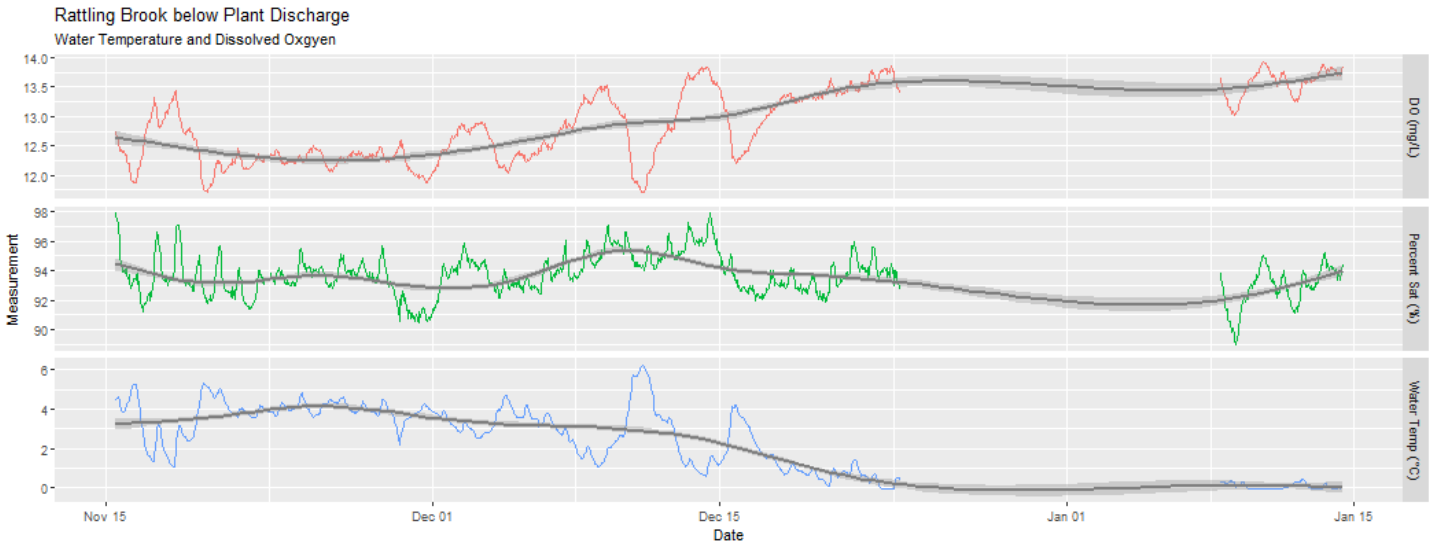

Station	Mean	Median	Min	Max
Big Pond	12.36	12.50	11.29	13.39
Below Bridge	12.83	12.88	11.82	13.71
Below Plant Discharge	12.83	12.78	11.70	13.94

- Dissolved oxygen concentrations increased at each monitoring station as water temperatures decreased into the winter months.

