Real-Time Water Quality Deployment Report

Rattling Brook Network

July 16th, 2010 to August 12th, 2010

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.
- Vale Inco will be apprised of any significant water quality events, including automated turbidity alerts.
- This report interprets water quality data from July 16th to August 12th, 2010, a period of 26 days.
- Due to a turbidity probe malfunction, the instrument at Rattling Brook below Bridge station was replaced on July 29th. No corrections were made to data at Rattling Brook below Bridge station due to an inability to generate corrections data from two unique instruments.
- Correction data could not be generated for turbidity data due to the lack of a turbidity probe on the QAQC instrument used during removal. As a result, all turbidity comparative rankings are marked as NA.

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 along side the Field Sonde. Values for temperature and dissolved oxygen are compared between the two instruments. A grab sample is taken to compare with the Field Sonde for specific conductivity, pH and turbidity parameters. Based on the degree of difference between parameters recorded by the Field Sonde, QAQC Sonde and grab sample a qualitative statement is made on the data quality in Table 1 upon Deployment.
  - At the end of a deployment period, readings are taken in the water body from the Field Sonde before and after a thorough cleaning in order to assess the degree of biofouling. During calibration in the laboratory, an assessment of calibration drift is made and the two error values are combined to give Total Error (T_e). If T_e exceeds a predetermined data correction criterion, a correction based on T_e is applied to the dataset using linear interpolation. Based on the value for T_e, a qualitative statement is also made on the data quality in Table 1 upon Removal.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook below Plant Discharge	July 16, 2010	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	August 12, 2010	Removal	Excellent	Good	Excellent	Excellent	NA
Rattling Brook below Bridge	July 16, 2010	Deployment	Excellent	Fair	Good	Excellent	Excellent
	August 12, 2010	Removal	Good	Excellent	Excellent	Excellent	NA
Rattling Brook Big Pond	July 16, 2010	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	August 12, 2010	Removal	Excellent	Excellent	Excellent	Excellent	NA

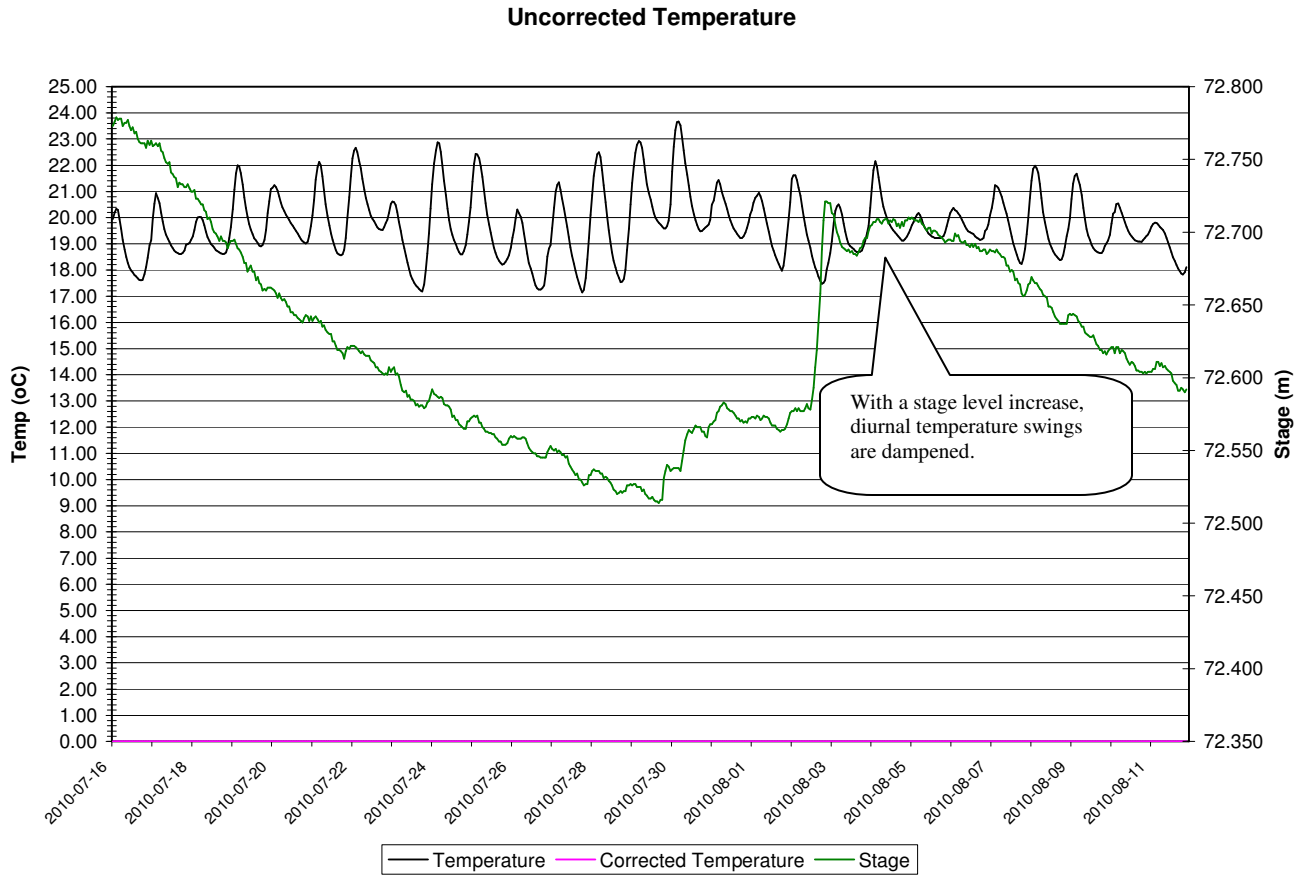
Data Interpretation

- The following graphs and discussion interprets water quality data for Rattling Brook below Plant Discharge, below Bridge, and Big Pond stations.

