Real-Time Water Quality Deployment Report

Rattling Brook Network

May 23, 2014 to July 3, 2014

Newfoundland Labrador

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

Real-Time Water Quality Deployment Report

Rattling Brook Network

2014-05-23 to 2014-07-03

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Water quality instrumentation were in place for a total of 40 days during this deployment period.

- Larger than normal peaks in specific conductivity were observed over the course of this deployment period at Plant Discharge station. These peaks were found to be the result of settling pond dewatering during working hours. Dewatering occurs to ensure depth remains below a particular operation threshold. Vale staffs are now aware of these fluctuations and are endeavoring to find a solution that will avoid frequent shifts in water chemistry.

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

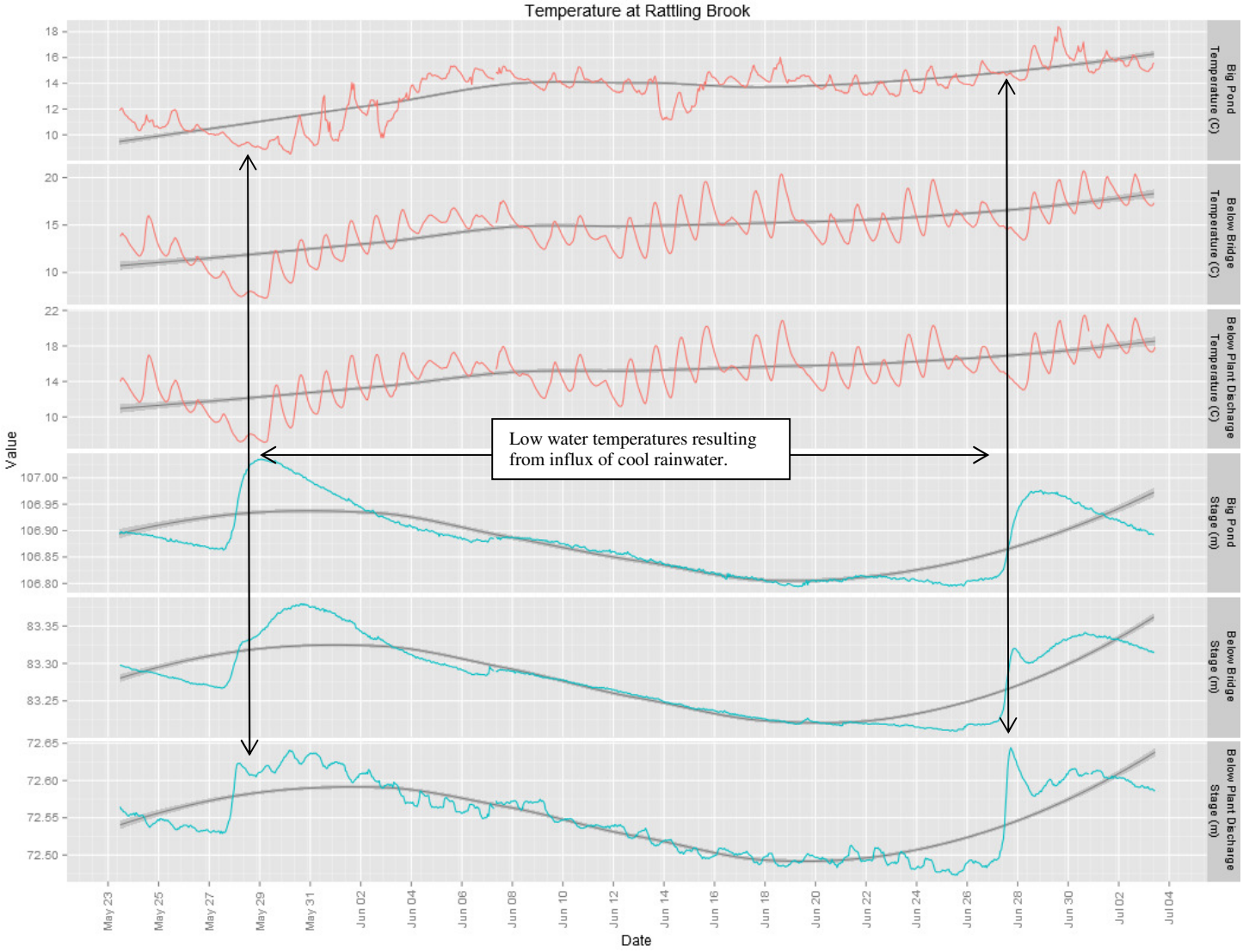
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	May 23, 2014	Deployment	Good	Excellent	Excellent	Fair	Excellent
	July 3, 2014	Removal	Excellent	Excellent	Excellent	Excellent	Excellent
Rattling Brook below Bridge	May 23, 2014	Deployment	Excellent	Good	Good	Good	Excellent
	July 3, 2014	Removal	Good	Good	Excellent	Excellent	Excellent
Rattling Brook below Plant Discharge	May 23, 2014	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	July 3, 2014	Removal	Excellent	Excellent	Excellent	Excellent	Excellent