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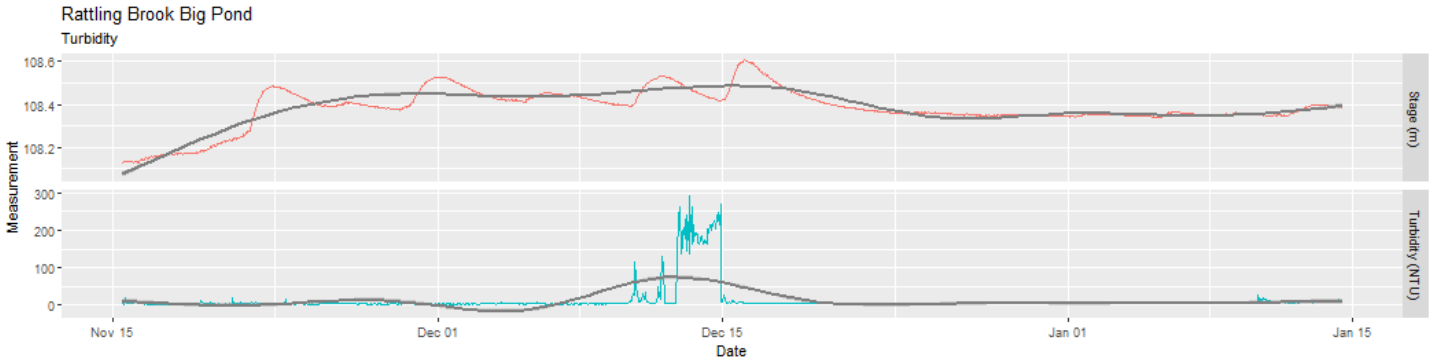
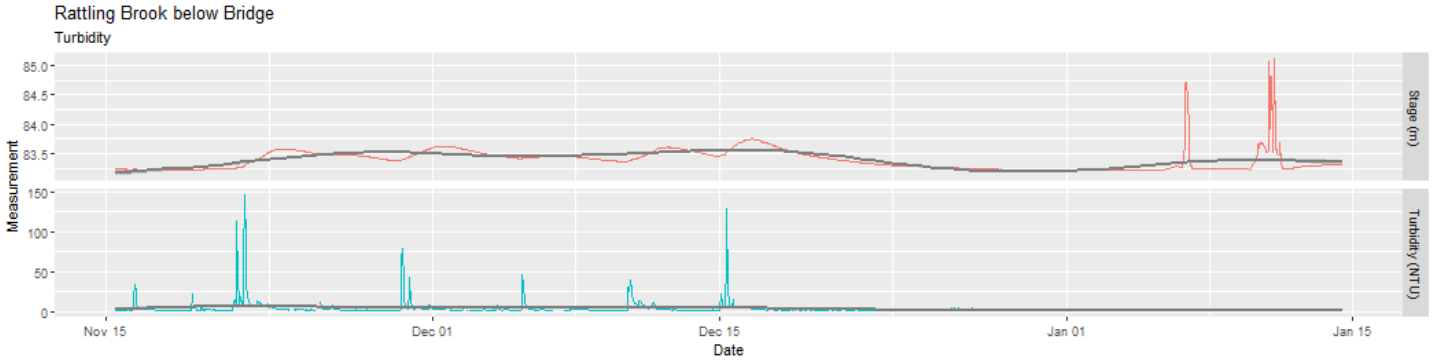
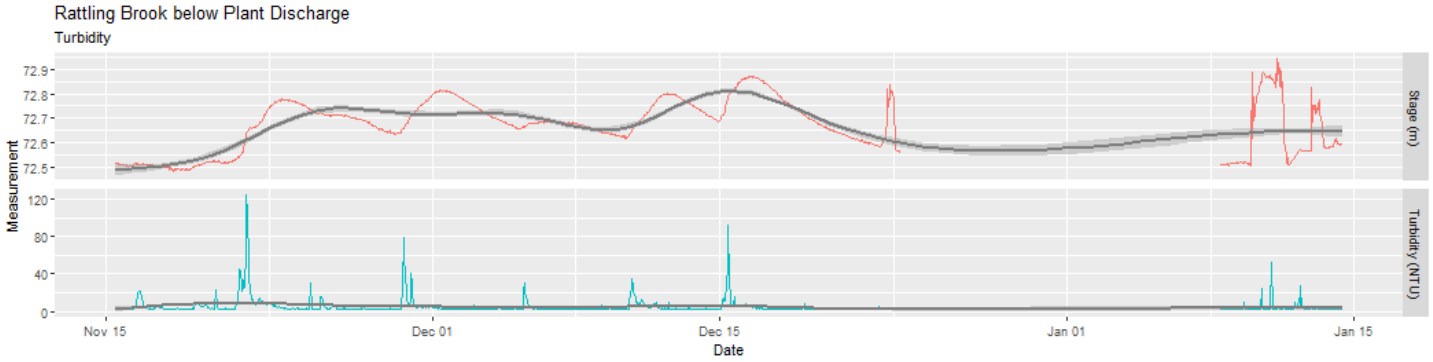
Turbidity

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
Big Pond	11.5	3.3	2.0	291.9
Below Bridge	3.9	2.0	1.2	145.8
Below Plant Discharge	4.9	2.5	1.7	124.4

- Turbidity levels were generally low for this deployment period with Big Pond turbidity remaining stable when ice cover occurs. Most turbidity peaks are associated with precipitation events and stage level increases; November to December experienced multiple precipitation events which correspond with turbidity events at the monitoring stations during that time.