Rattling Brook below Plant Discharge

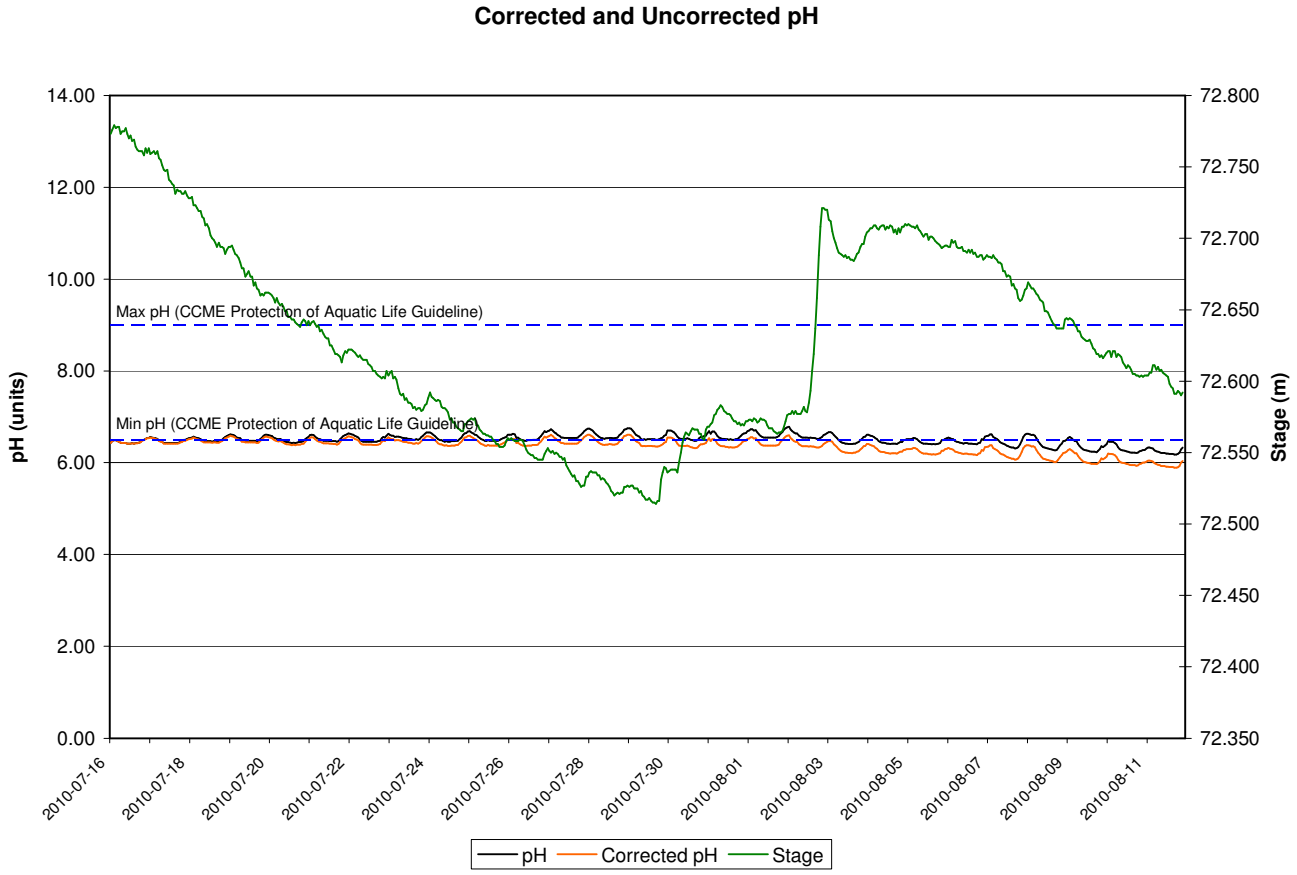
- Temperature data was not corrected for this deployment period since the total error did not exceed the data correction criterion.
- Throughout this deployment period, water temperature reached its summer plateau and no major up- or downward trend is recognized. Water temperatures cycle diurnally and range from a low of 17.15 to a high of 23.67°C.

Figure 1: Water Temperature at Rattling Brook below Plant Discharge from July 16 to August 12



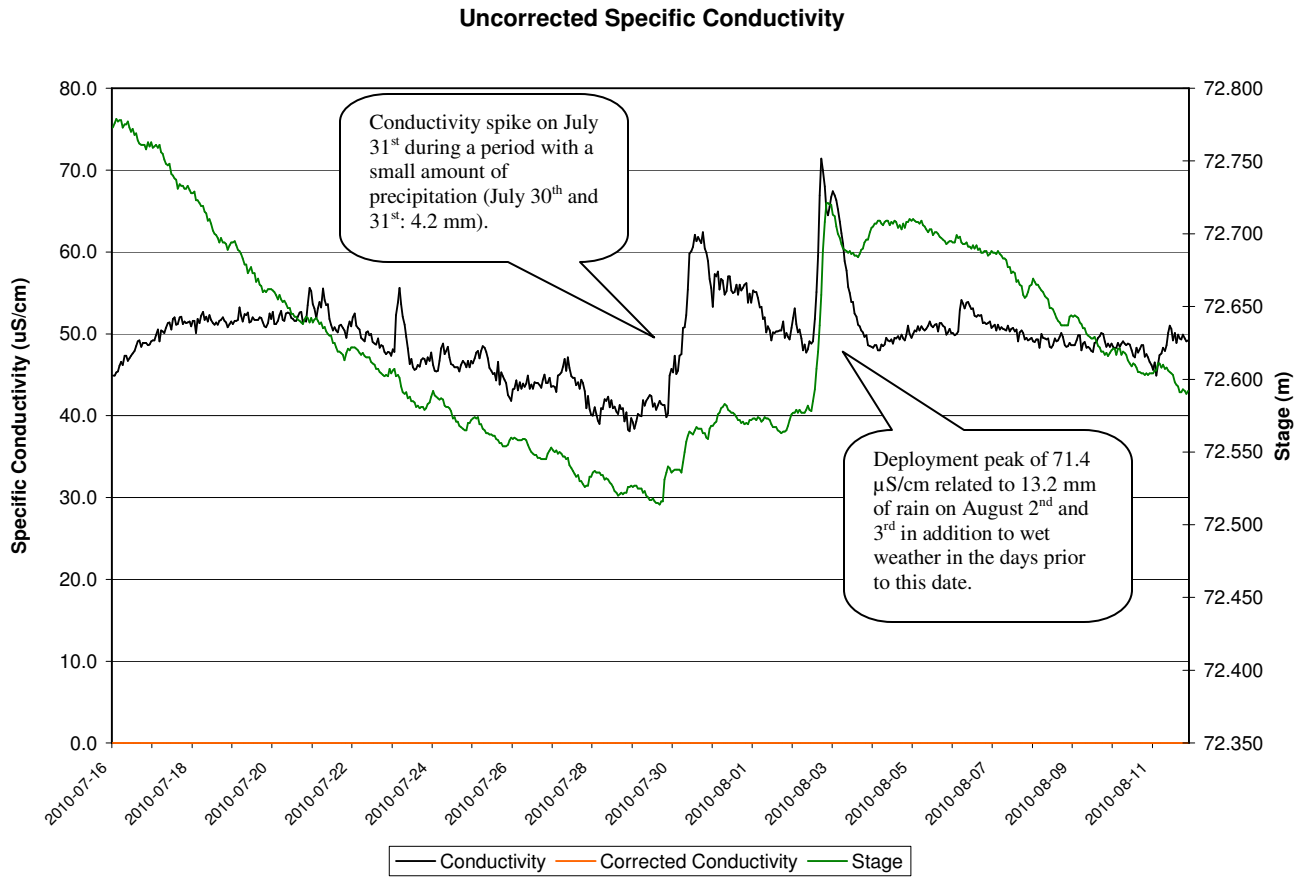
- The total error was calculated as -0.29 which is greater than the data correction criterion of 0.2. Therefore, a small correction is applied to pH during this deployment period
- A slightly downward trend in pH is seen with most values falling below the CCME Guideline of 6.5 for the Protection of Aquatic Life. Corrected pH ranged from 6.61 to 5.89.
- Rapid changes are not recorded throughout the deployment period, indicating that no concern is warranted regarding pH.

