Real-Time Water Quality Deployment Report

Rattling Brook Network

February 17, 2012 to March 29, 2012

Newfoundland Labrador

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

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General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- This deployment report describes the water quality events over 42 days.
- Some equipment issues were experienced at Bridge and Plant Discharge stations, including movement of the water quality sonde and failures in stage level instruments. These problems are discussed in greater detail below.

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	February 17, 2012	Deployment	Good	Excellent	Good	Poor*	Excellent
	March 29, 2012	Removal	Excellent	Excellent	Good	Good	Excellent
Rattling Brook below Bridge	February 16, 2012	Deployment	Excellent	Excellent	Excellent	Fair	Good
	March 29, 2012	Removal	Good	Excellent	Excellent	Excellent	NA†
Rattling Brook below Plant Discharge	February 17, 2012	Deployment	Good	Good	Excellent	Fair	Poor‡
	March 29, 2012	Removal	Excellent	Marginal	Excellent	Good	Excellent

* Dissolved oxygen was ranked as poor during deployment at Big Pond station. This rank is probably an underestimate since QAQC DO readings at Bridge and Plant Discharge stations are also somewhat higher than Field sonde readings.

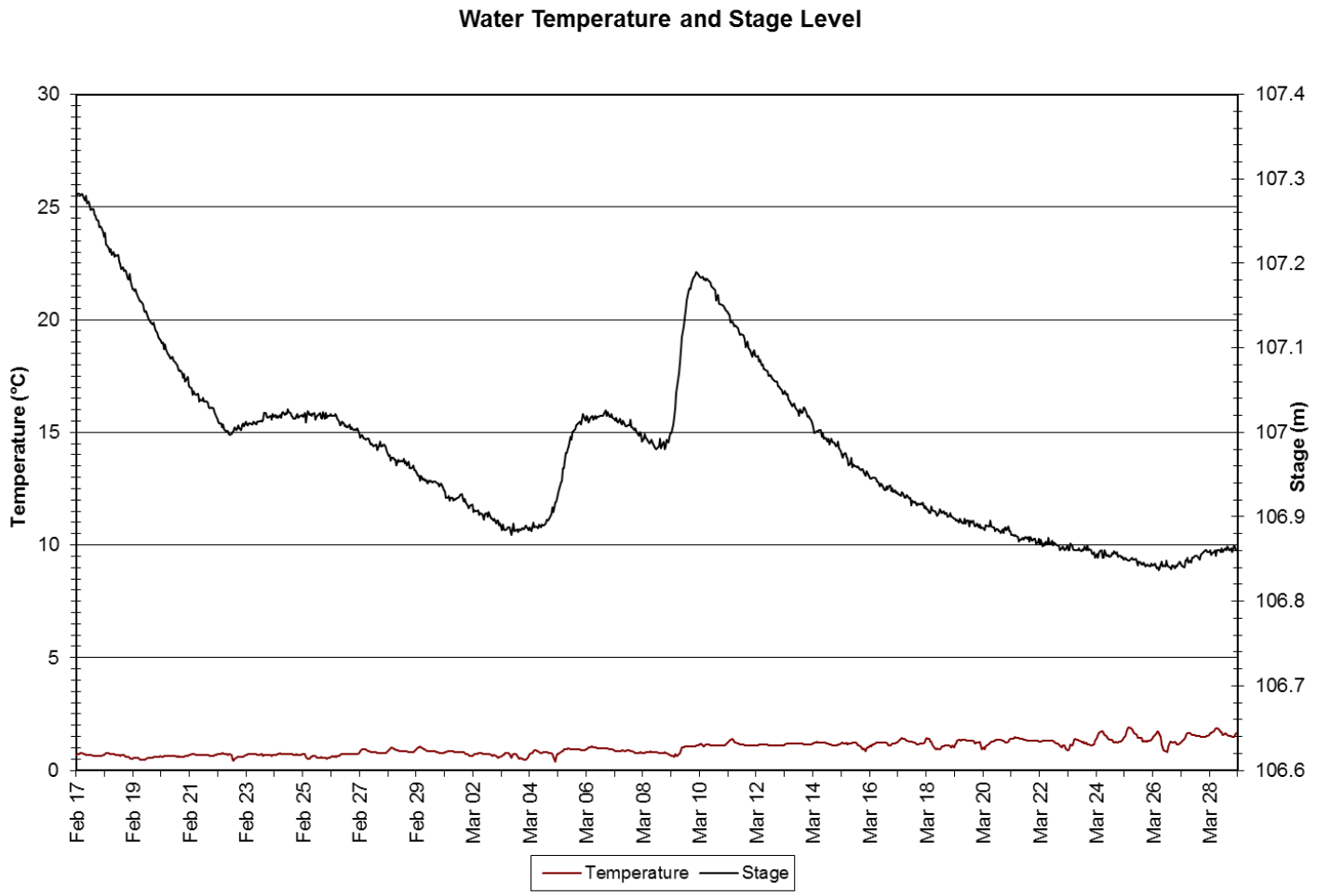
† At removal time, it was found that the Field sonde was pushed to the side of the river and was partially submerged. The turbidity probe was not reliable at this time and the Ranking has been omitted.

‡ It is not uncommon to record highly variable turbidity values at Discharge station even when sampling points are separated by a few centimeters.

Data Interpretation

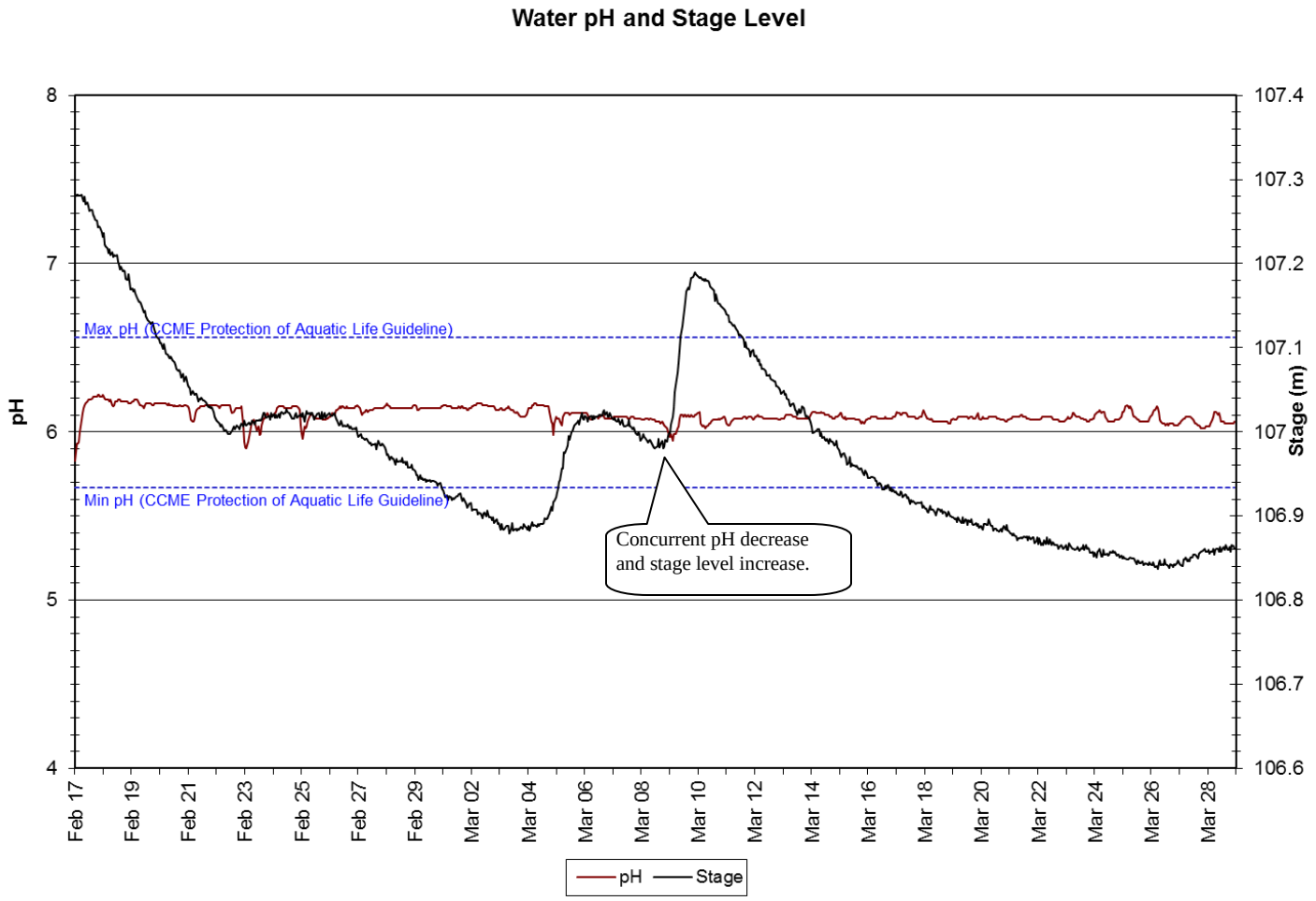
Rattling Brook Big Pond

Figure 1: Water Temperature at Rattling Brook Big Pond from February 17 to March 29