- Quality rankings ranged from Excellent to Fair during this deployment period.

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.

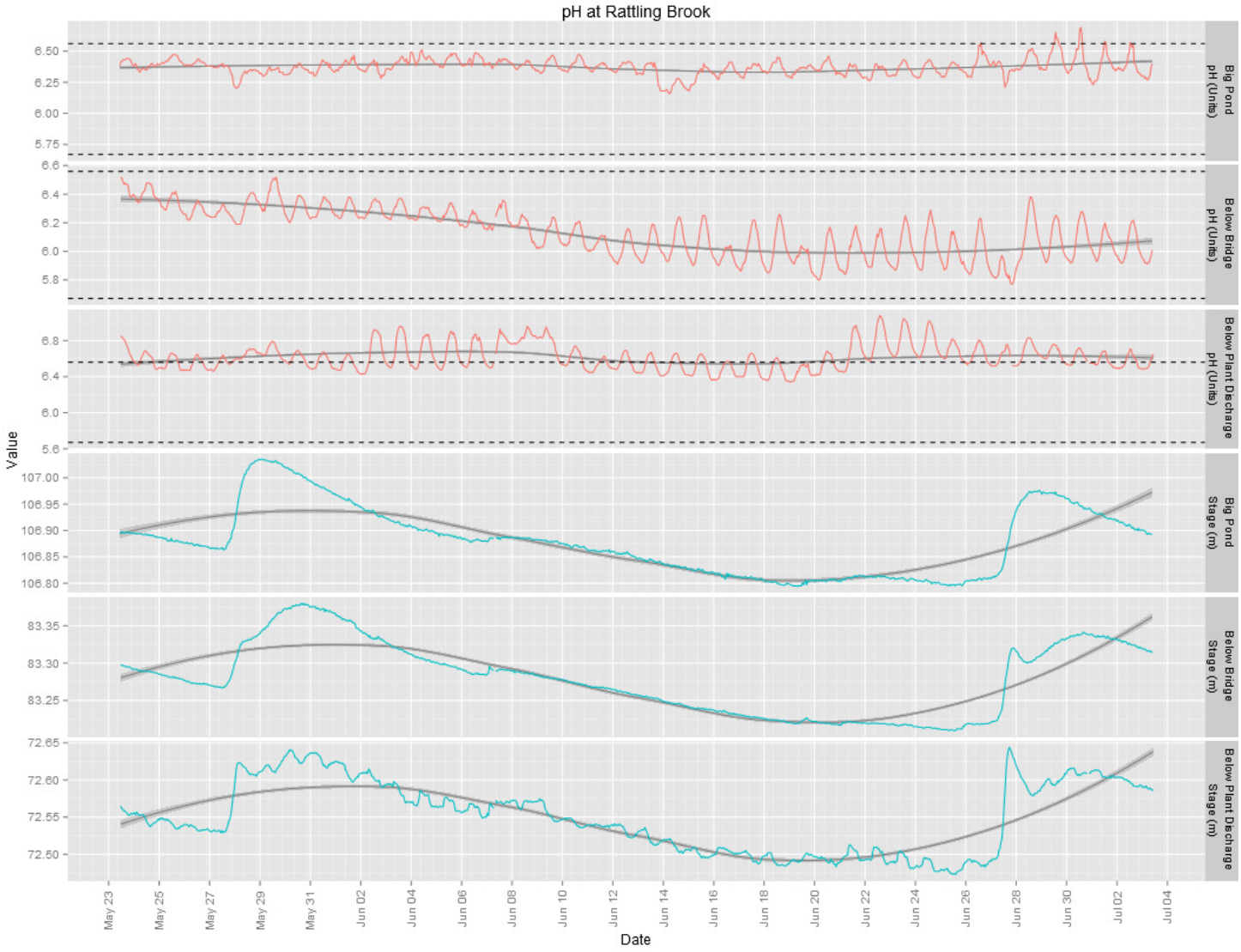


Station	Mean	Median	Min	Max
Big Pond	13.32	13.94	8.52	18.40
Below Bridge	14.53	14.82	7.30	20.71
Below Plant Discharge	14.84	15.06	7.13	21.48

- Water temperatures within ranged between a low of 7.13°C on May 29th to a high of 21.48°C on June 30th. Both temperature extremes were observed at Plant Discharge station. In late May and late June, substantial increases in stage level at all stations correlated with relatively low water temperatures, as indicated.

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.