Figure 2: pH at Rattling Brook below Plant Discharge from July 16 to August 12



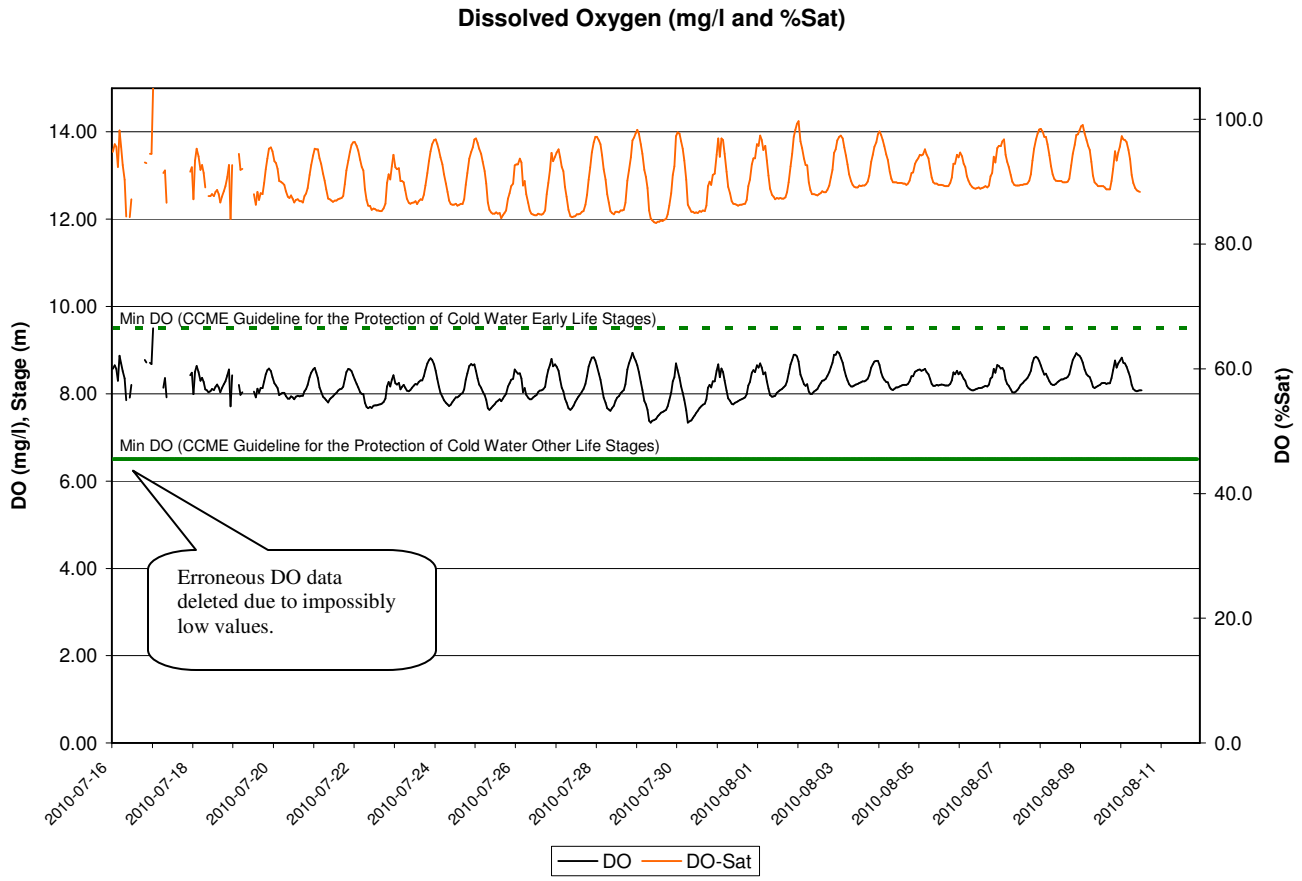
- Specific conductivity was not corrected during this deployment period and the data is presented in its raw format.
- Large swings in specific conductivity are seen in conjunction with large changes in stage level. Conductivity ranged from 38.1 to a high of 71.4 µS/cm on August 3rd at 5:30 am.

Figure 3: Specific Conductivity at Rattling Brook below Plant Discharge from July 16 to August 12



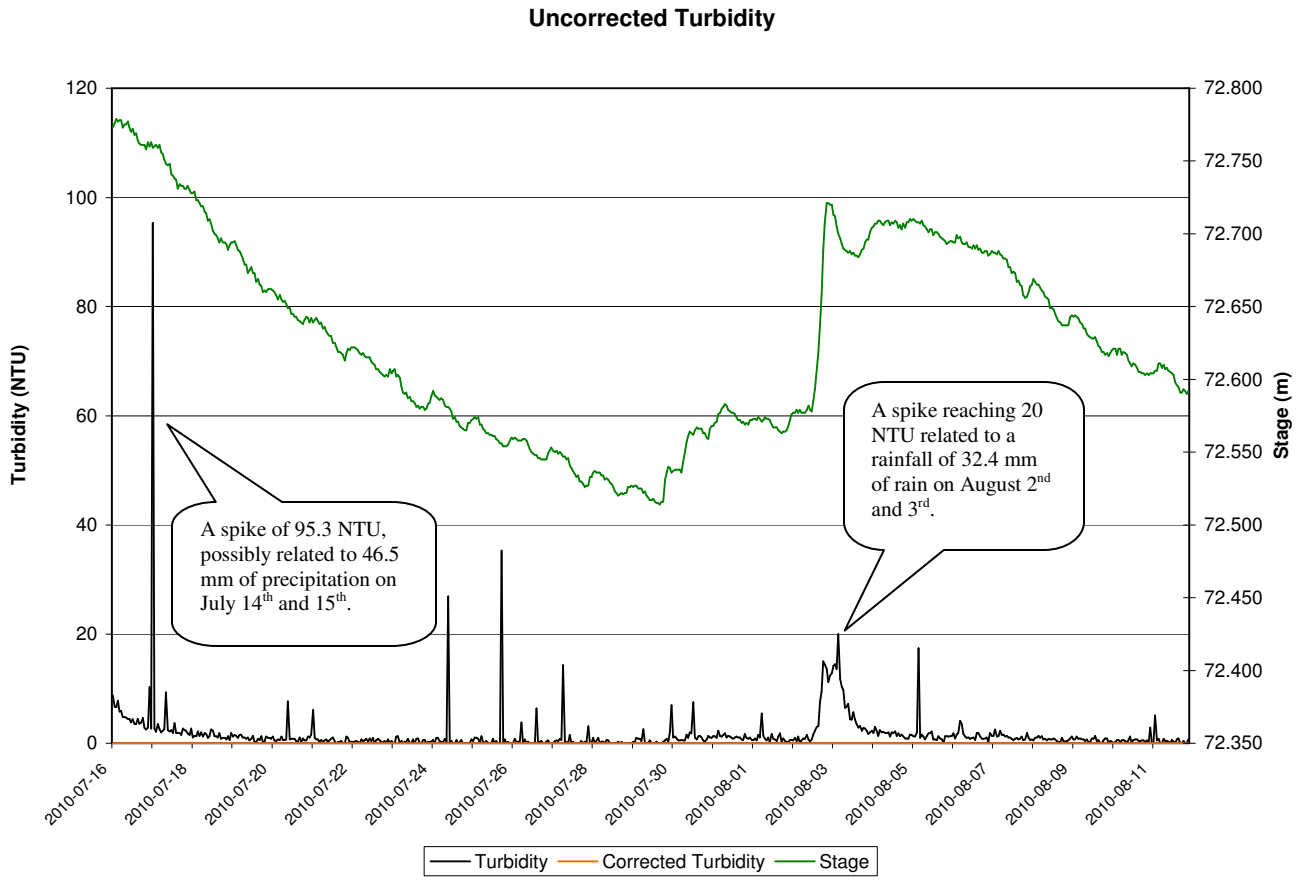
- No correction was applied to Dissolved Oxygen for this deployment. The data presented is in its raw format.
- A handful of readings were deleted at the beginning of the deployment period due to spurious, impossibly low values. Such erroneous data is likely the result of a DO probe issue which will be corrected at the next calibration period.
- The saturation of Dissolved Oxygen ranged from 83.4 to 105.1% with a concentration of dissolved oxygen ranging from 7.34 to 9.50 mg/l. Values below 9.5 mg/l DO are recorded as below the CCME Guideline for the Protection of Early Life Stage Aquatic Biota, however all values were above the guideline of 6.5 mg/l for the Protection of Other Life Stage Aquatic Biota. No reports of adverse impact on aquatic life have been received indicating that this is not of major concern.

