Real-Time Water Quality Deployment Report

Rattling Brook Network

September 28, 2012 to November 1, 2012

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

Newfoundland Labrador

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2012-09-28 to 2012-11-01

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- In the past, monthly reports for the Rattling Brook Real-Time Network have been broken down by station. This report has been reorganized to present data by parameter instead of station allowing for a clearer understanding of differences between each station.

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

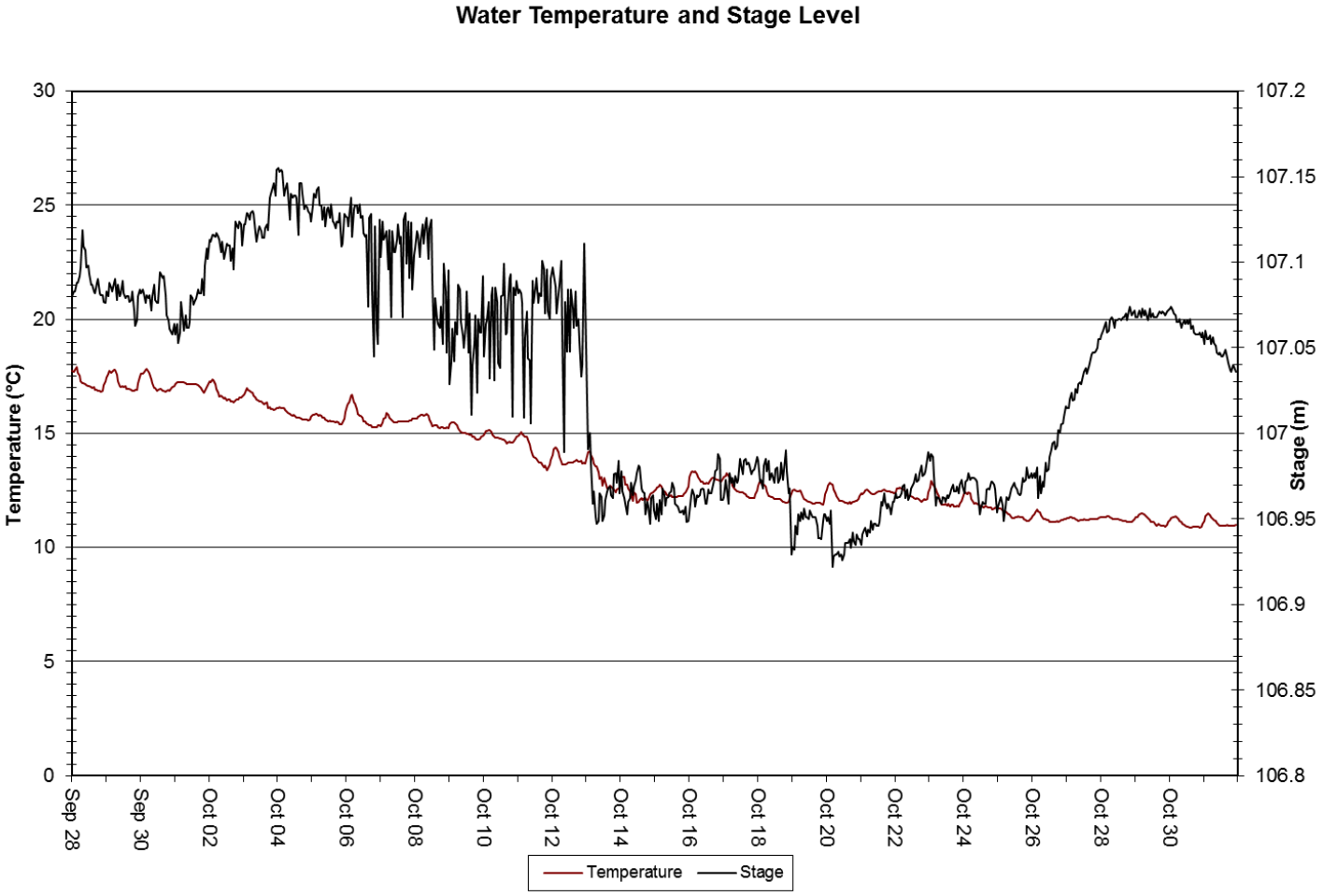
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	September 28, 2012	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	November 1, 2012	Removal	Excellent	NA	Excellent	Excellent	Excellent
Rattling Brook below Bridge	September 28, 2012	Deployment	Good	Fair	Poor	Excellent	Excellent
	November 1, 2012	Removal	Fair	NA	Good	Marginal	Fair
Rattling Brook below Plant Discharge	September 28, 2012	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	November 1, 2012	Removal	Excellent	NA	Marginal	Excellent	Good

- The pH sensor on the QAQC instrument at deployment produced questionable data that was not used in the rankings.
- During the calibration of the Below Bridge instrument following removal, it was found that the DO probe was non-functional. This may indicate failure prior to removal which would impact the quality of DO and Turbidity quality rankings calculated at deployment.

Data Interpretation

Water Temperature

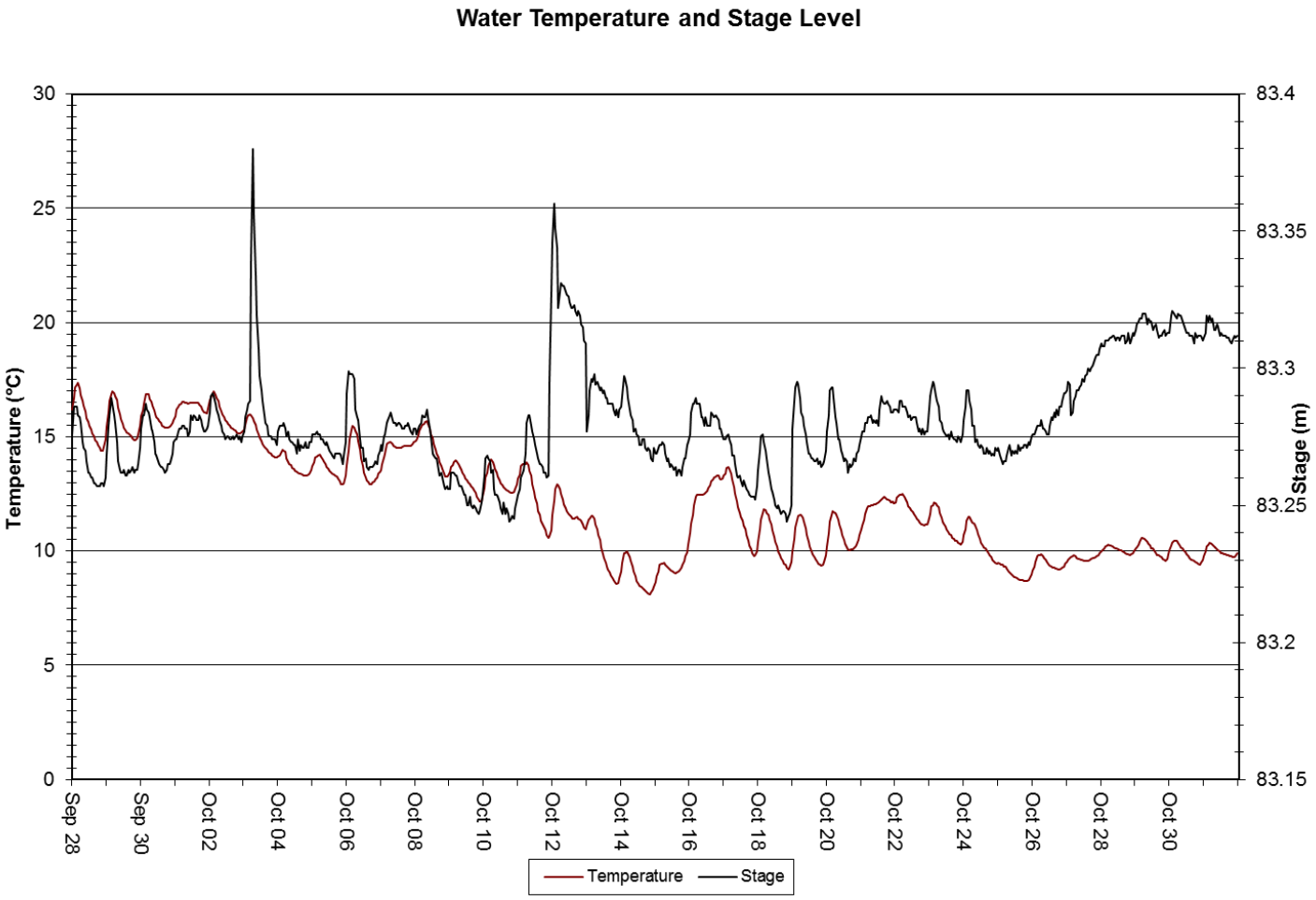
Figure 1: Water temperature at Rattling Brook Big Pond from September 28th to November 1st



Parameter	Max	Min	Median
Temperature('C)	17.89	10.85	12.81

- Water temperature declined steadily at Big Pond station from deployment to removal. The early part of this deployment is marked by a more rapid fall in temperature versus the slower, near-flat decline seen in the final week of deployment.