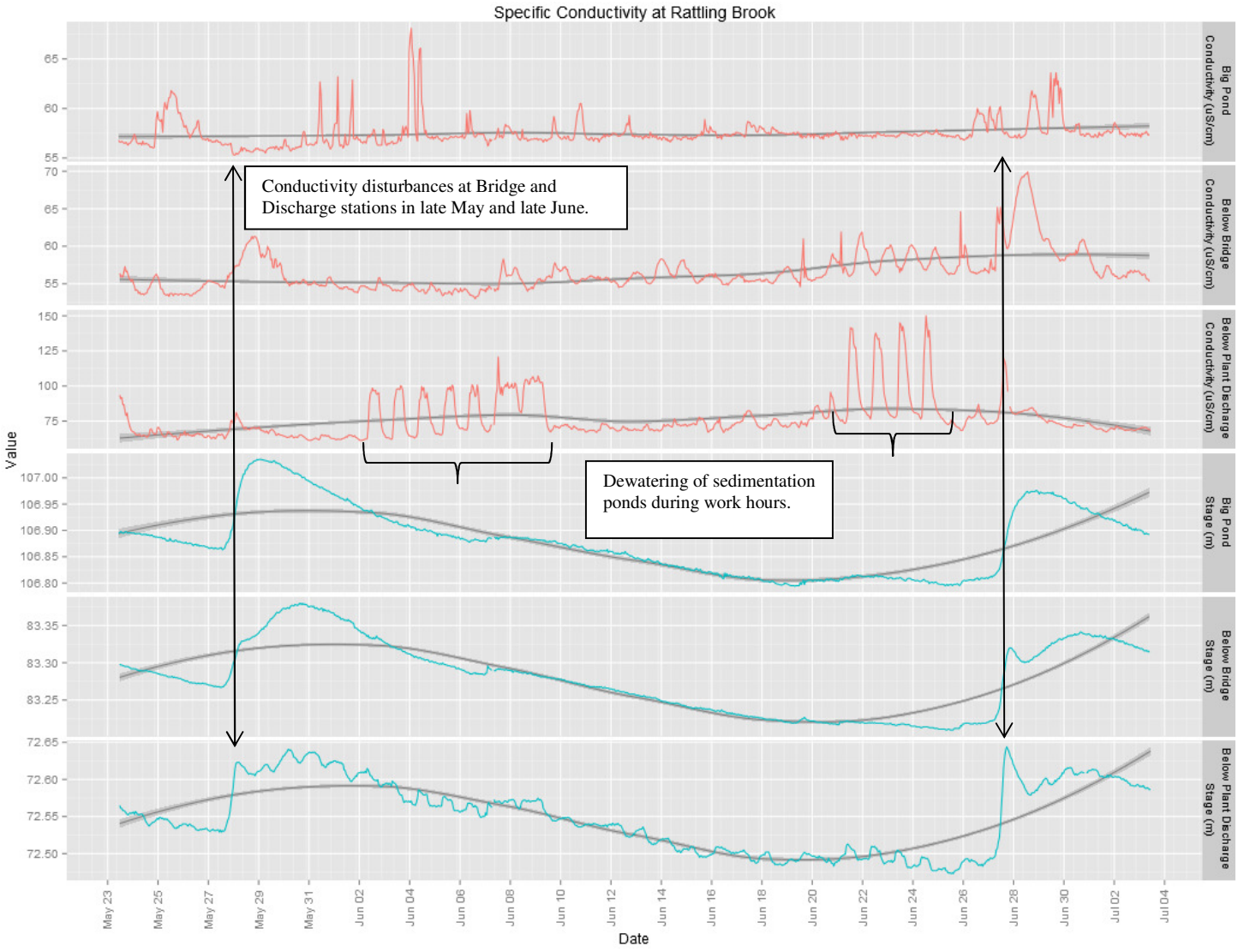


Station	Mean	Median	Min	Max
Big Pond	6.37	6.37	6.16	6.69
Below Bridge	6.13	6.16	5.77	6.52
Below Plant Discharge	6.62	6.60	6.34	7.08

- Most pH values fell between the Site Specific Guidelines of 5.67 – 6.56, except for Plant Discharge station which fell along the upper bounds of the guidelines for much of the deployment period. This is the result of additional alkalinity observed in a grab sample taken on May 23rd. Alkalinity at Big Pond and Bridge stations was below the method reporting limit (MRL) of 5 mg/l as $CaCO_3$, while Discharge station had a value of 16 mg/l $CaCO_3$. This additional alkalinity is likely derived from overland runoff.

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.