Figure 4: Dissolved Oxygen at Rattling Brook below Plant Discharge from July 16 to August 12



- Turbidity data presented is in its uncorrected, raw form.
- A low level of turbidity is recorded at Rattling Brook below Plant Discharge station for this deployment period. Turbidity ranged from 0.0 to 95.3 NTU with a median of 0.8 NTU.

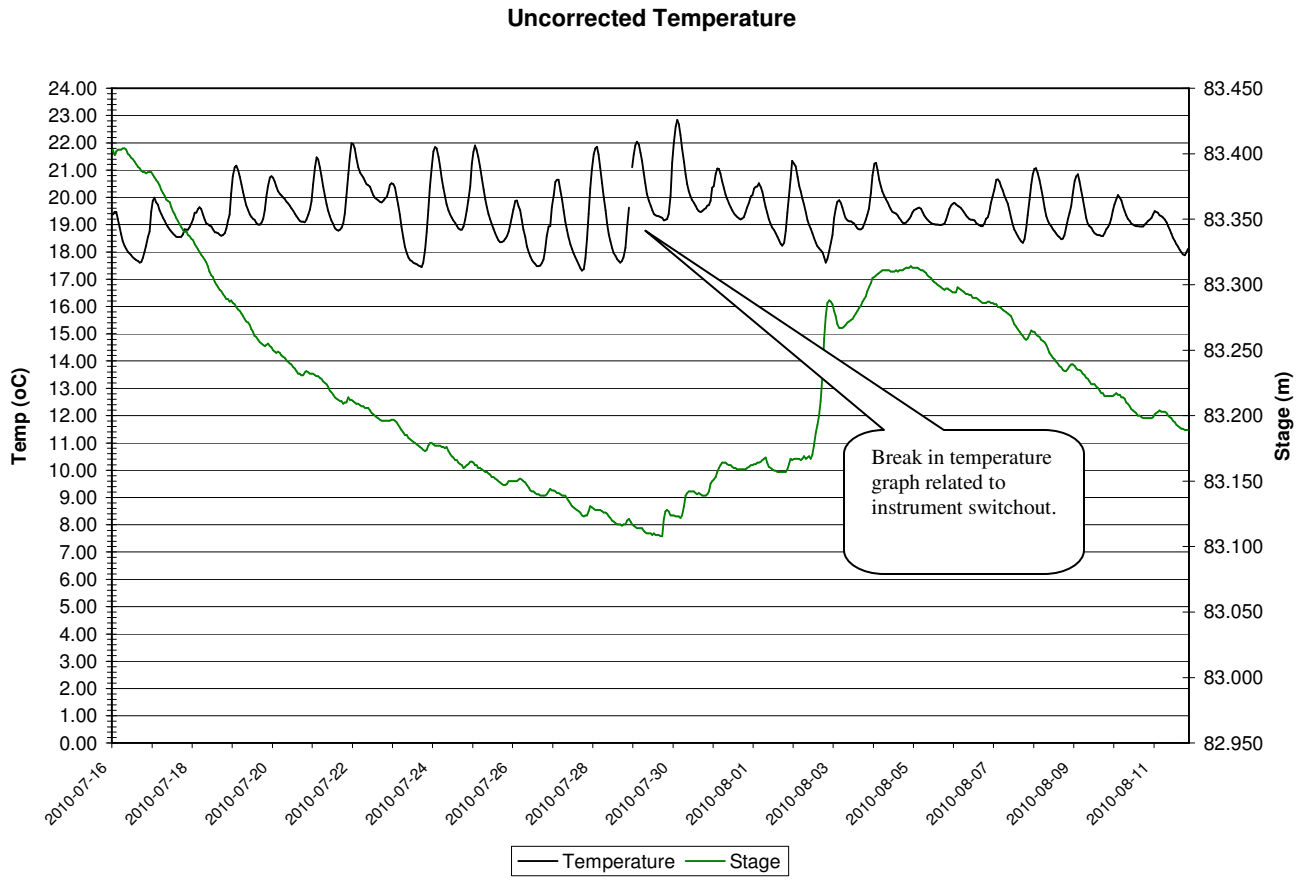
Figure 5: Turbidity at Rattling Brook below Plant Discharge from July 16 to August 12



Rattling Brook below Bridge

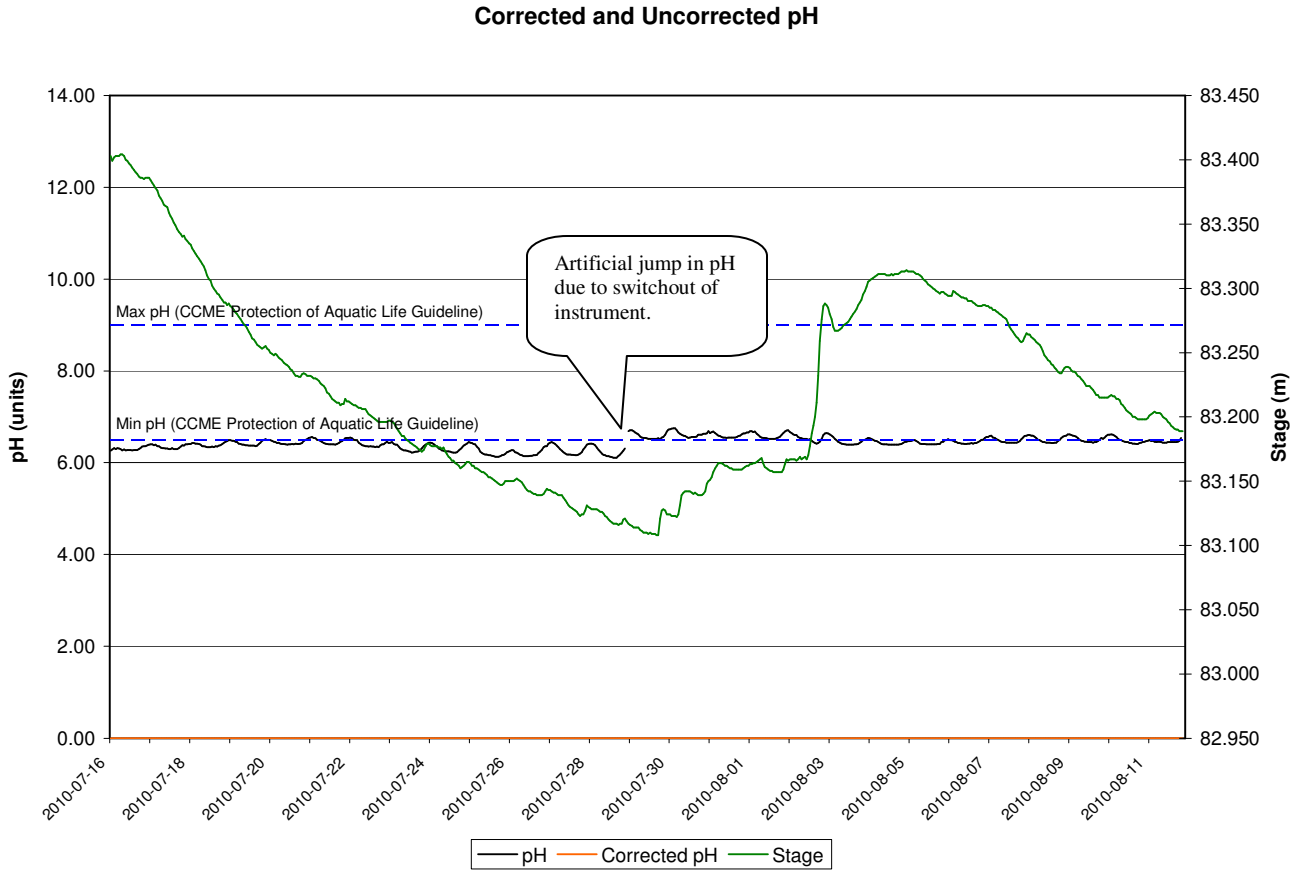
- Water temperature was not corrected for this deployment period and raw data is presented.
- Water temperature shows no major upward or downward trend for this deployment period. For this 26 day period, temperature ranged from 17.31 to 22.84°C.