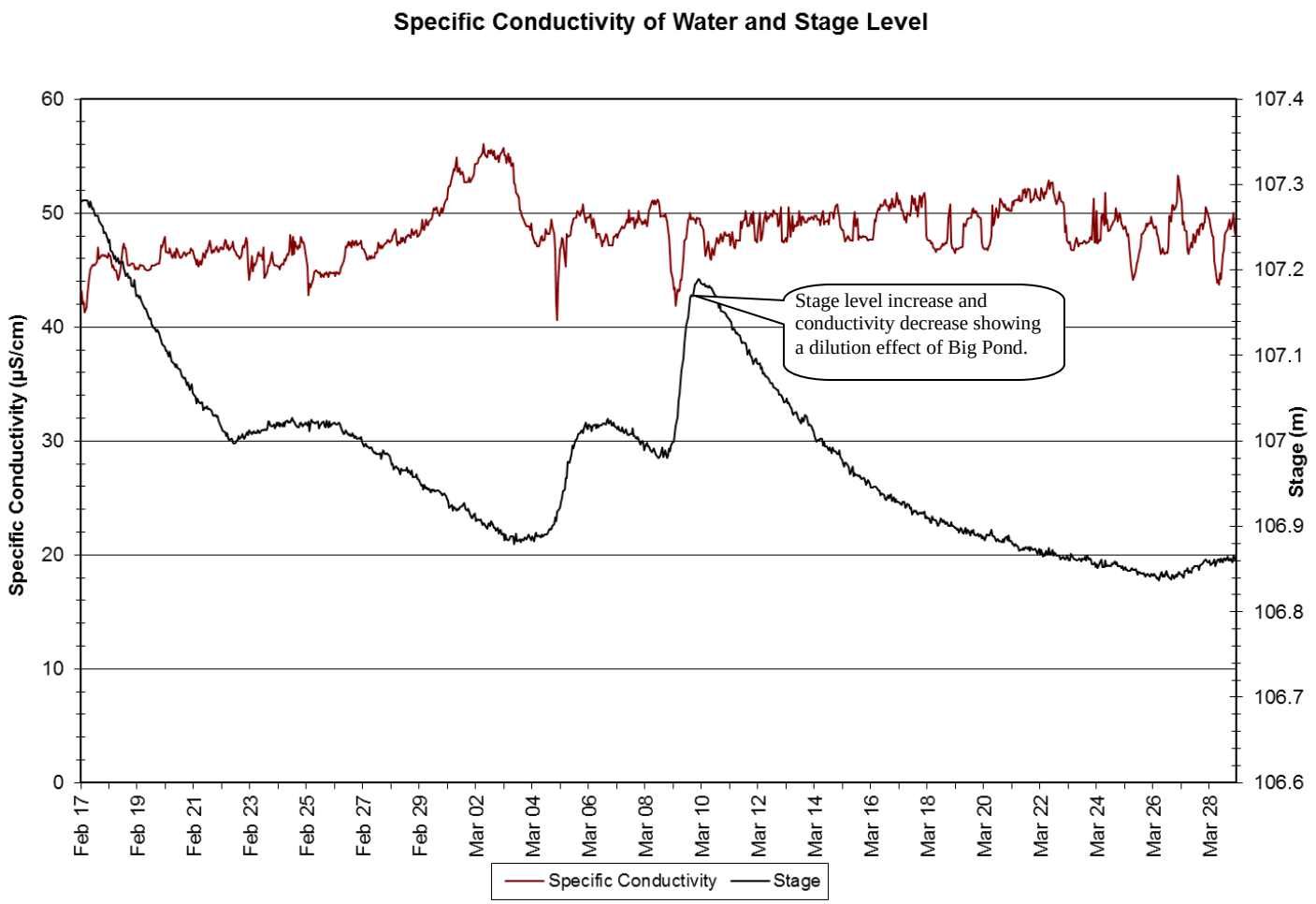
- An obvious increase in water temperature is evident in Figure 1 as Big Pond begins to warm at the end of the winter season. A low of 0.37°C was observed on March 5th with a high temperature of 1.92°C observed on March 25th (median value: 0.95°C).

Figure 2: pH at Rattling Brook Big Pond from February 17 to March 29



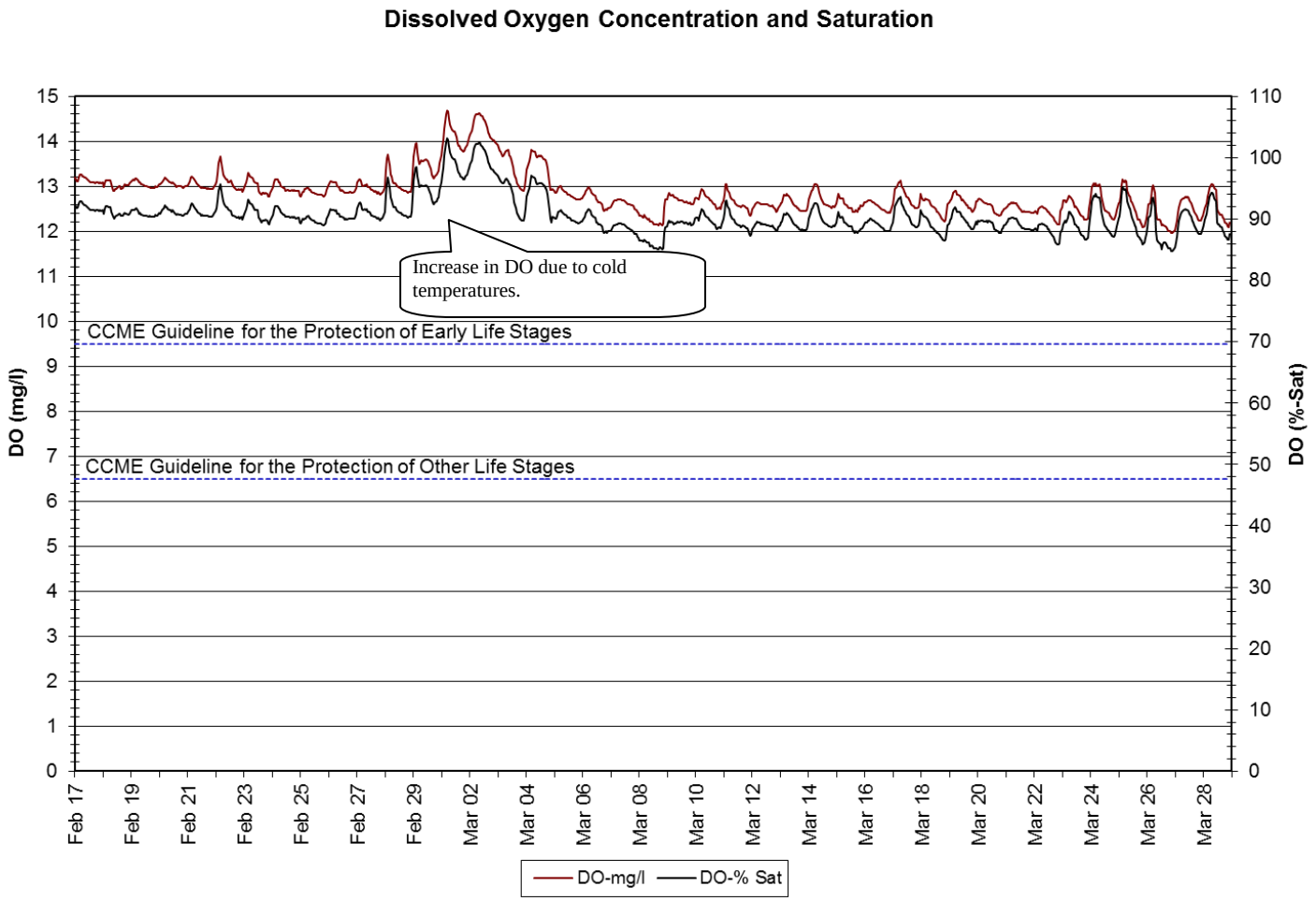
- pH levels fell entirely within the Site Specific Guidelines of 5.67 – 6.56. A range of 5.83 to 6.22 was recorded with a median value of 6.09.