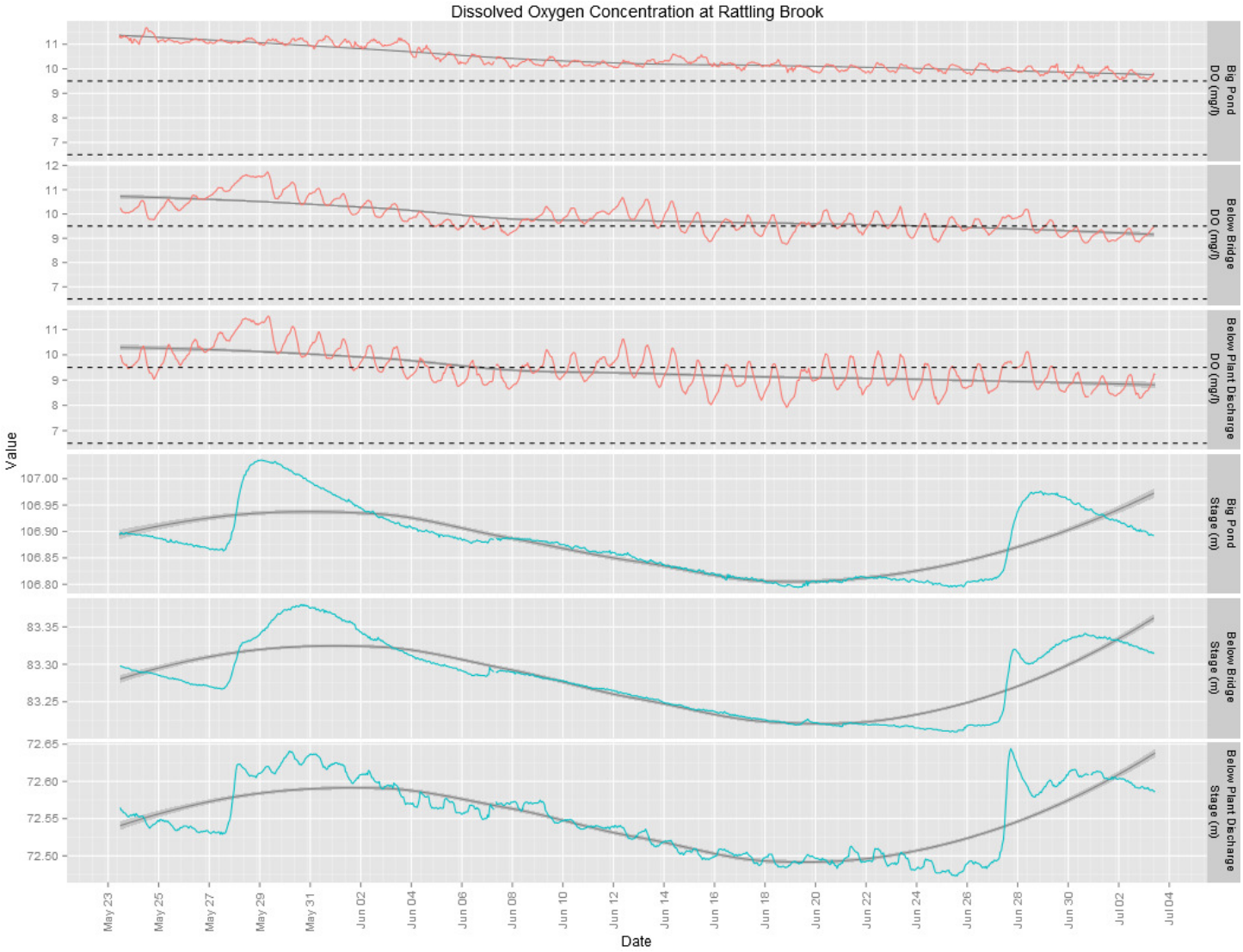


Station	Mean	Median	Min	Max
Big Pond	57.5	57.3	55.3	68.1
Below Bridge	56.6	55.9	53.0	69.9
Below Plant Discharge	76.6	71.8	61.2	150.1

- Conductivity was generally found to be highest at Plant Discharge station and showed two particular periods of daily cycling associated with dewatering of sedimentation ponds during working hours. Conductivity disturbances were also associated with rising stage levels primarily at Bridge and Discharge stations as indicated.

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.