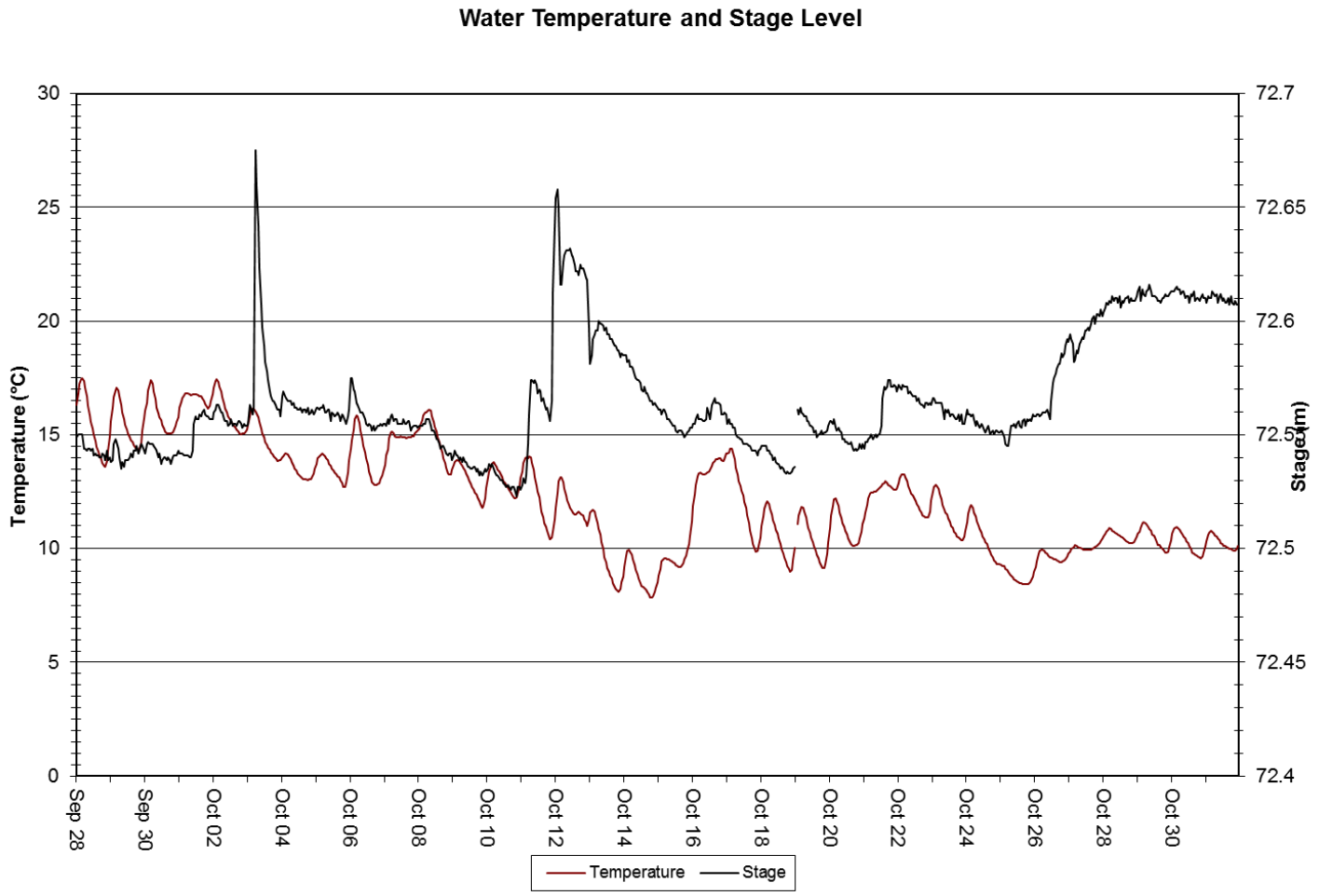
Figure 2: Temperature at Rattling Brook below Bridge from September 28th to November 1st



Parameter	Max	Min	Median
Temperature('C)	17.35	8.12	11.74

- Like at Big Pond, water temperature at Bridge station declined throughout the deployment period with a faster decline initially and slowing towards the end of deployment. Diel cycling of temperature and stage level is readily apparent relative to Big Pond – water temperature and stage level tends to be higher during the day versus the evening.

Figure 3: Temperature at Rattling Brook below Plant Discharge from September 28th to November 1st

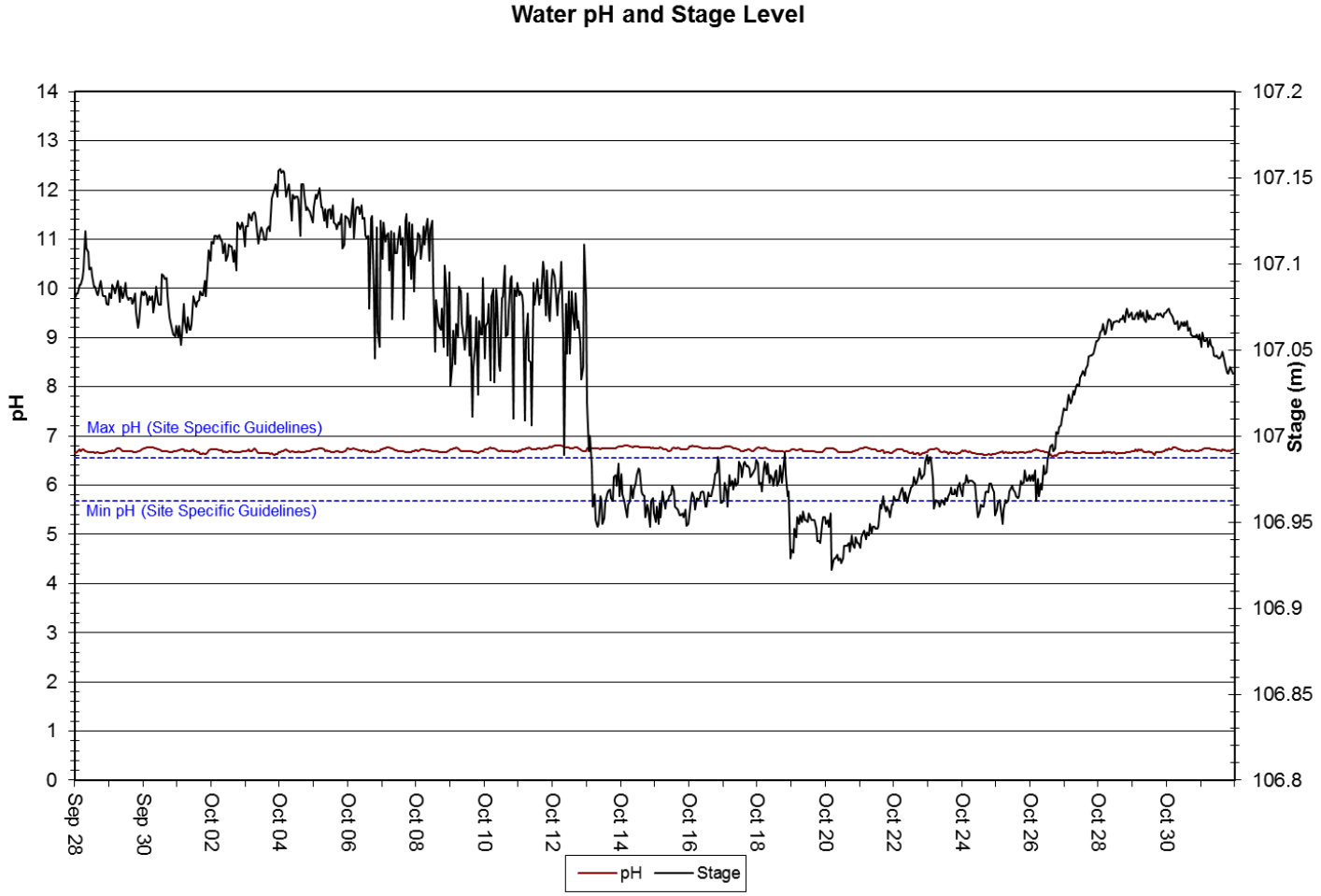


Parameter	Max	Min	Median
Temperature('C)	17.49	7.83	12.11

- The river channel at Plant Discharge is wider and shallower than at Bridge station allowing for more interaction between the air and water. As such, water temperature extremes tend to be larger here than upstream and reflect a greater range in temperatures. Regardless, the trace of temperature is nearly identical to that upstream at Bridge station.