Figure 3: Specific Conductivity at Rattling Brook Big Pond from February 17 to March 29



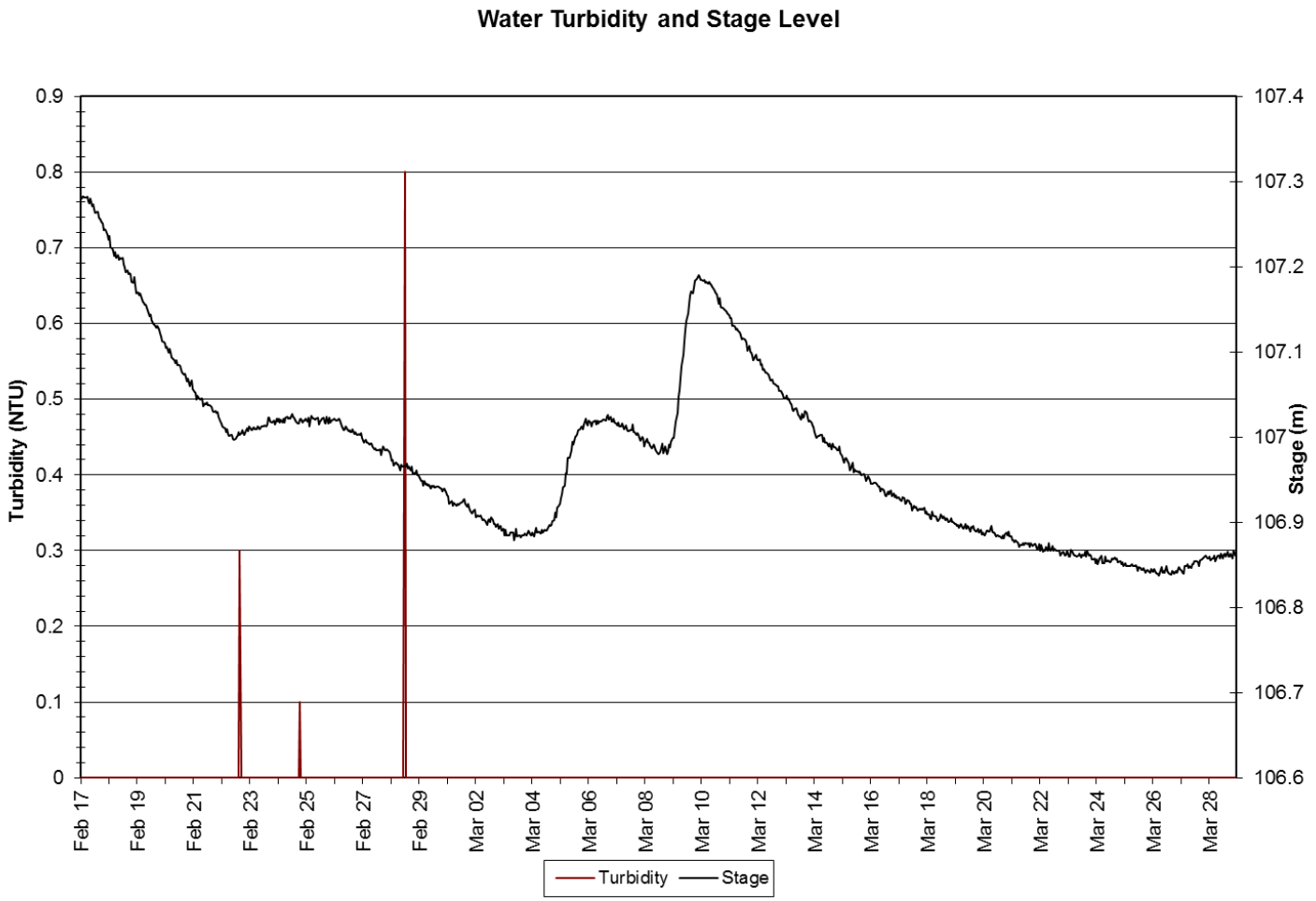
- Specific conductivity was highly variable during this deployment period and a slight upward trend was evident. Conductivity ranged from 40.6 µS/cm to 56.1 µS/cm with a median value of 48.0 µS/cm.

Figure 4: Dissolved Oxygen at Rattling Brook Big Pond from February 17 to March 29



- All dissolved oxygen values were above the CCME Guidelines for the Protection of Early and Other Life Stage cold water biota. A large increase in DO was observed from February 28th to March 4th. This may have been related to the sub-zero mean daily temperatures experienced at that time.
- Dissolved oxygen ranged from 11.97 to 14.69 mg/l with a median value of 12.79 mg/l.

Figure 5: Turbidity at Rattling Brook Big Pond from February 17 to March 29

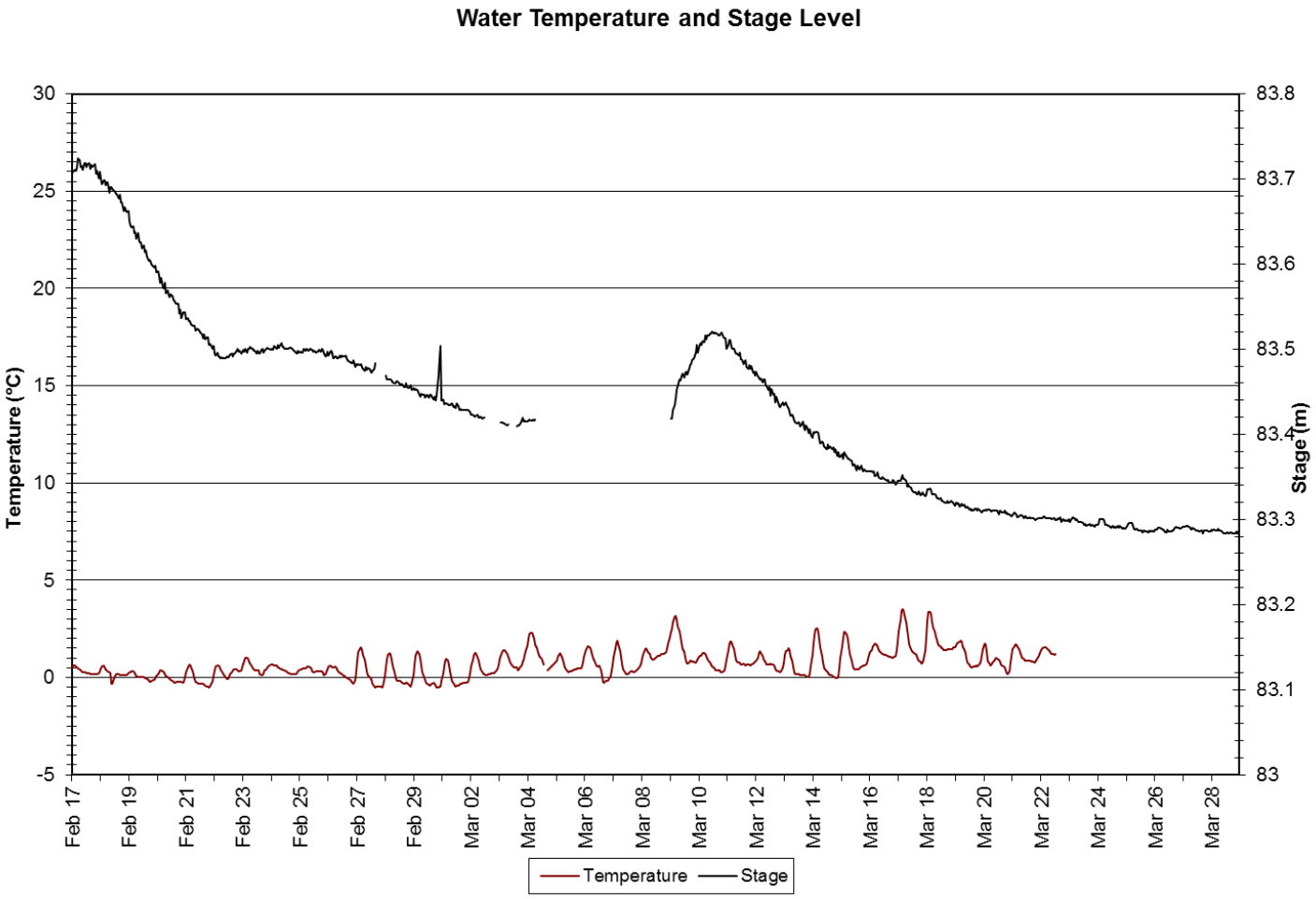


- Only three records of non-zero turbidity were encountered during this deployment period. Turbidity ranged from 0.0 NTU to 0.8 NTU with a median value of 0.0 NTU.
- It is difficult to associate the three turbidity measurements with any event in particular since single instances of turbidity do not constitute a trend and the values are relatively small.