Figure 6: Water Temperature at Rattling Brook below Bridge from July 16 to August 12, 2010



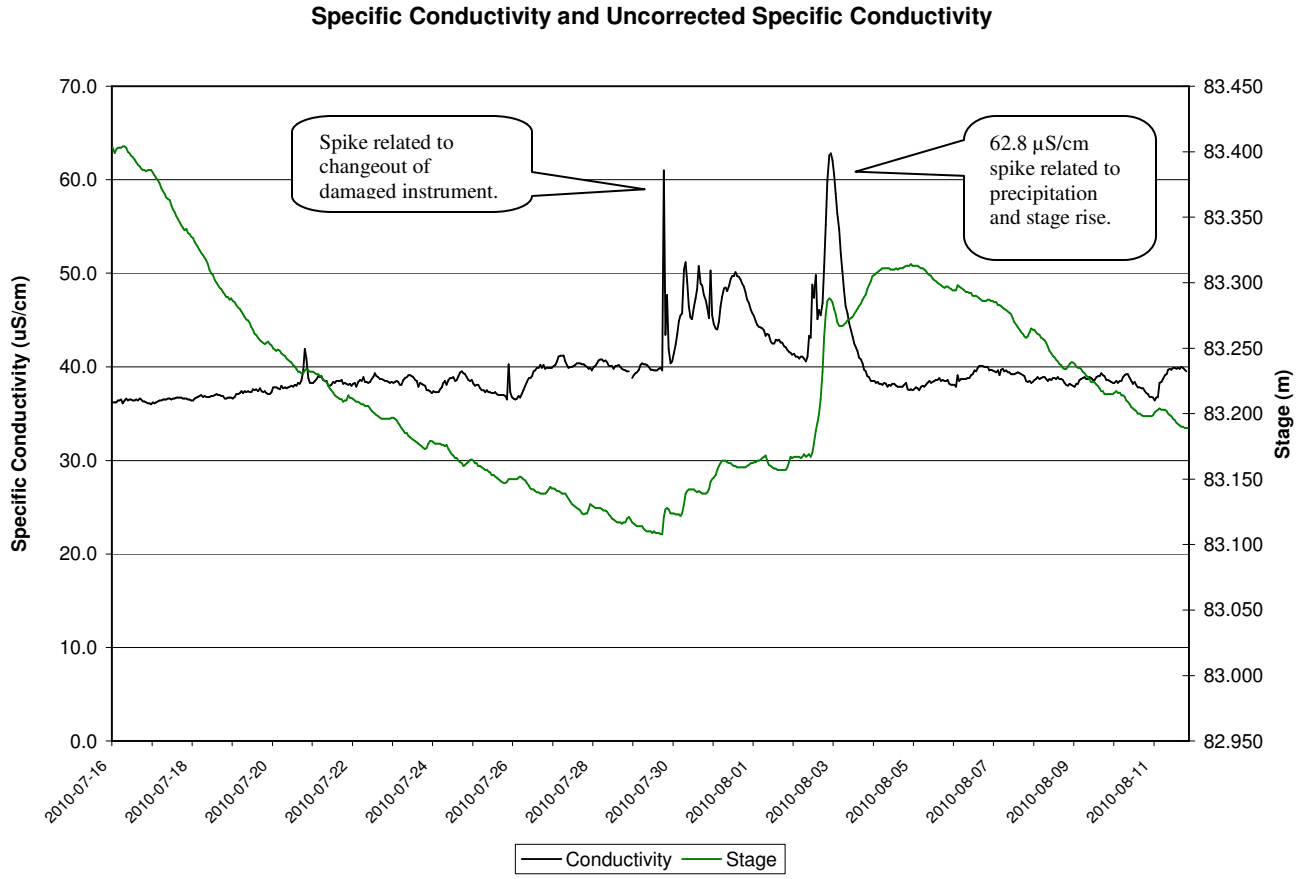
- pH is not corrected for this deployment period and raw pH data is presented in Figure 7.
- The range in pH is from 6.11 to 6.75 with a slight, disjointed jump in the middle of deployment related to the switchout of the instrument on July 29th.
- pH values straddle the CCME Guideline of 6.5 for the Protection of Aquatic Life. This is considered steady state and the normal condition for this station.

Figure 7: pH at Rattling Brook below Bridge from July 16 to August 12, 2010



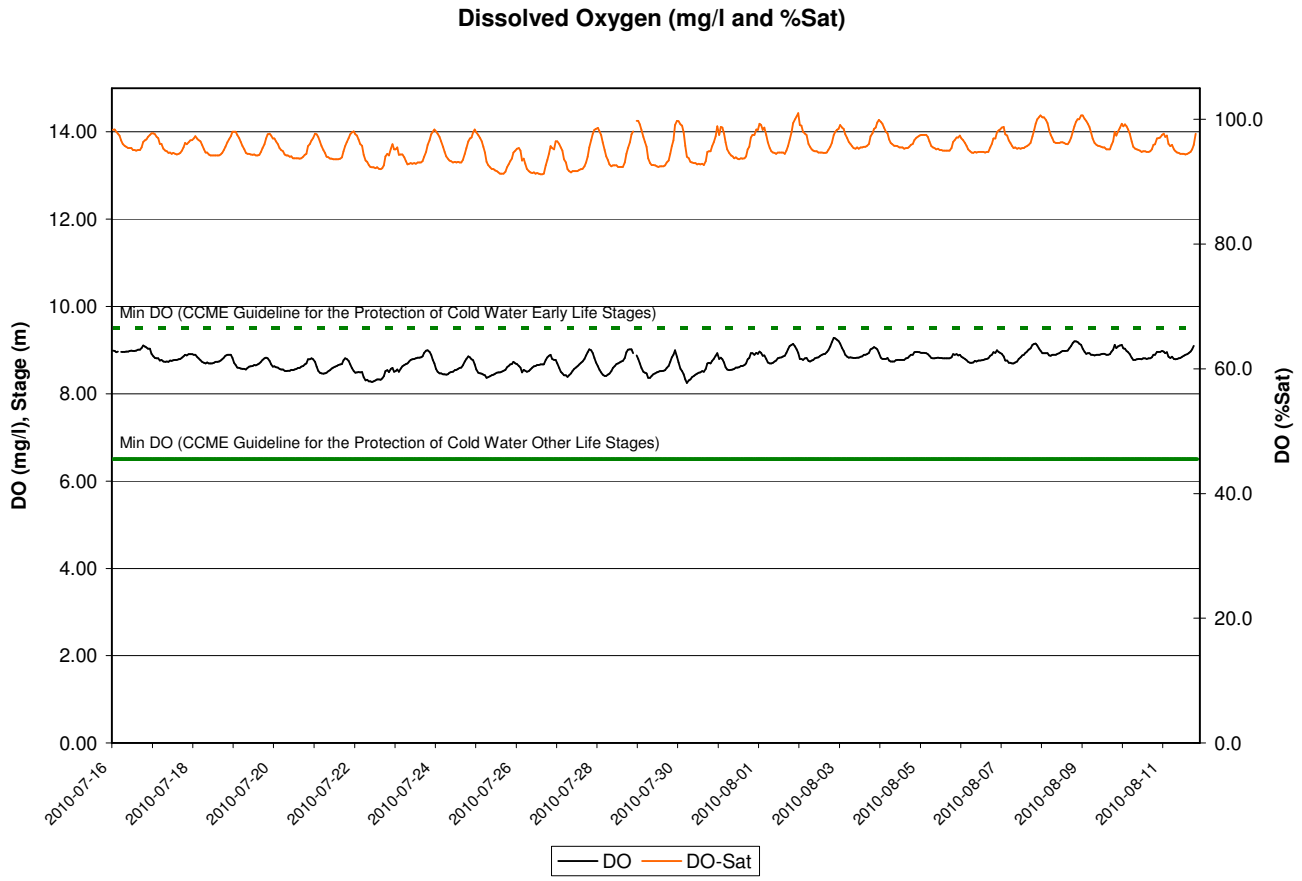
- No correction was applied to specific conductivity for this deployment. The data presented in Figure 8 is in its raw from.
- Specific conductivity ranged from 36.0 to 62.8 µS/cm for the month with some disturbance in the middle of the deployment related to the changeout of the damaged instrument and precipitation causing an influx of overland flow.