pH

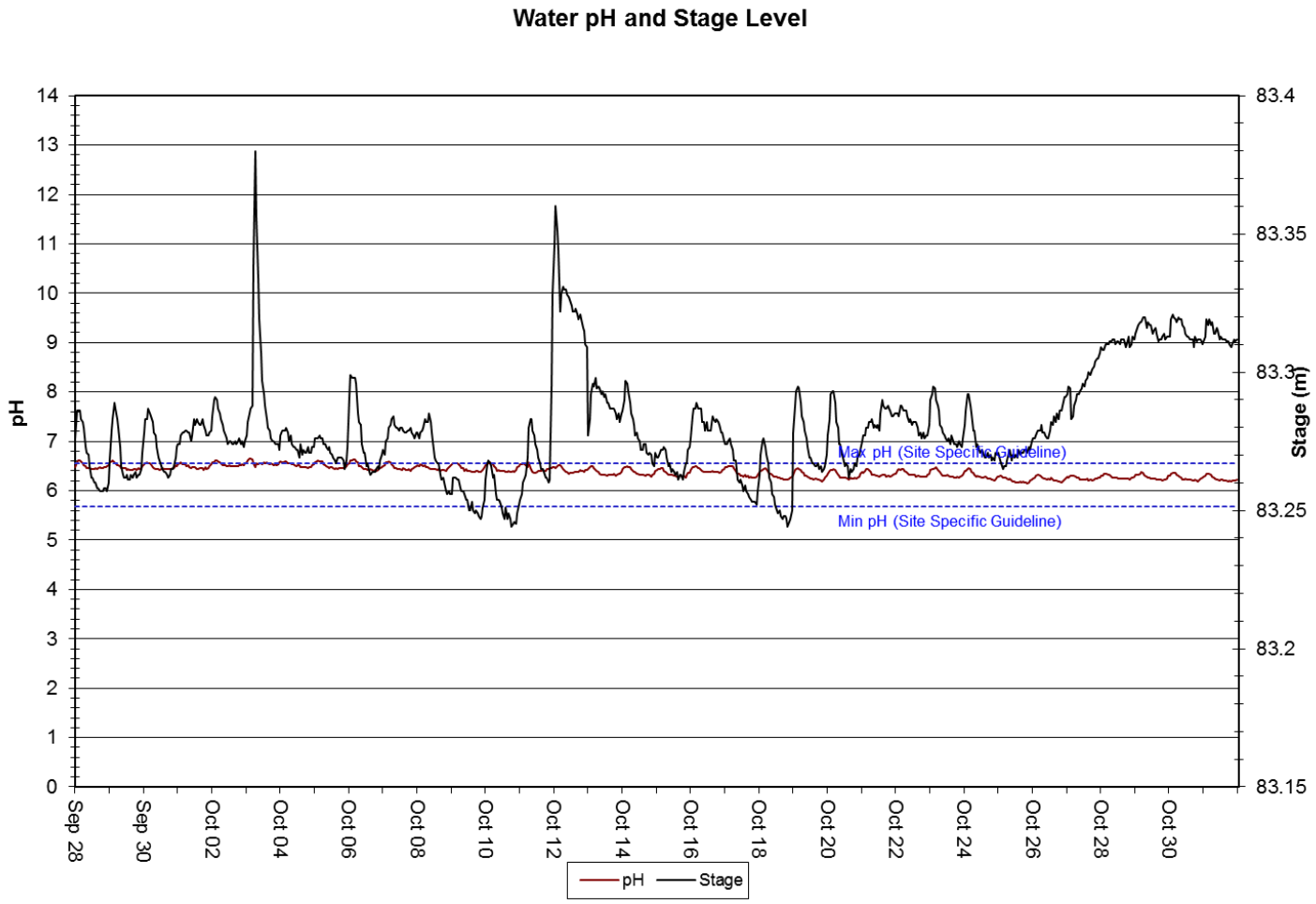
Figure 4: pH at Rattling Brook Big Pond from September 28th to November 1st



Parameter	Max	Min	Median
pH	6.81	6.58	6.70

- pH levels were entirely above the Site Specific Guidelines for the Rattling Brook network during this deployment period. At deployment, pH was ranked as Excellent and values did not show a trend downwards that is reminiscent of calibration drift. It should be noted that, though pH values are slightly above the Site Specific Guidelines, the magnitude of exceedence is not critical.

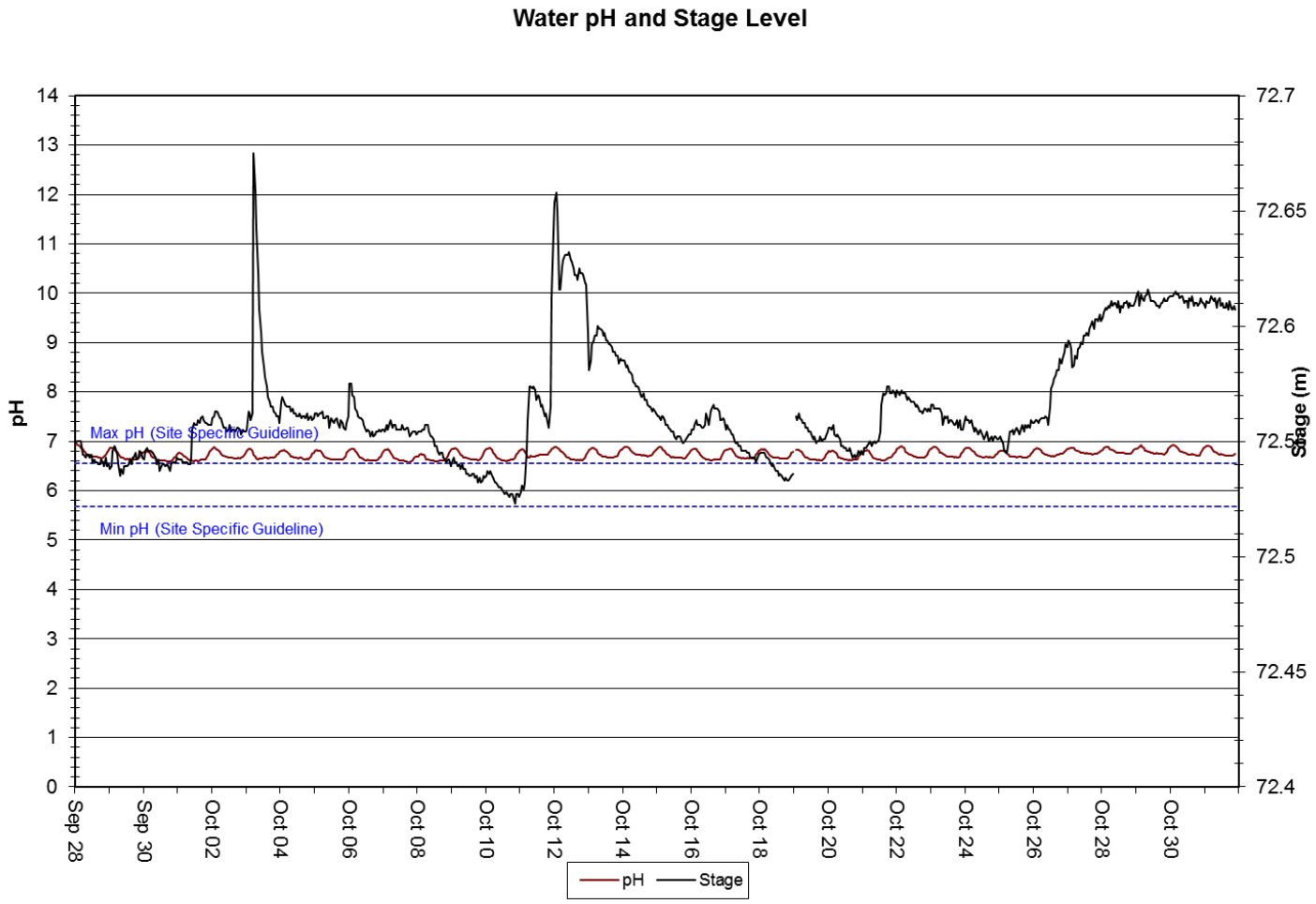
Figure 5: pH at Rattling Brook below Bridge from September 28th to November 1st



Parameter	Max	Min	Median
pH	6.66	6.14	6.39

- pH values at Bridge station are somewhat lower than those found at Big Pond station. Given the similarity of pH values between Big Pond and Plant Discharge station, there is reasonable cause to believe that these pH values are slightly less than actual values. Regardless, the response of the pH probe did pick up daily cycling in pH values. This indicates that major perturbations would have been detected if they were present.