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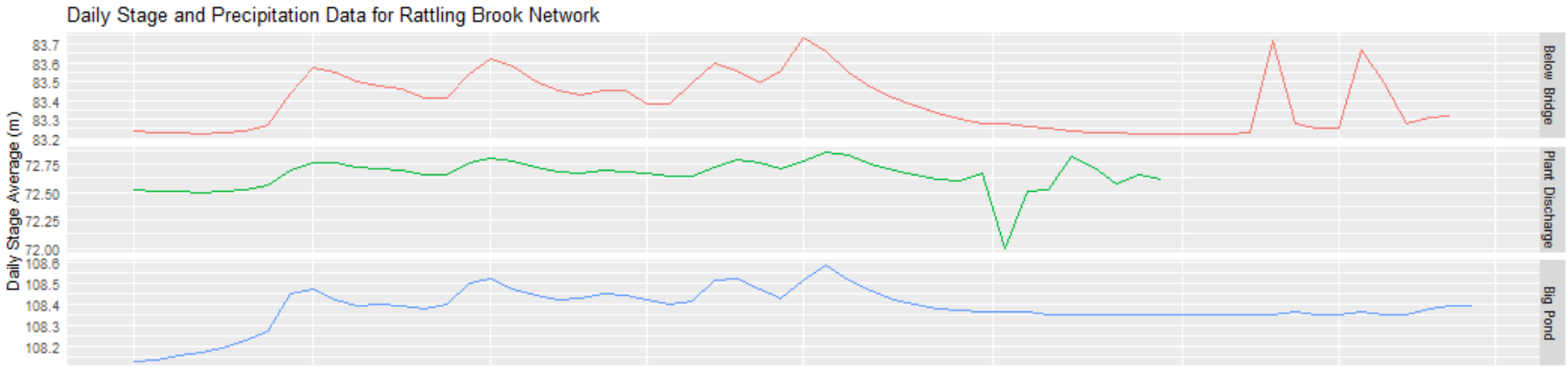
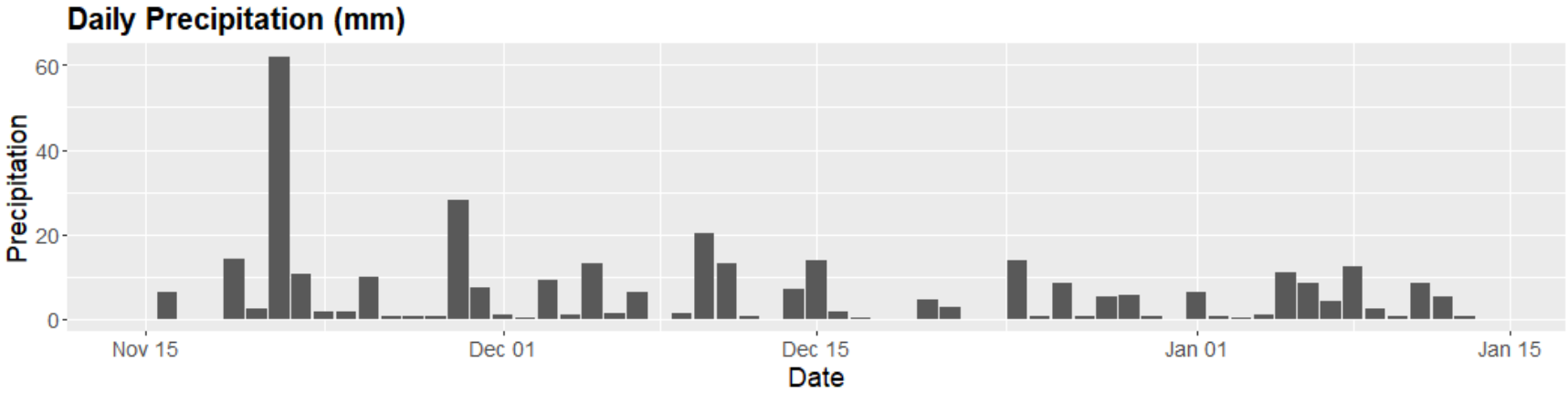
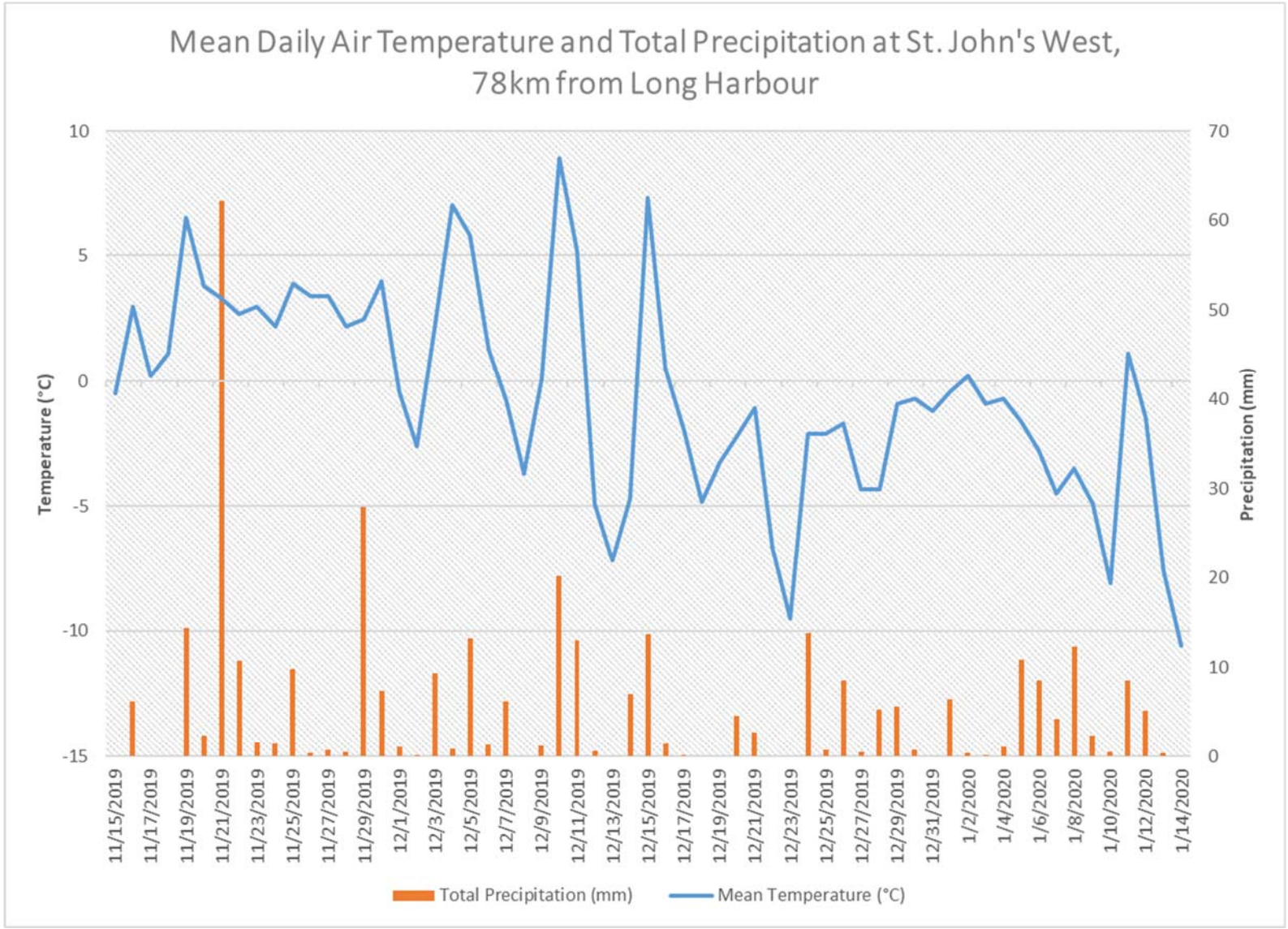
Appendix


Daily Stage and Precipitation Data for Rattling Brook Network
Daily Stage Average (m)
83.7
83.6
83.5
83.4
83.3
83.2
72.75
72.50
72.25
72.00
108.6
108.5
108.4
108.3
108.2
Below Bridge
Plant Discharge
Big Pond


Daily Precipitation (mm)
Precipitation
60
40
20
0
Nov 15
Dec 01
Dec 15
Jan 01
Jan 15
Date


Mean Daily Air Temperature and Total Precipitation at St. John's West, 78km from Long Harbour
Temperature (°C)
Precipitation (mm)
10
5
0
-5
-10
-15
70
60
50
40
30
20
10
0
11/15/2019
11/17/2019
11/19/2019
11/21/2019
11/23/2019
11/25/2019
11/27/2019
11/29/2019
12/1/2019
12/3/2019
12/5/2019
12/7/2019
12/9/2019
12/11/2019
12/13/2019
12/15/2019
12/17/2019
12/19/2019
12/21/2019
12/23/2019
12/25/2019
12/27/2019
12/29/2019
12/31/2019
1/2/2020
1/4/2020
1/6/2020
1/8/2020
1/10/2020
1/12/2020
1/14/2020
Total Precipitation (mm)
Mean Temperature (°C)