Figure 8: Specific Conductivity at Rattling Brook below Bridge from July 16 to August 12, 2010



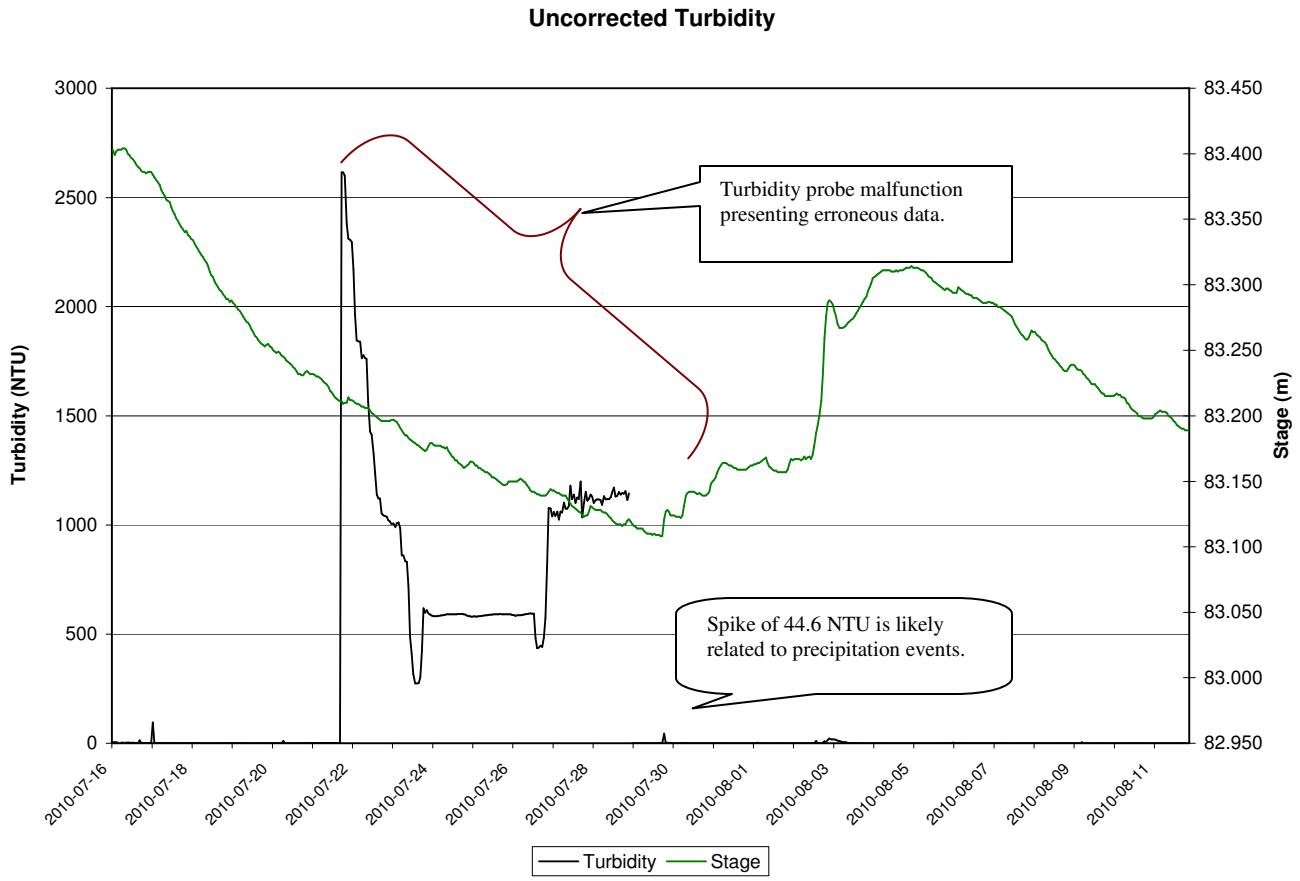
- No correction was applied to dissolved oxygen during this deployment period and the data presented is in its raw form.
- The saturation of dissolved oxygen ranged from 91.2 to 101.0% for this deployment period with a median of 95.4%. No major swings in saturation are present.
- Concentration of dissolved oxygen ranged from 8.25 to 9.28 mg/l. The entire range recorded falls below the CCME guideline of 9.5 mg/l for the Protection of Early Life Stage Aquatic Biota but above the guideline of 6.0 mg/l for the Protection of Other Life Stage Aquatic Biota.
- A slight upward trend in dissolved oxygen concentration is just noticeable corresponding with the slightly downward trend in water temperature.

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from July 16 to August 12, 2010



- Turbidity was not corrected in this deployment and the data provided in Figure 10 is raw, including the data identified as erroneous. All turbidity data prior to July 29th was removed to ensure a conservative approach towards removal of potentially incorrect data.
- Disregarding the erroneous turbidity data, the range in real values is from 0 to 44.6 NTU, with the median being 0 NTU. A spike in turbidity is recorded soon after the faulty instrument was replaced. Initially it was thought that this could be related to the replacement of the sonde itself, although since it occurs 19 hours following replacement, it is thought to be related to precipitation.