Figure 6: pH at Rattling Brook below Plant Discharge from September 28th to November 1st

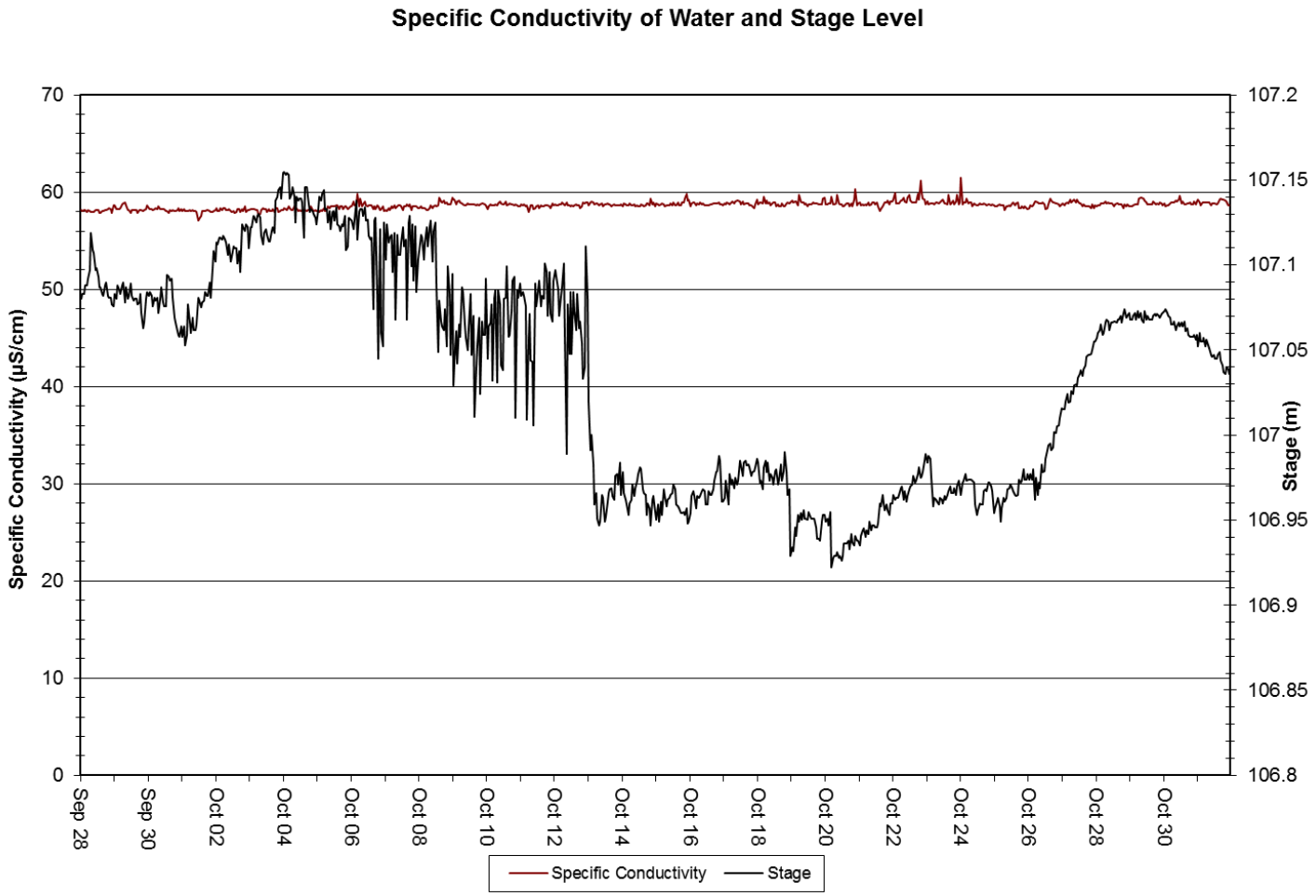


Parameter	Max	Min	Median
pH	6.94	6.58	6.71

- pH values were found to be above the Site Specific Guidelines, much like those at Big Pond, but did not show a trend up or down. Given the low magnitude of the exceedence, no concern is warranted at this time, but a close watch will be made to ensure pH levels do not continue to rise a great deal.

Specific Conductivity

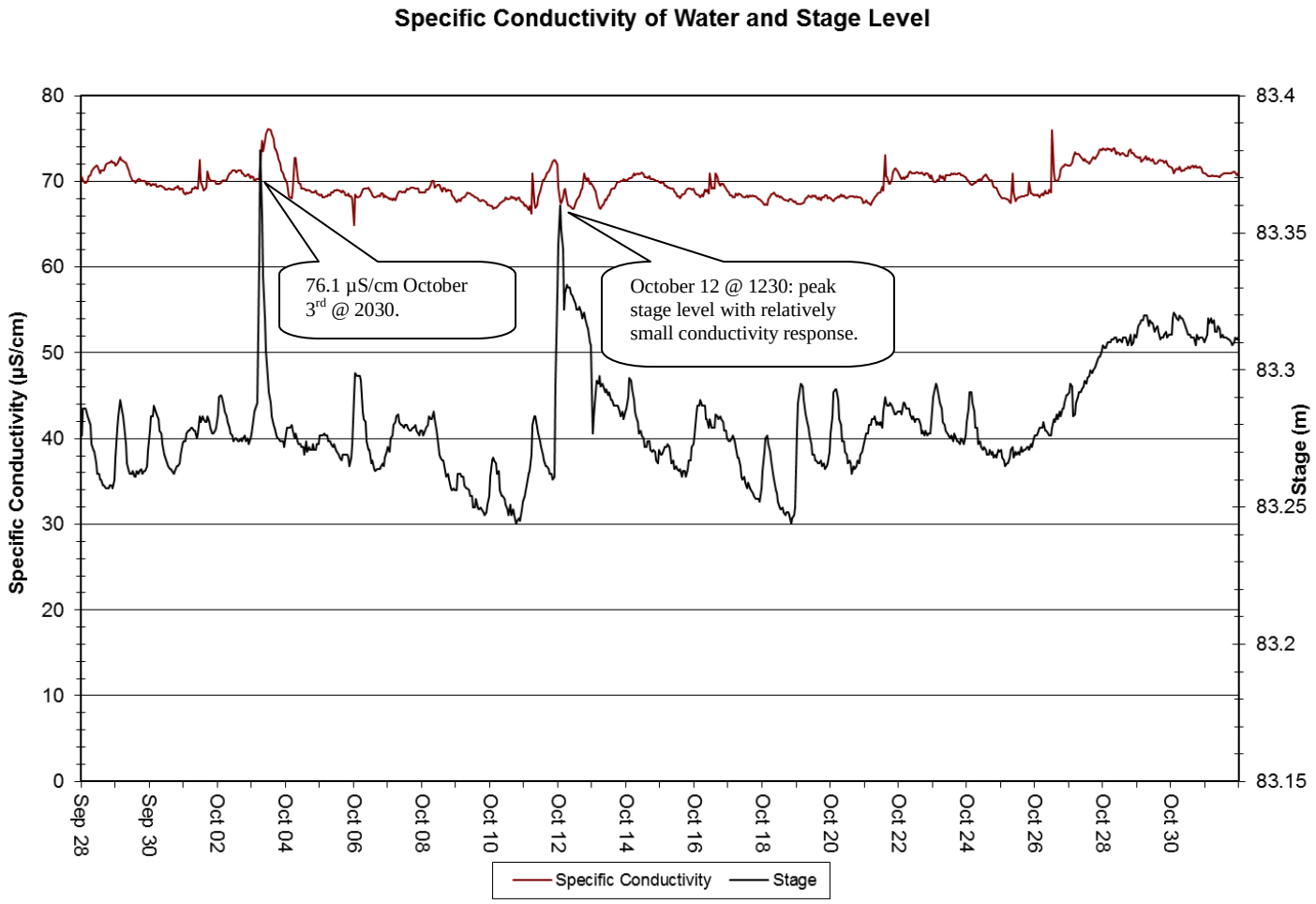
Figure 7: Conductivity at Rattling Brook Big Pond from September 28th to November 1st



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	61.5	57.1	58.6

- A slight increase in conductivity is apparent over the course of the deployment period. No major fluctuations were identified from September 28th to November 1st. Specific conductivity at Big Pond tends to be lower than the downstream stations where overland runoff and flow from settling ponds tends to increase the amount of solids in the water.