Rattling Brook below Bridge

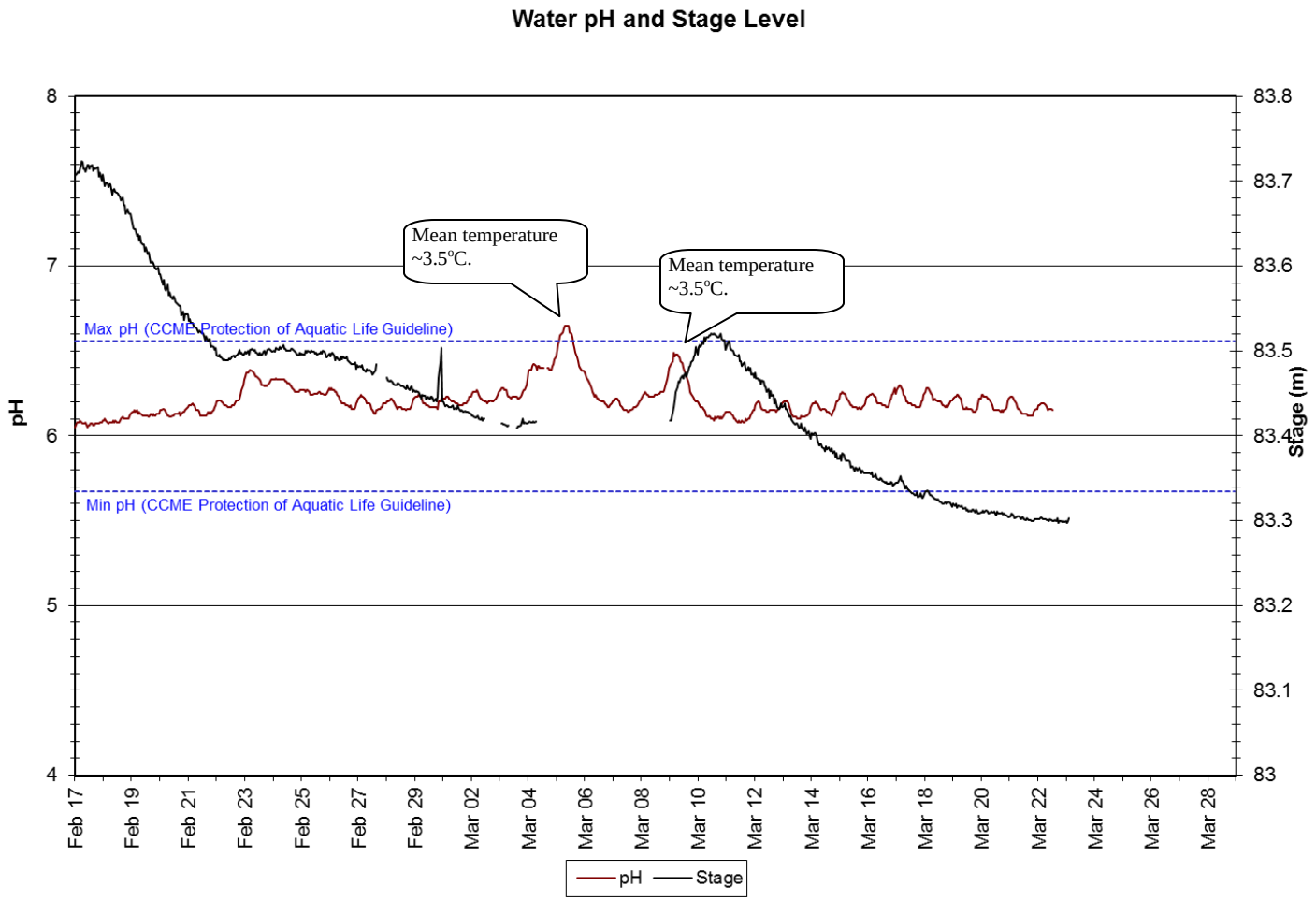
- Subsequent to March 22nd, there was a failure to meet water quality data objectives as a result of the Hydrolab washing up on the side of Rattling Brook. While the sensor was not fully out of the water at removal, the probes were not sufficiently immersed to provide useful data.

Figure 6: Water Temperature at Rattling Brook below Bridge from February 17 to March 29



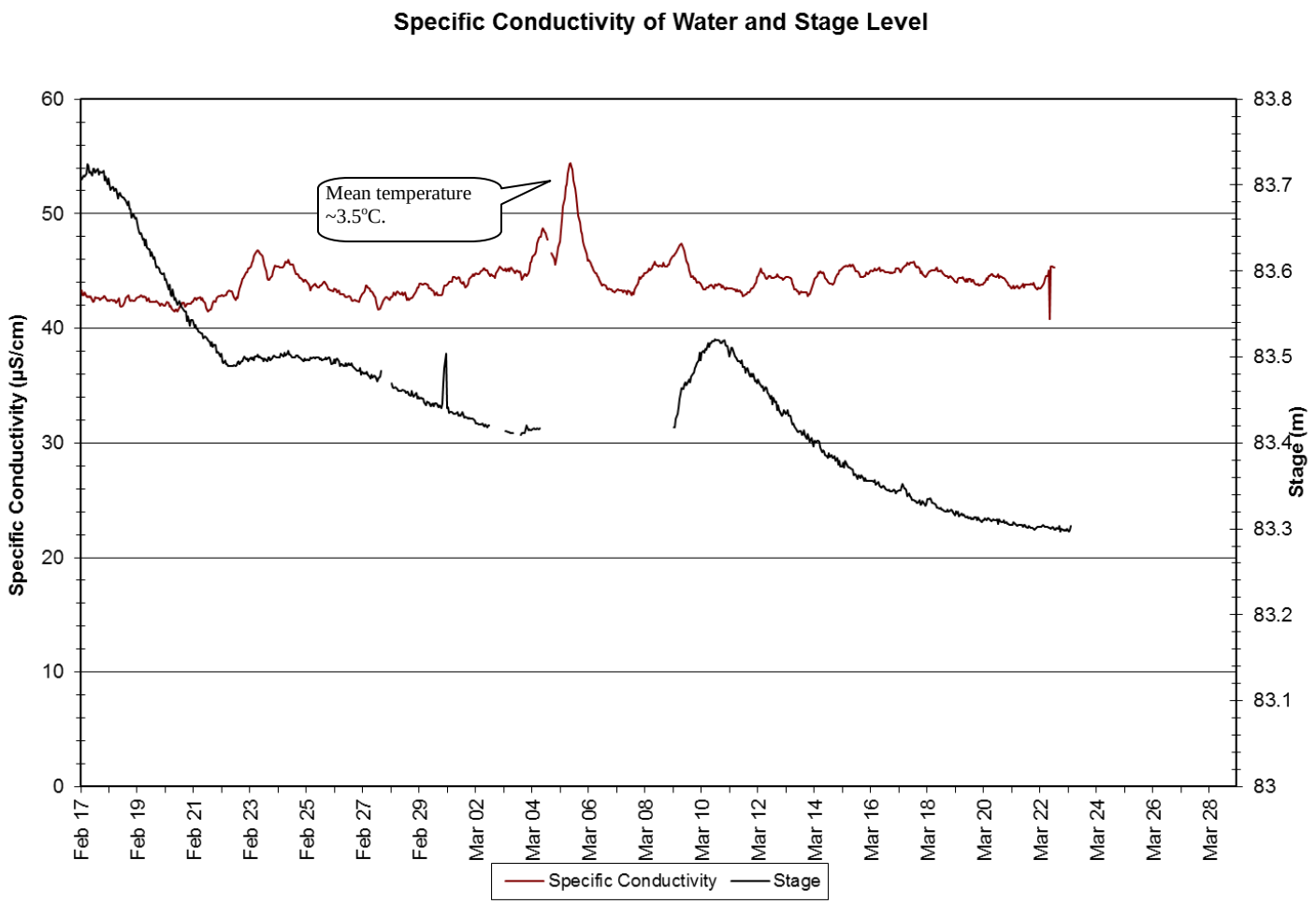
- During this deployment period, water temperature recorded at Bridge station ranged from -0.51°C to 3.50°C with a median temperature of 0.56°C. An increasing trend is observed over the course of the deployment.