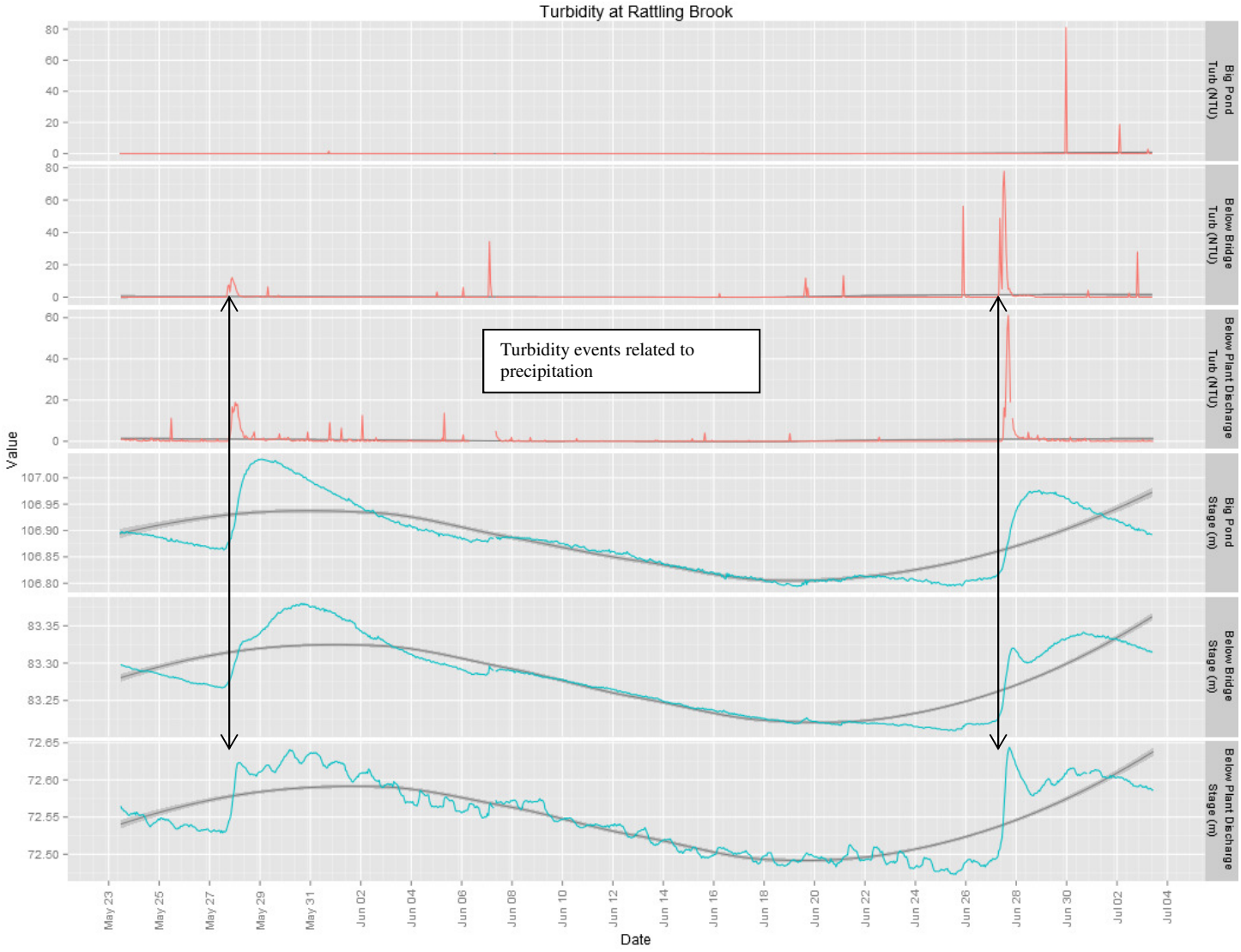


Station	Mean	Median	Min	Max
Big Pond	10.40	10.22	9.56	11.68
Below Bridge	9.87	9.78	8.75	11.74
Below Plant Discharge	9.44	9.39	7.92	11.54

- In early June dissolved oxygen values at Bridge and Plant Discharge stations began to fall lower than 9.5 mg/l – the guideline for the protection of early life stage aquatic biota. This is typical for the time of year. Big Pond generally remains cooler than the other stations, thus maintaining a higher oxygen level.