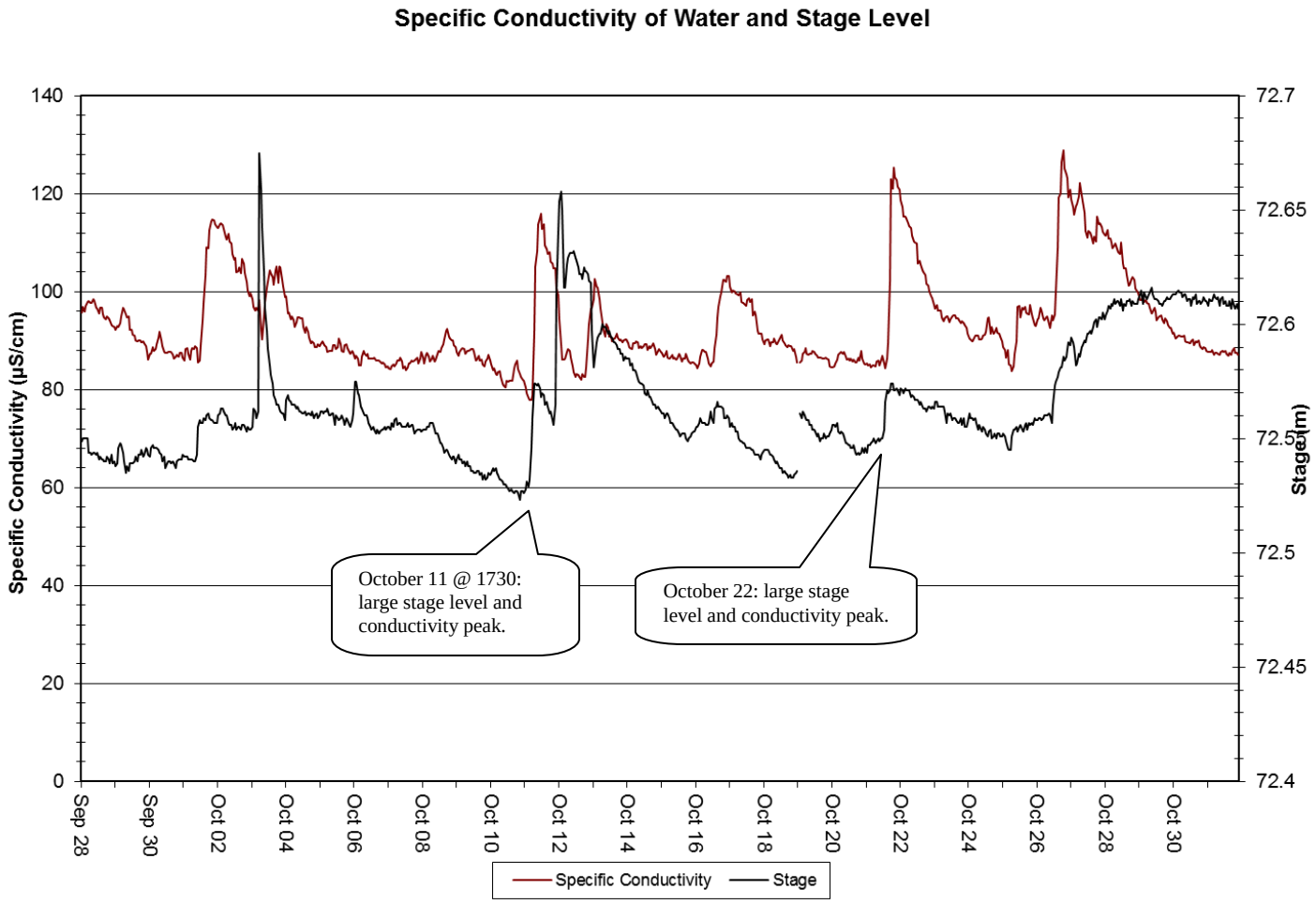
Figure 8: Conductivity at Rattling Brook below Bridge from September 28th to November 1st



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	76.1	64.9	69.4

- Specific Conductivity is a great deal more variable downstream of Big Pond – due in large part to the habitat rehabilitation work being undertaken at Forgotten Pond. Dredging of the pond and bank work has liberated a great deal of silt and sediments that contribute to the dissolved solids that increases conductivity.
- Two large peaks in stage level did not have a major impact on specific conductivity as would normally be expected.

Figure 9: Conductivity at Rattling Brook below Plant Discharge from September 28th to November 1st

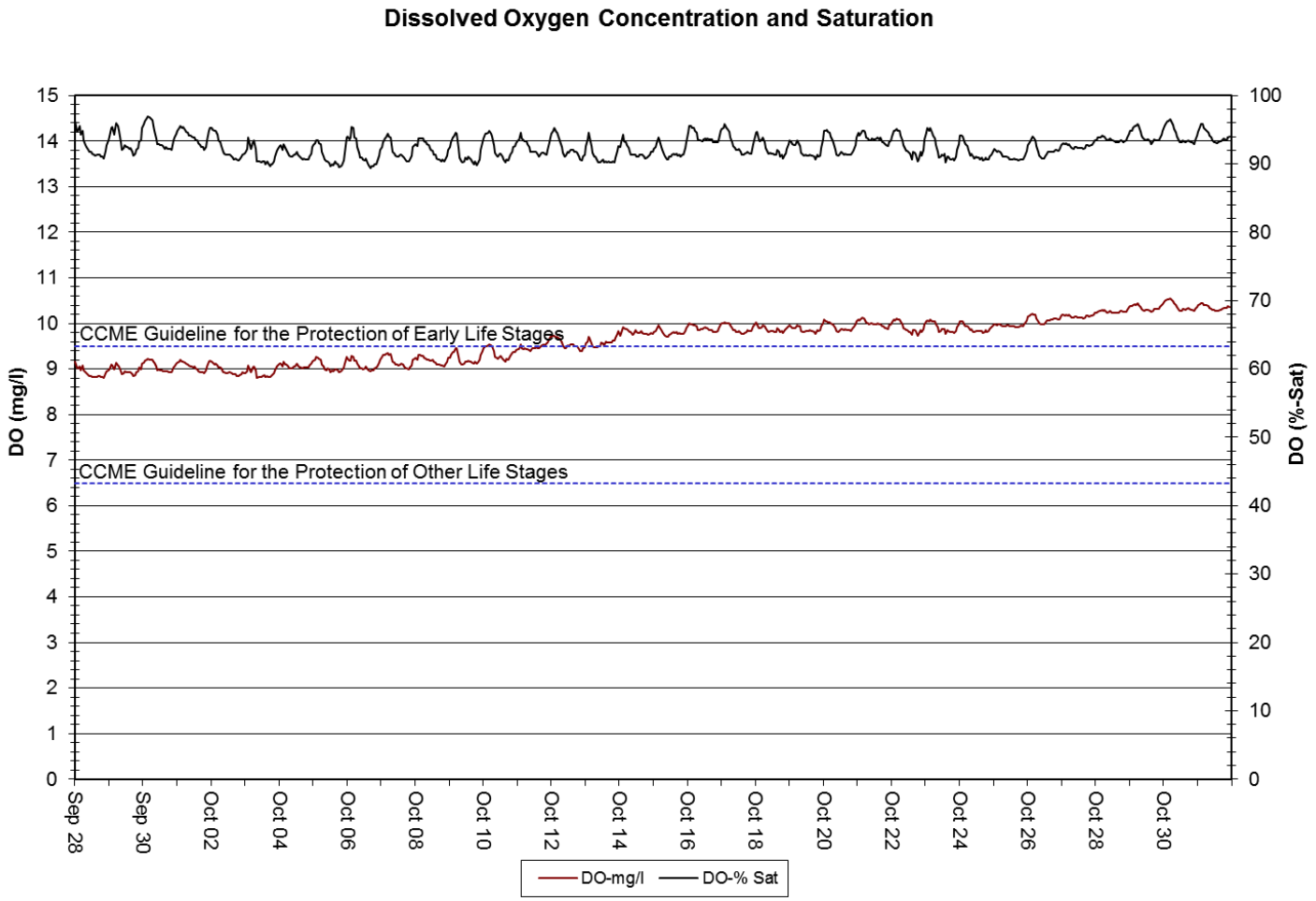


Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	128.9	77.9	90.1

- In addition to the silt and sediments liberated from Forgotten Pond, Plant Discharge station also receives waters flowing from large sedimentation ponds. Each additional source of water entering Rattling Brook tends to have an additive effect in terms of dissolved solids, thus increasing specific conductivity values as the river progresses.
- Unlike Bridge station, conductivity values appear to increase over time at Plant Discharge station.