Figure 7: pH at Rattling Brook below Bridge from February 17 to March 29



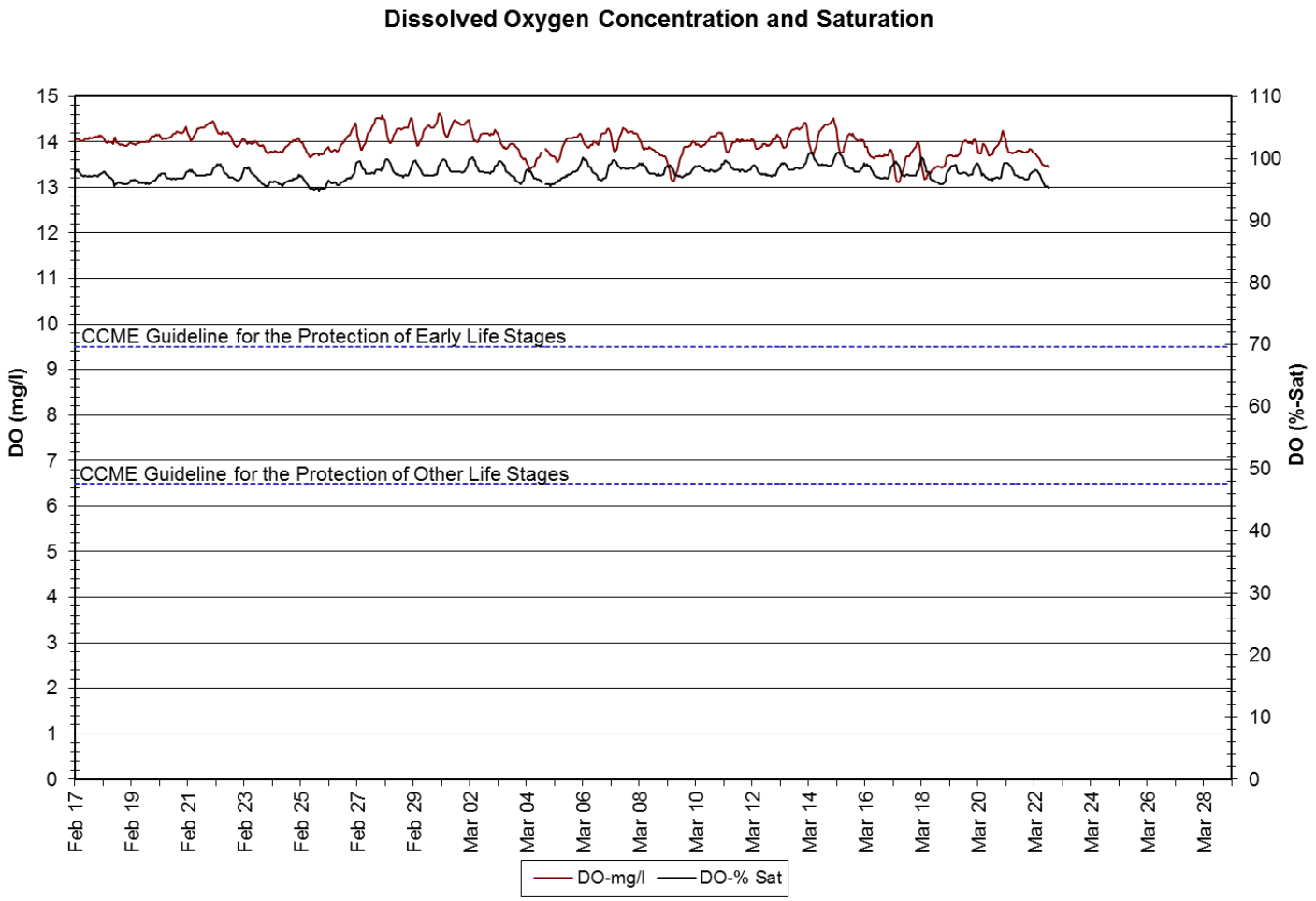
- pH values indicate a marginal increase over the deployment period with two notable peaks, possibly related to relatively high mean daily temperatures.
- Most records of pH fall within the Site Specific Guidelines for the Rattling Brook Network – a low of 6.05 and a high of 6.65 was recorded (median value: 6.19 units).

Figure 8: Specific Conductivity at Rattling Brook below Bridge from February 17 to March 29



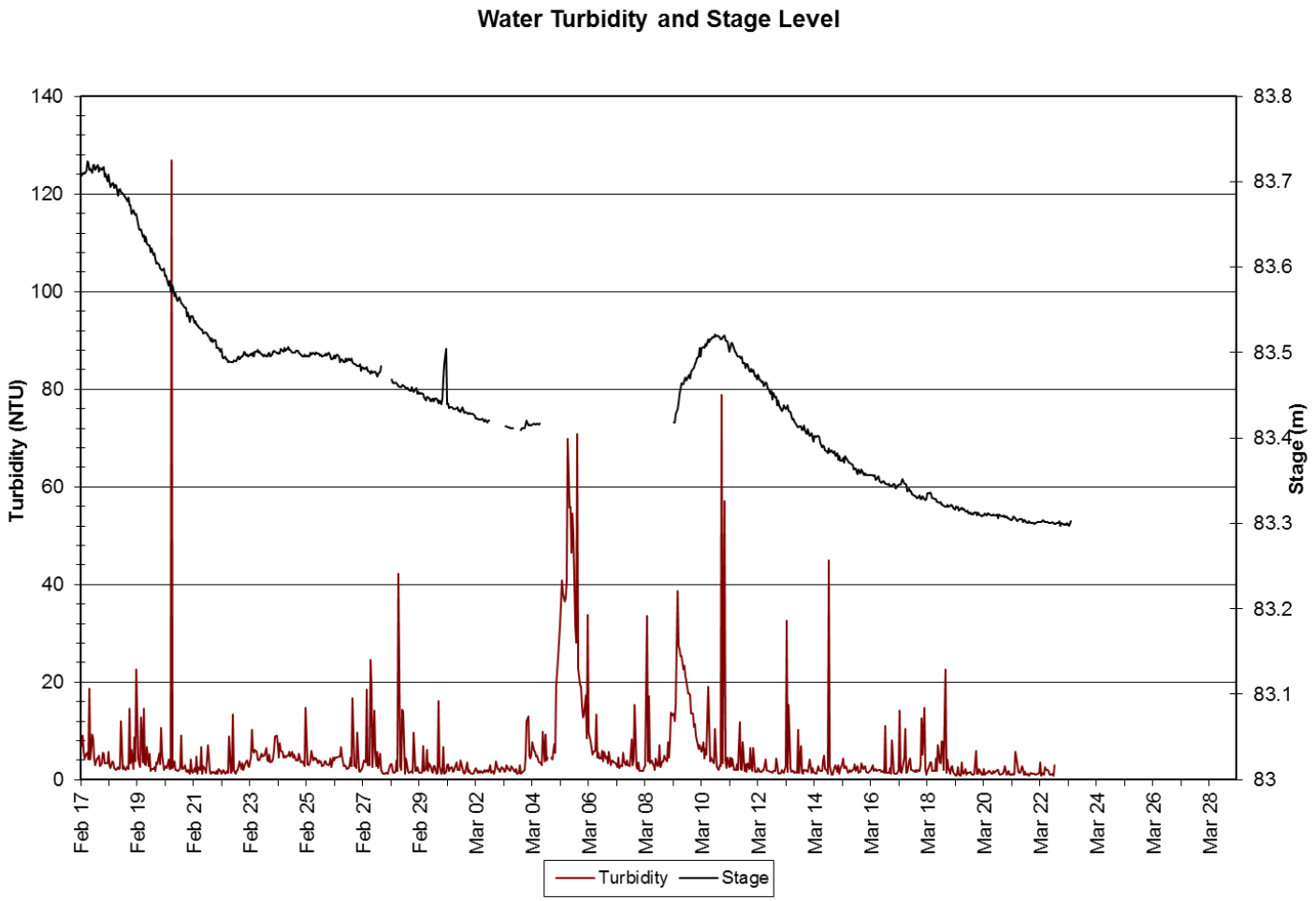
- Specific conductivity showed a marginal increase over the deployment period from February 17th to March 22nd. Values fell between 40.8 to 54.4 µS/cm (median value: 44.1 µS/cm).
- A peak is observed in specific conductivity on March 4th, likely related to a warm daytime temperature allowing the deposition of salts and sediments in the river channel.

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from February 17 to March 29



- All dissolved oxygen values were found to be above the CCME DO Guidelines for the protection of Early and Other Life stage cold water biota. No major trends in dissolved oxygen are observed.