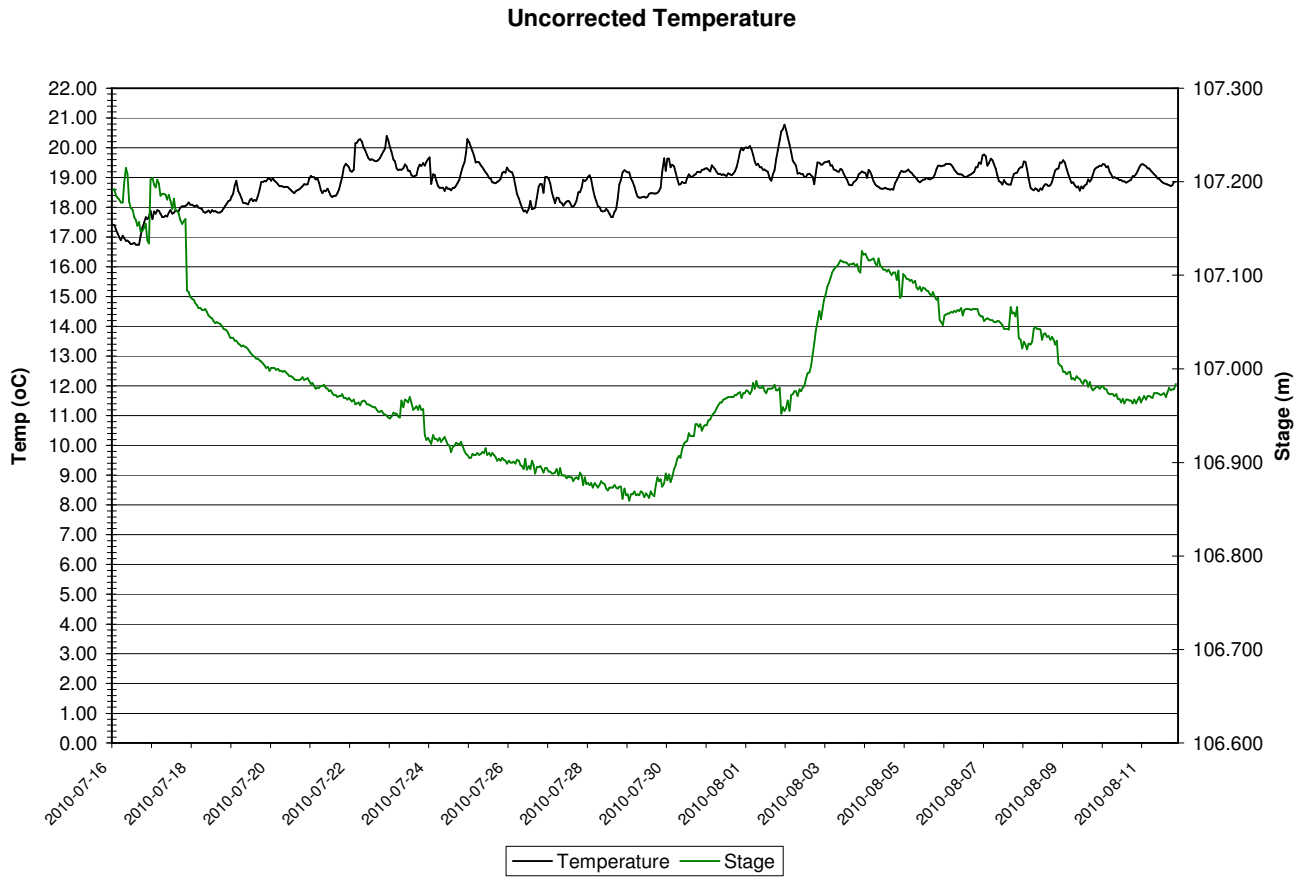
Figure 10: Turbidity at Rattling Brook below Bridge from July 16 to August 12, 2010



Rattling Brook Big Pond

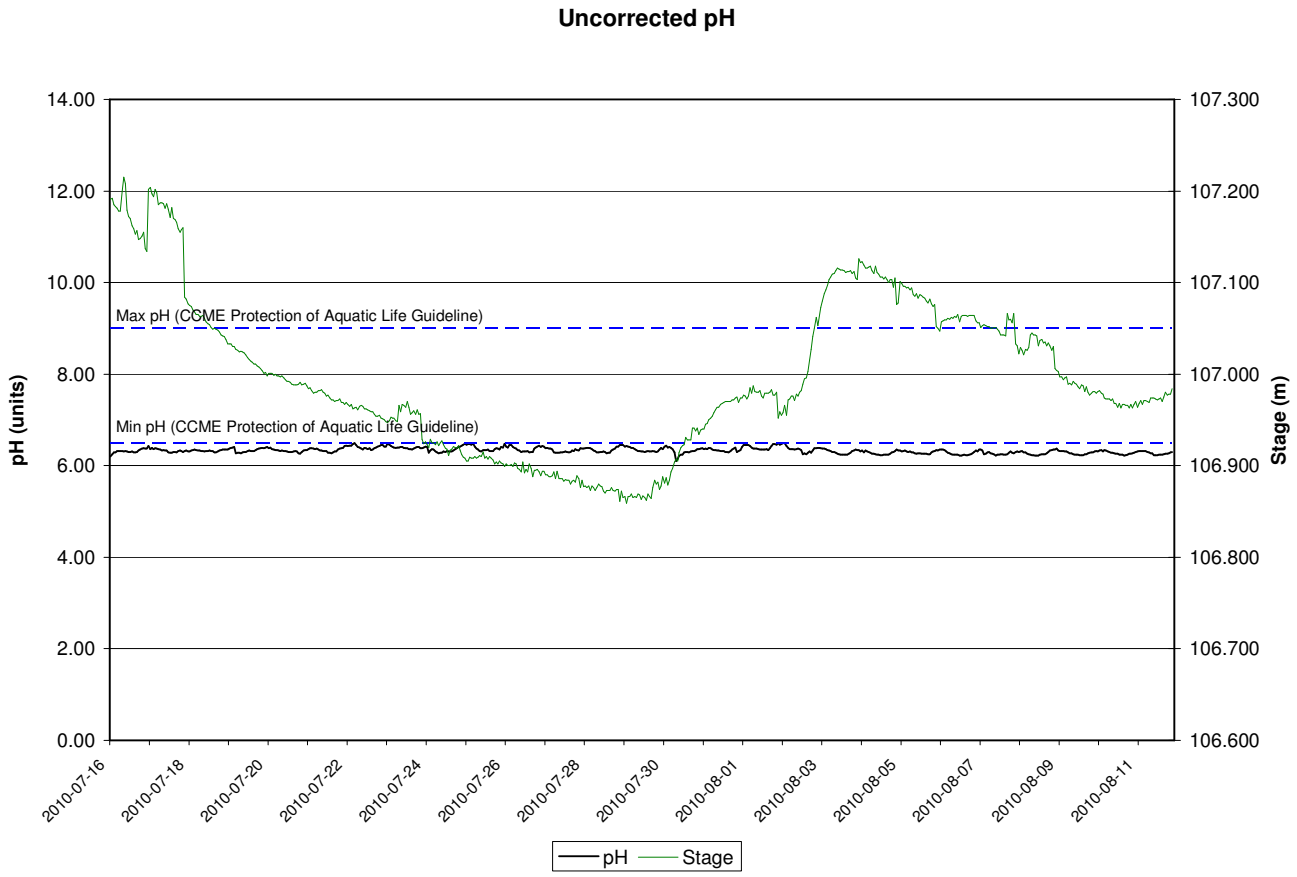
- Water temperature did not receive a correction during this deployment period since the total error did not exceed the data correction criterion.
- Water temperature increased slightly over the course of this deployment period despite the slight decline downstream at below Bridge and below Plant Discharge stations. Temperature here ranged from 16.74 to 20.77^{o}C.