Dissolved Oxygen

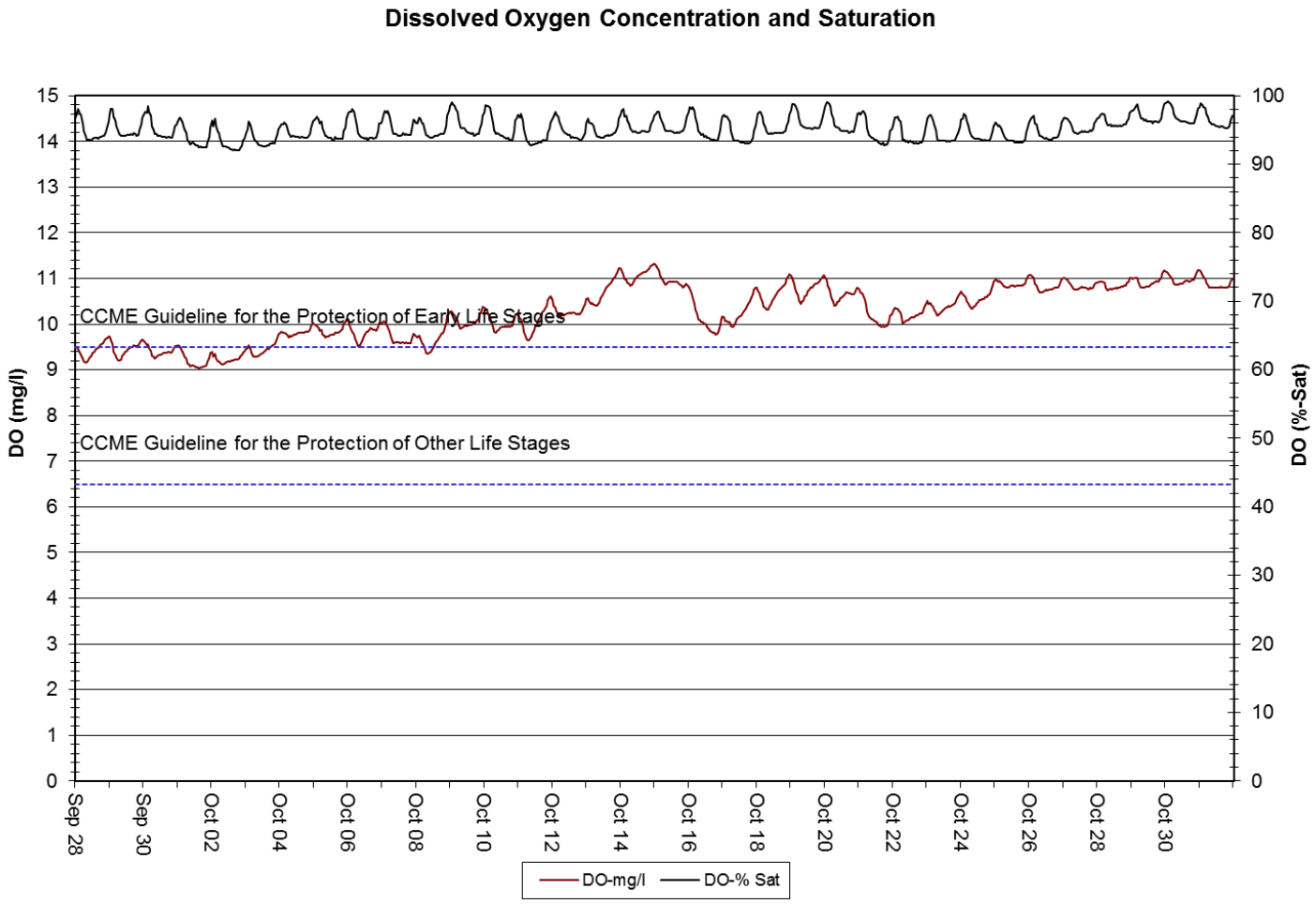
Figure 10: Dissolved Oxygen at Rattling Brook Big Pond from September 28th to November 1st



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	96.9	89.4	92.3
Dissolved Oxygen (mg/l)	10.55	8.81	9.78

- Dissolved oxygen consistently increased above the CCME Guideline for the protection of early Life Stage cold water biota around October 13th. A clear rising trend is obvious over the course of the deployment period, which is consistent with falling water temperatures. Oxygen saturation remained mostly constant across the deployment period.

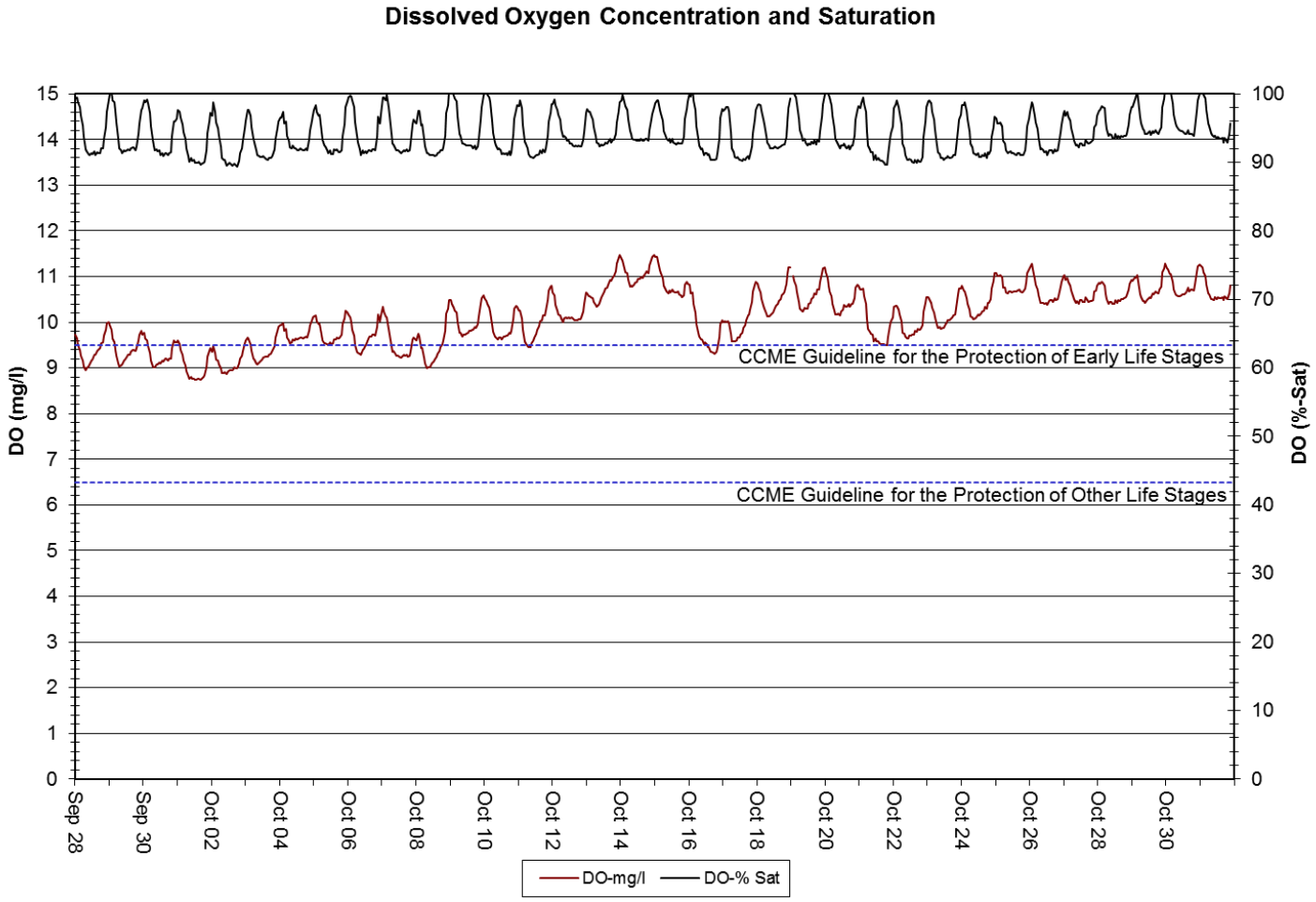
Figure 11: Dissolved Oxygen at Rattling Brook below Bridge from September 28th to November 1st



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	99.2	92.0	94.8
Dissolved Oxygen (mg/l)	11.32	9.04	10.26

- Concentrations were found to be higher downstream at Bridge station versus Big Pond station – mainly due to the increased ability of oxygen to dissolve in vigorously moving water. Concentrations also rose faster and sooner than at Big Pond, passing the CCME Guideline of 9.5 mg/l almost ten days early: October 4th.