Figure 10: Turbidity at Rattling Brook below Bridge from February 17 to March 29

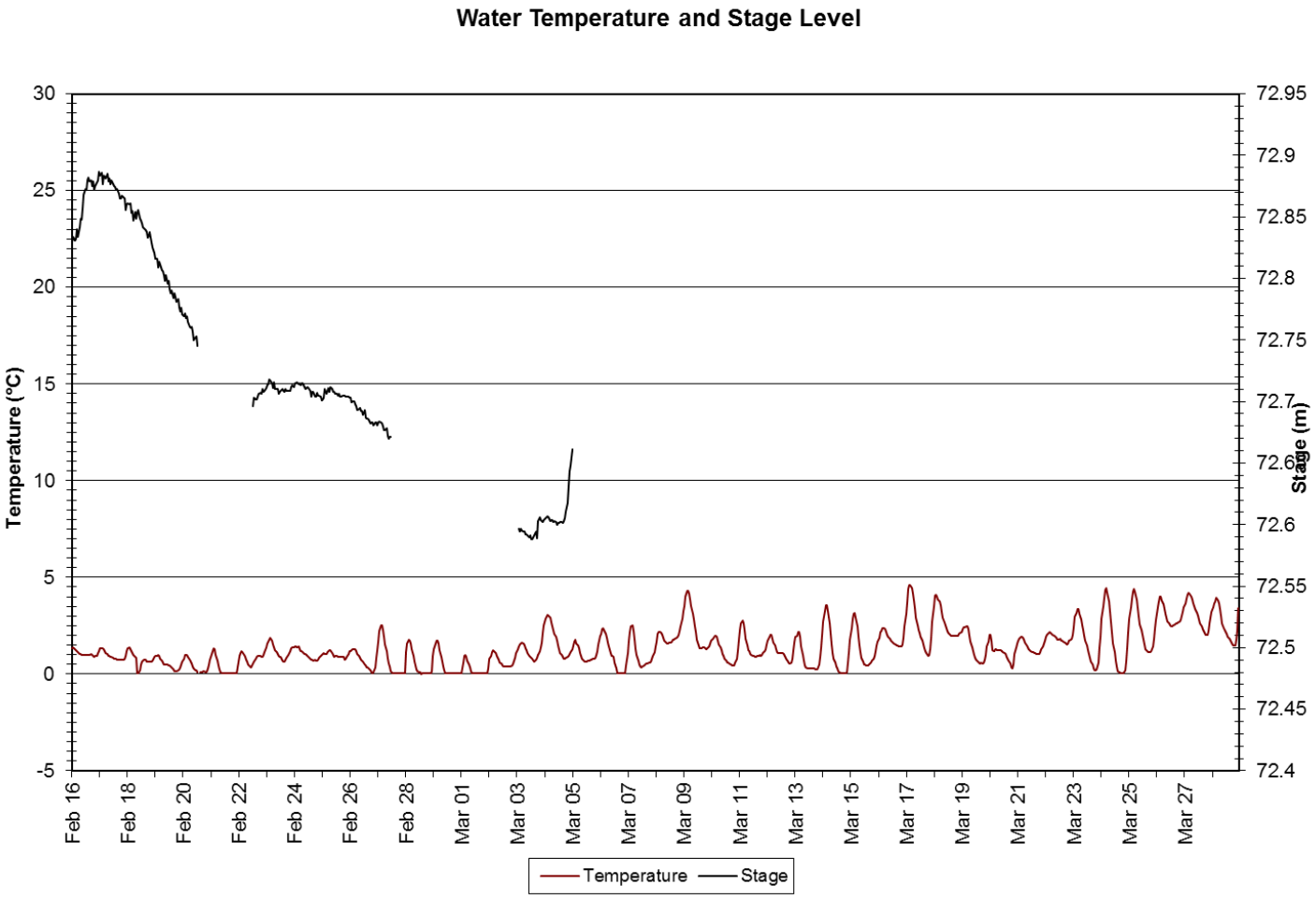


- Turbidity ranged from 0.9 NTU to 126.9 NTU (median value: 2.7 NTU)
- Two peaks of turbidity are evident in Figure 10 related to above-zero mean daily temperatures. A downward trend in turbidity is evident.

Rattling Brook below Plant Discharge

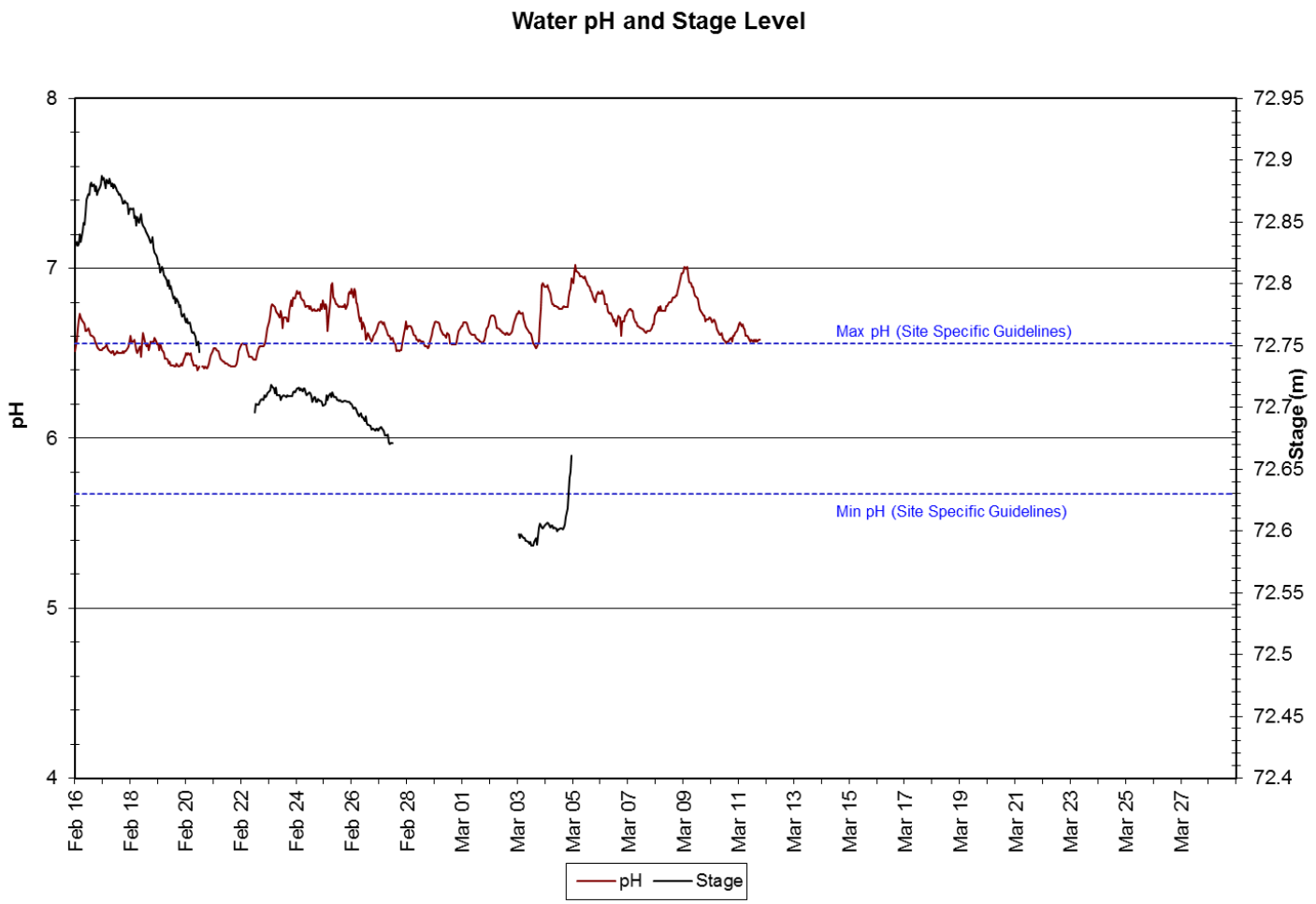
- A failure of the water level sensor led to an incomplete record of stage level at Rattling Brook below Plant Discharge station during this deployment period.