Turbidity

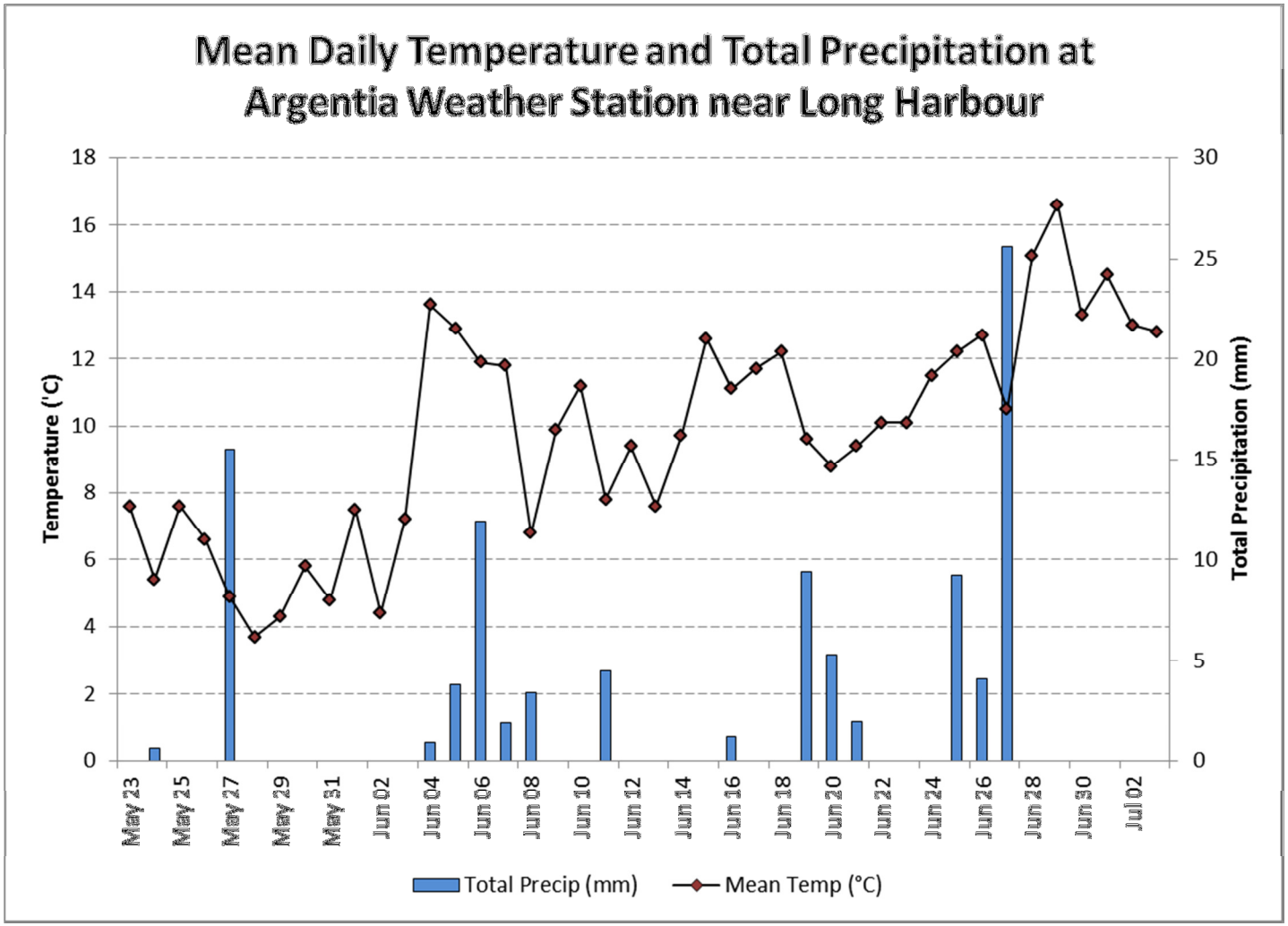
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Station	Mean	Median	Min	Max
Big Pond	0.1	0.0	0.0	81.1
Below Bridge	0.6	0.0	0.0	77.7
Below Plant Discharge	0.7	0.0	0.0	61.1

- Turbidity levels were nil for much of the deployment period at all stations with median turbidity values at 0.0 NTU. Occasional peaks in turbidity were observed at each station, reaching a maximum of 81.1 NTU at Big Pond station on June 29th for a single hour. Both Bridge and Plant Discharge stations had peaks of several hours in relation to rising waters following precipitation events in late May and late June.

Appendix



Prepared by:
Ryan Pugh
Department of Environment and Conservation
Water Resources Management Division
Phone: 709.729.1681
Fax: 709.729.3020