Figure 12: Dissolved Oxygen at Rattling Brook below Plant Discharge from September 28th to November 1st

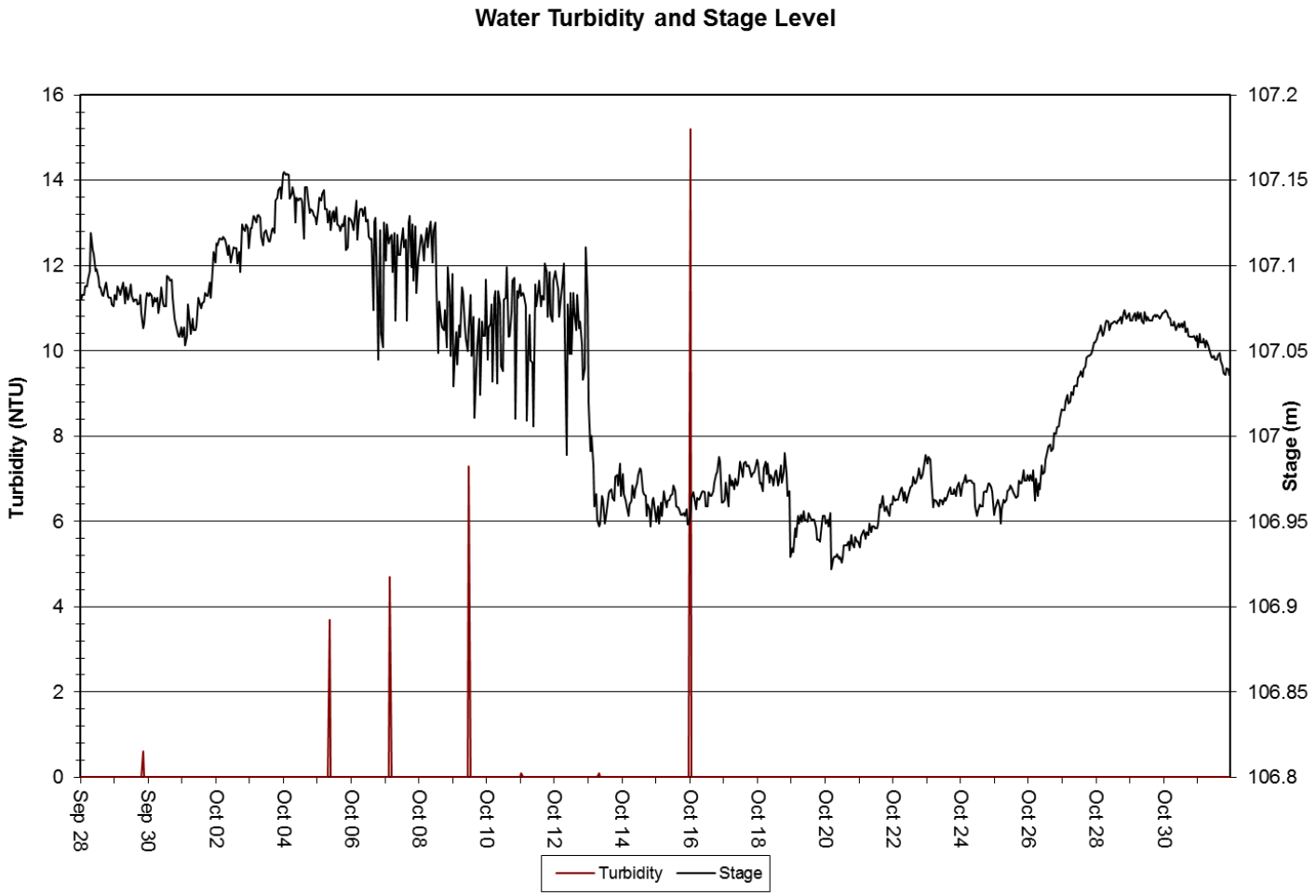


Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	101.0	89.4	93.3
Dissolved Oxygen (mg/l)	11.47	8.74	10.14

- The most variable of the three Rattling Brook stations is Plant Discharge where the highest and lowest DO values were recorded in the network over the deployment period. In this stretch of Rattling Brook, large boulders are littered across the shallow, wide streambed. In low flow, low water levels and slow flow tends to run flat without much turbulence. In high flow, however, these rocks become partially submerged causing a long stretch of rapids. The two extremes in flow characteristics leads to the highest and lowest DO values.
- DO values rose above CCME Guidelines around the same time as Bridge station – October 4th.

Turbidity

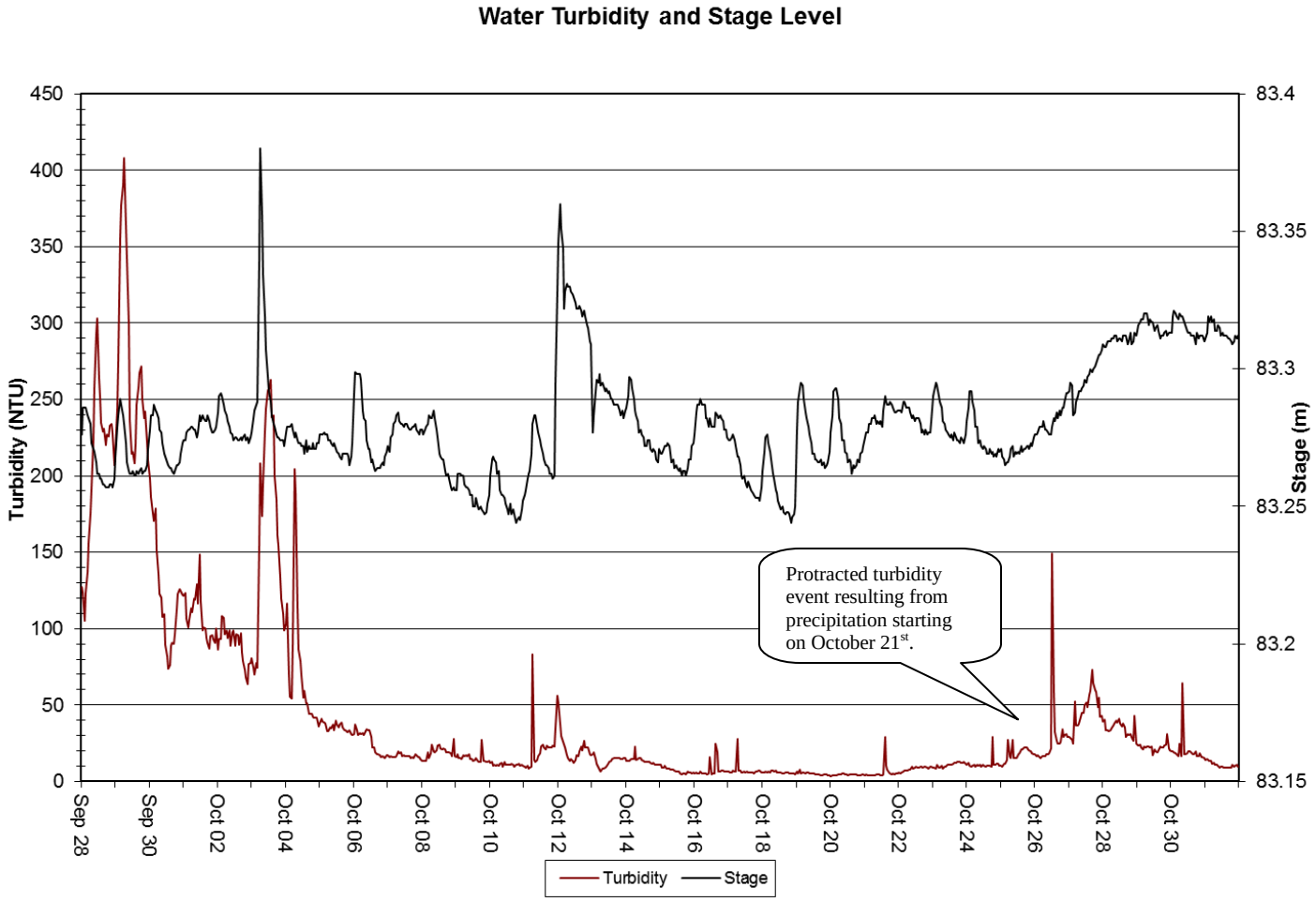
Figure 13: Turbidity at Rattling Brook Big Pond from September 28th to November 1st



Parameter	Max	Min	Median
Turbidity (NTU)	15.2	0.0	0.0

- Turbidity was very low over the course of this deployment period with only seven instances of turbidity values greater than 0 NTU. These brief periods of turbidity may simply be the result of a temporary blockage of the sensor since values return to zero within the next hour.