Figure 11: Water Temperature at Rattling Brook below Plant Discharge from February 16 to March 29



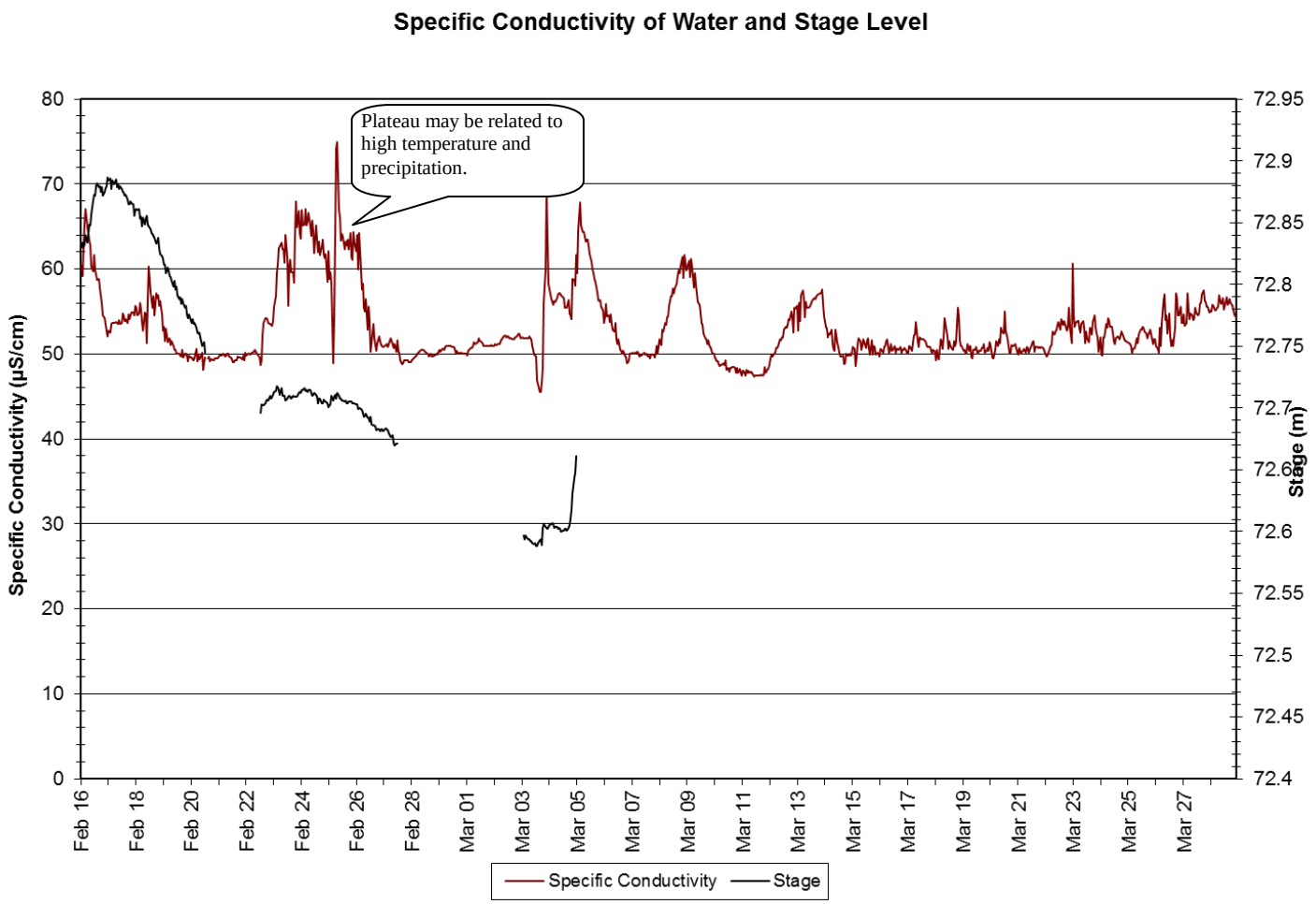
- An increasing trend is clear in Figure 11 as water temperature increases from the winter minimum near zero. During the deployment period, temperature ranged from 0.01°C to 4.61°C (median value: 1.12°C).

Figure 12: pH at Rattling Brook below Plant Discharge from February 16 to March 29



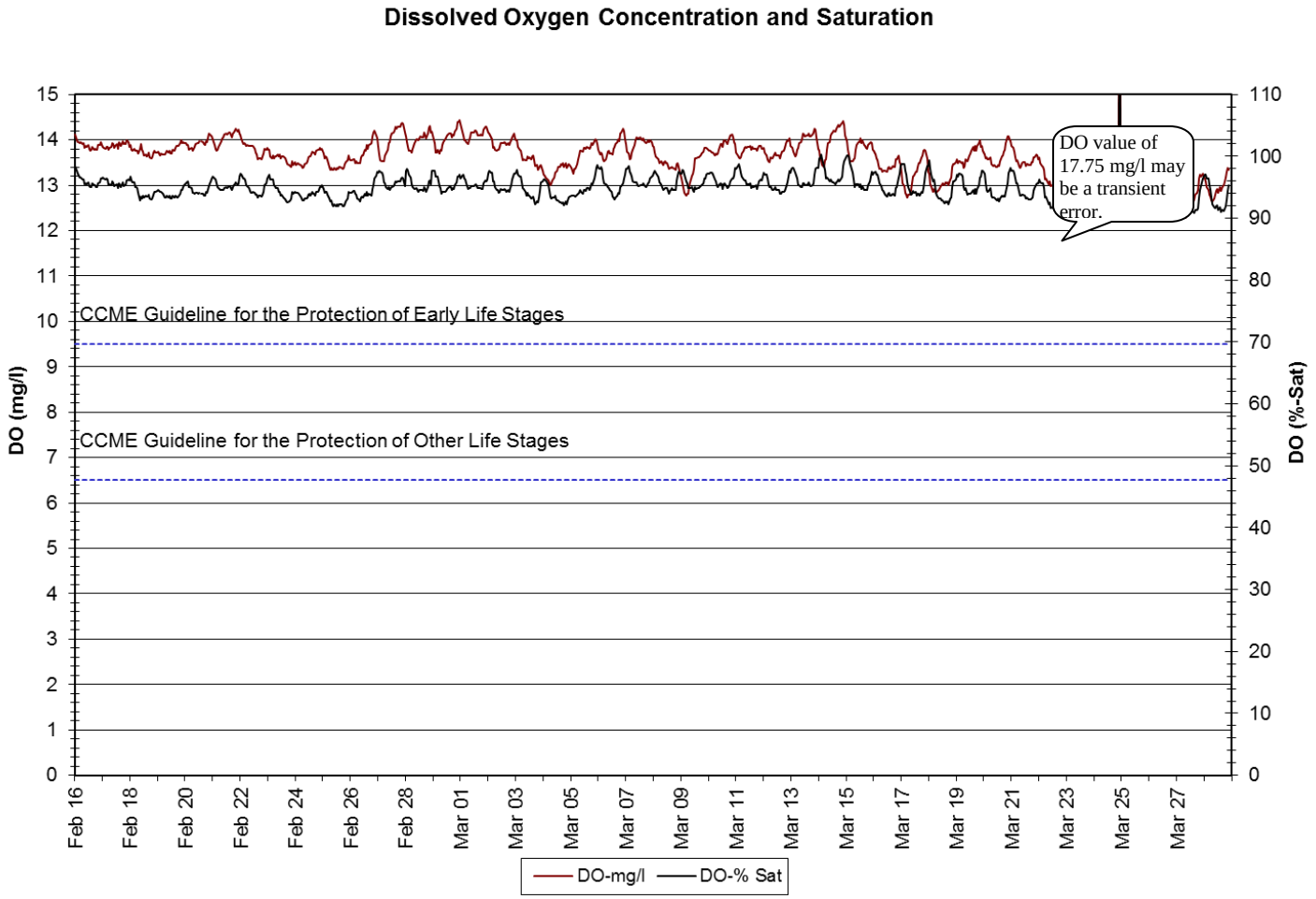
- A loss of calibration in the pH probe resulted in unexpectedly high pH readings after March 12th that trended very high. pH values after March 12th were removed from this report.
- pH values that fell within the expected range of 6.40 to 7.02 (median value: 6.64). Many values were found to fall outside the Site Specific Guidelines of 5.67 to 6.56. This may be the result of the pH probe losing its calibration earlier in the deployment (before March 12th). At removal time, pH ranking was found to be "Marginal.

Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from February 16 to March 29



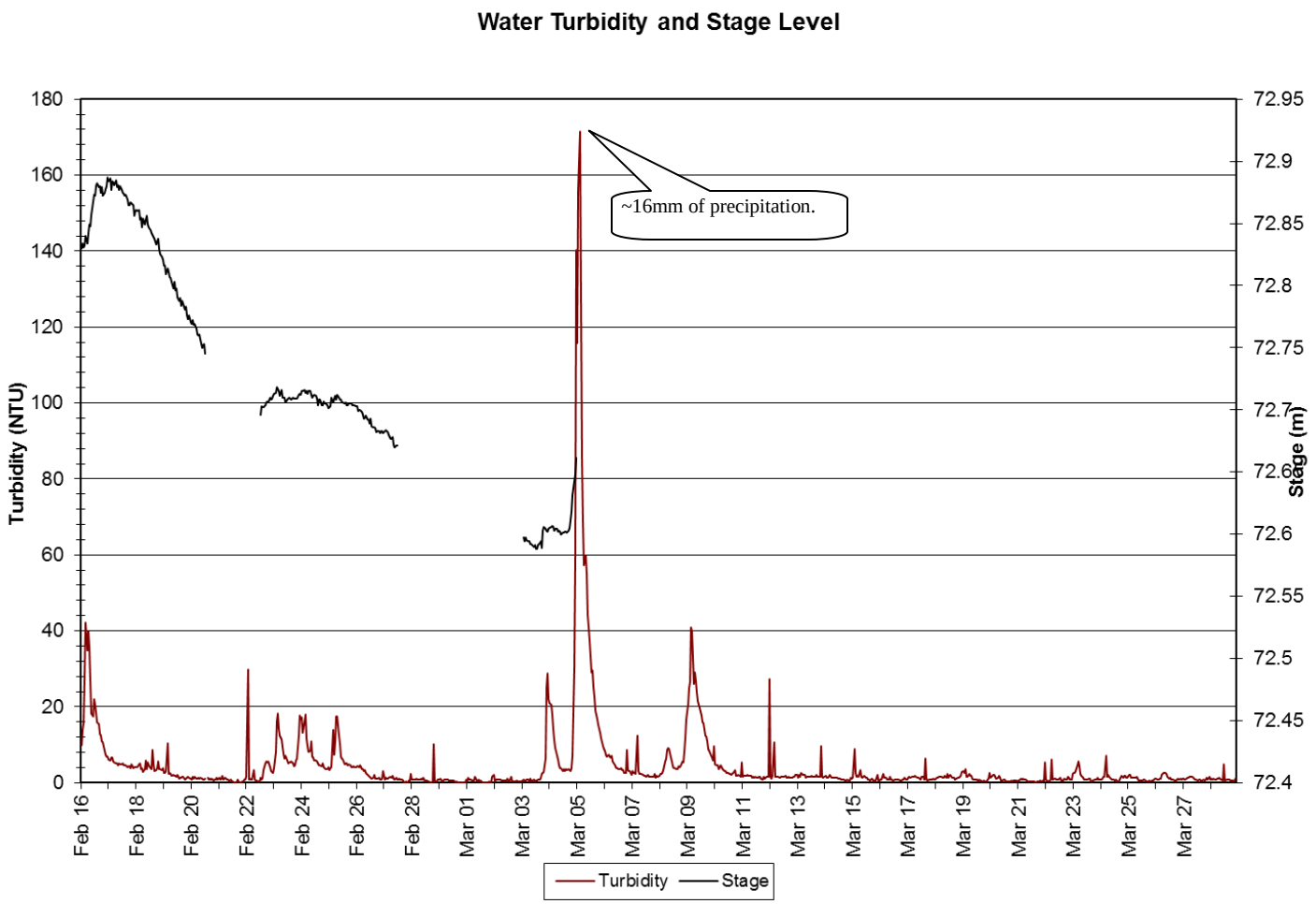
- Large fluctuations in specific conductivity were observed during this deployment period. A slight trend upward may be present towards the latter portion of the deployment.
- Conductivity ranged from 45.5 µS/cm to 75.0 µS/cm (median value: 51.7 µS/cm).

Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from February 16 to March 29



- A slight downward trend in dissolved oxygen was found during this deployment period as the water temperature increased from the winter low. DO fell between 17.75 and 12.29 mg/l with a median value of 13.68 mg/l. All values were found to be above the CCME Guideline for the Protection of Early and Other Life Stage cold water biota.
- On March 25, a peak value of 17.75 mg/l DO (corresponding to 123.8 % saturation) was recorded. At the time a temperature change of 0.66^{o}C was observed. No other parameters changed significantly, however, so this may be an error.

Figure 15: Turbidity at Rattling Brook below Plant Discharge from February 16 to March 29

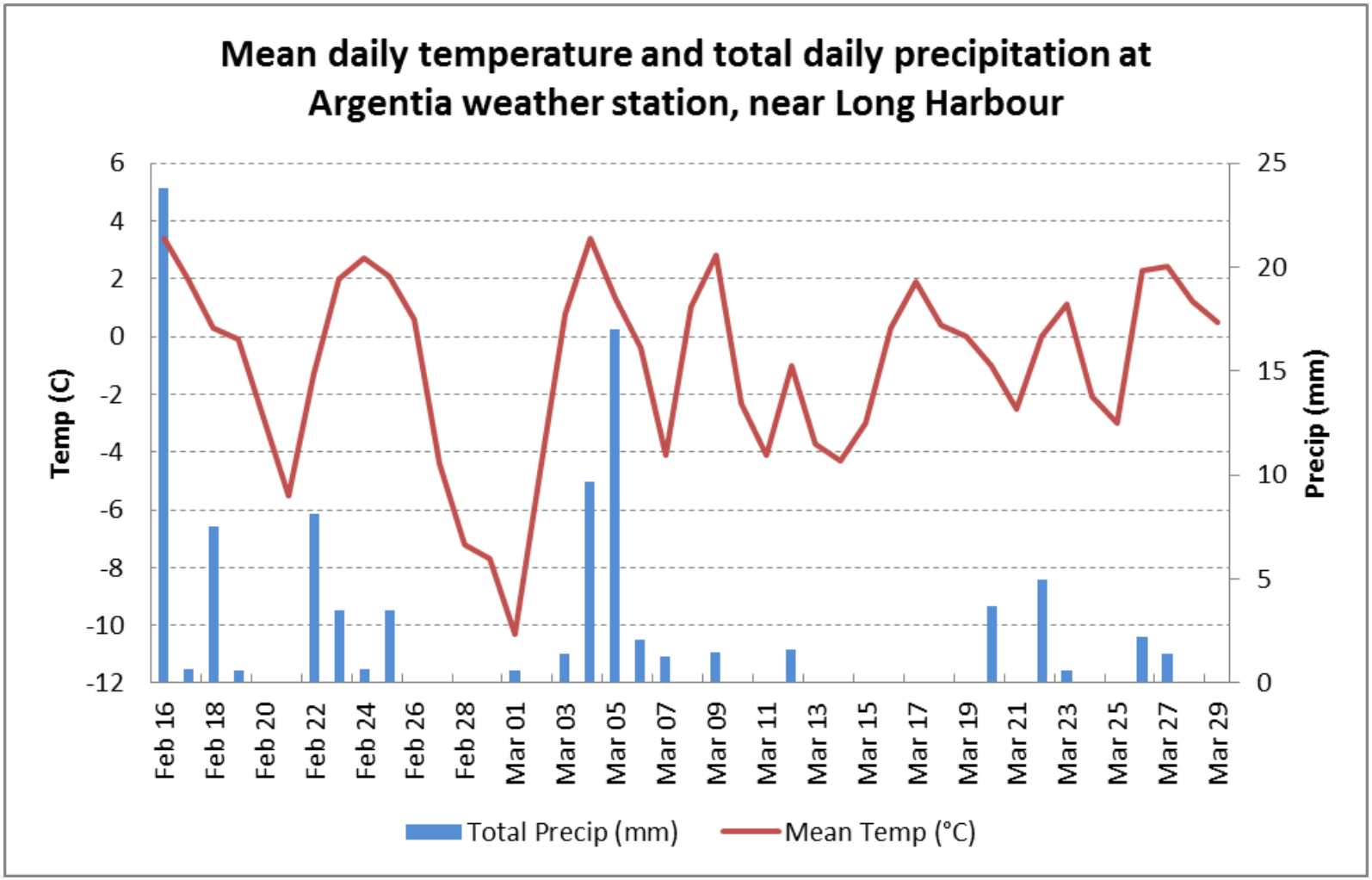


- Variable turbidity values were prevalent in the early to mid-deployment period. Towards late march, turbidity began to fall towards lower values.
- Values ranged from 0.0 to 171.4 NTU with a median value of 1.5 NTU. The high of 171 NTU occurred on March 5th during ~16 mm of precipitation.

Conclusions

- A fault with the stage level devices left gaps at Bridge and Discharge stations for that parameter. Environment Canada will deal with these issues at maintenance time.
- Unexpected movement of the Field sonde at Bridge station during the last week in deployment almost left the instrument high and dry. The data recorded by the instrument at this time did not fit quality objectives and was not considered in this deployment report.

Appendix



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