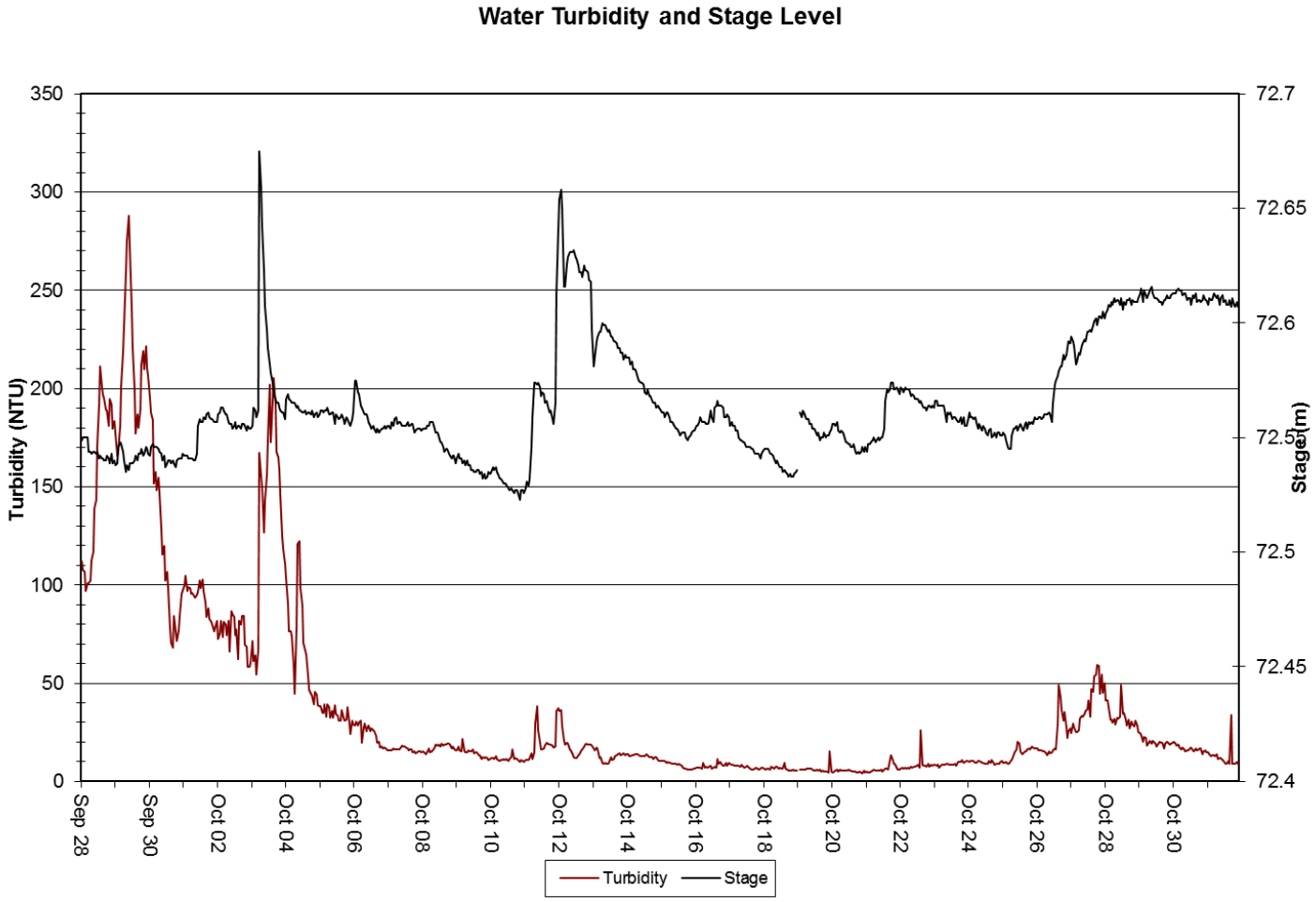
Figure 14: Turbidity at Rattling Brook below Bridge from September 28th to November 1st



Parameter	Max	Min	Median
Turbidity (NTU)	408.0	3.6	16.6

- Turbidity values have begun to return to lower values following the cessation of habitat restoration work at Forgotten Pond. Given the degree of disturbance, it can be expected that turbidity fluctuations will be high during rain events for some time.

Figure 15: Turbidity at Rattling Brook below Plant Discharge from September 28th to November 1st



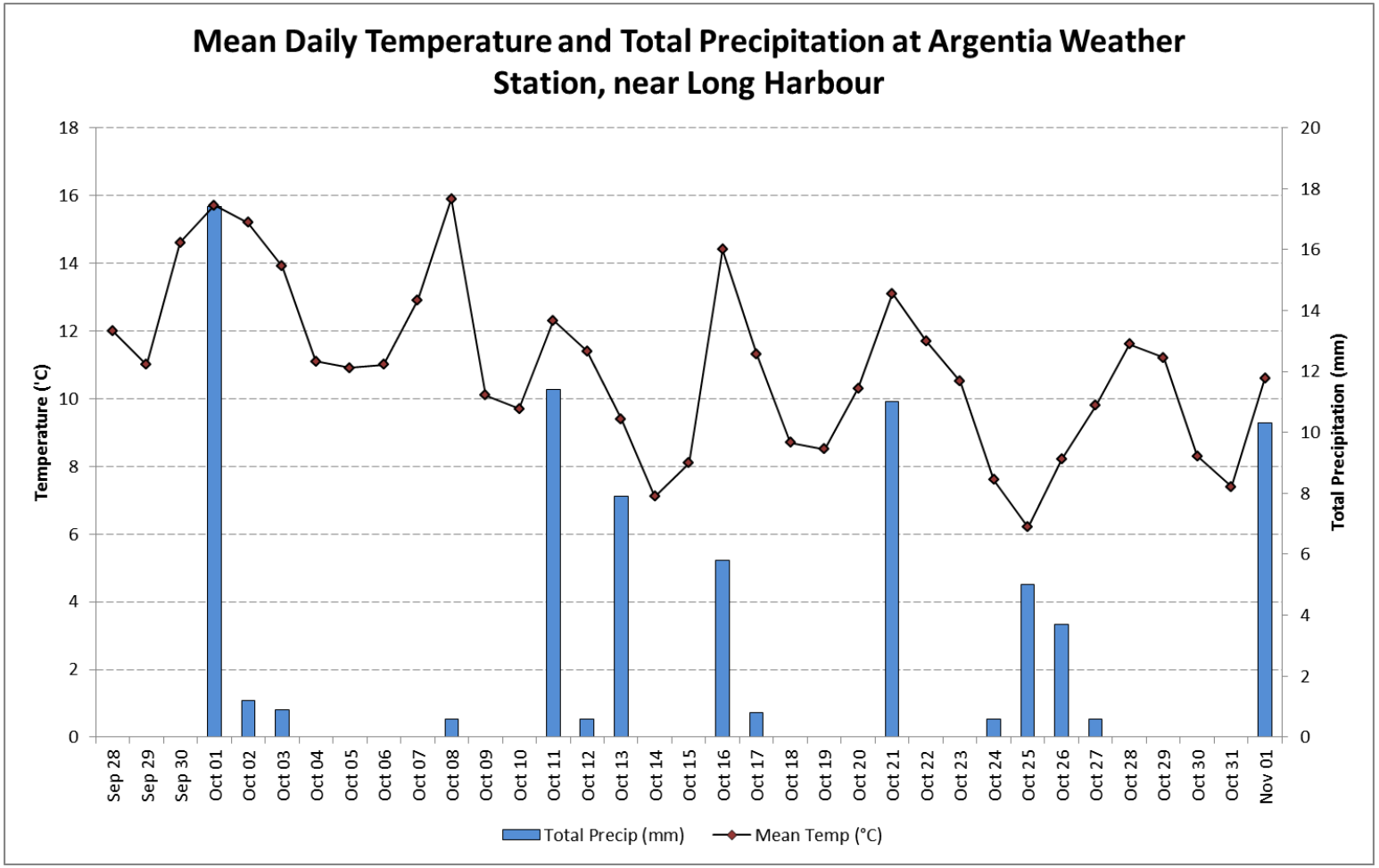
Parameter	Max	Min	Median
Turbidity (NTU)	288.0	3.9	15.7

- The same trend in turbidity was observed downstream at Plant Discharge station – the downstream flow of silt from Forgotten Pond is slightly tempered due to settling of material between the two stations, especially in the small pond near Bridge station.

Conclusions

- Habitat compensation work at Forgotten Pond is now complete; however, it will take some time for conductivity and turbidity levels to return to baseline levels.
- Rattling Brook will be monitored closely for problematic turbidity conditions resulting from heavy precipitation events.

Appendix



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