Figure 11: Water Temperature at Rattling Brook Big Pond from July 16 to August 12, 2010



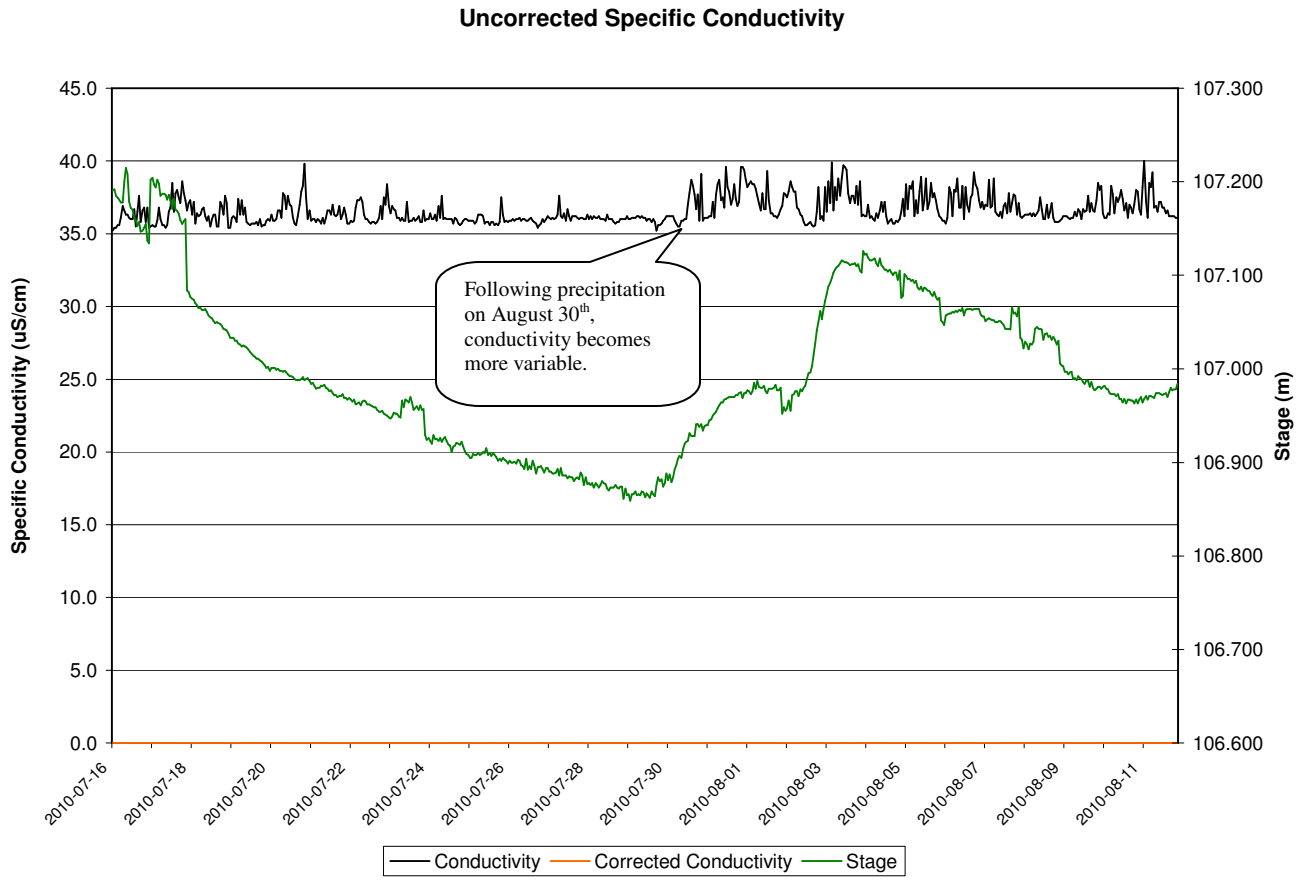
- pH was not corrected during this deployment period and raw data is presented in Figure 12.
- pH at Rattling Brook Big Pond remained stable throughout this deployment period with a low point of 6.10 and a high of 6.49. All readings fall below the CCME guideline range 6.5 to 9.0 for the Protection of Aquatic Life. This is considered normal for this region of the province.

Figure 12: pH at Rattling Brook Big Pond from July 16 to August 12, 2010



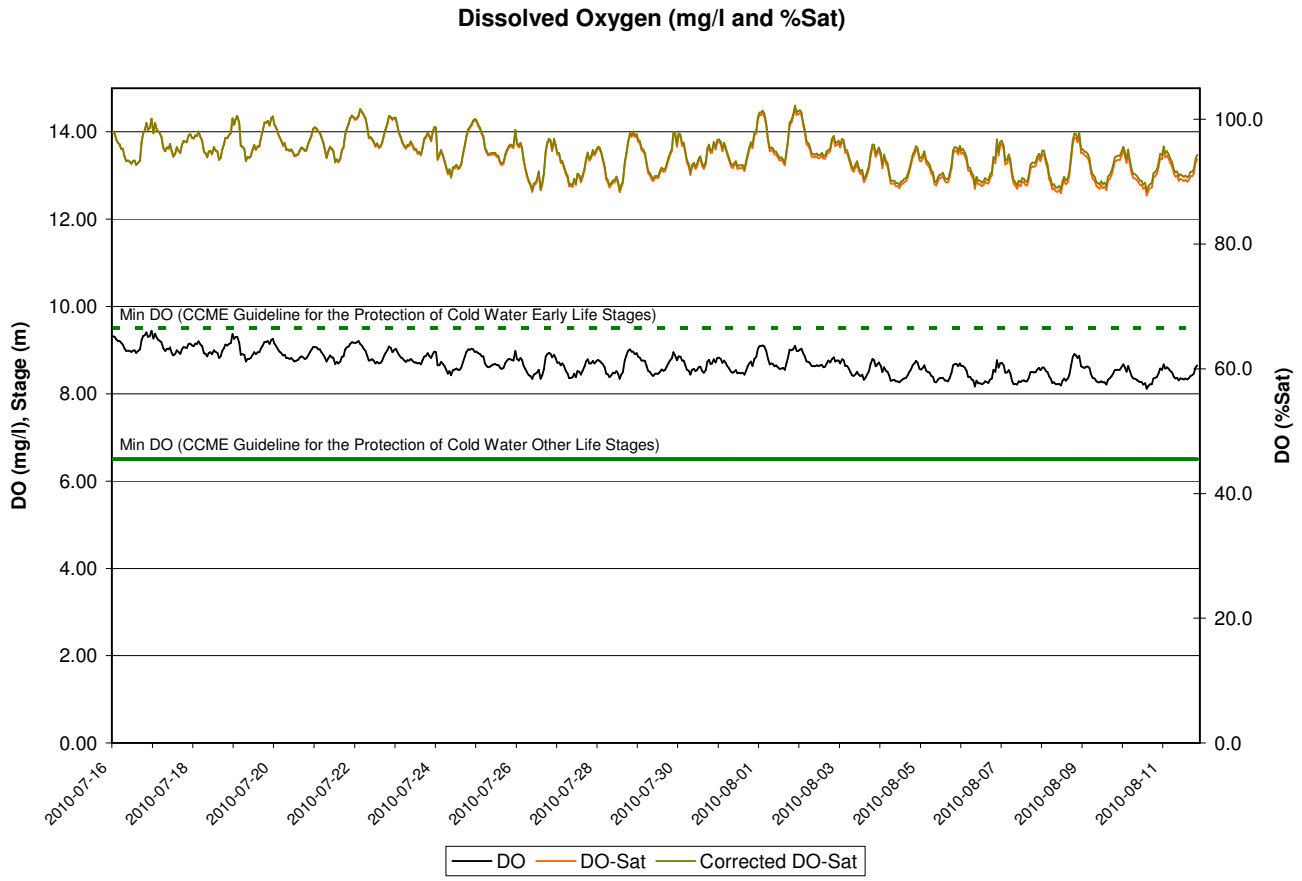
- At the beginning of deployment, specific conductivity appears more stable relative to the highly variable period following precipitation on July 30th. Conductivity ranged from 35.2 to 40.0 µS/cm with a median of 36.2 µS/cm.

Figure 13: Specific Conductivity at Rattling Brook Big Pond from July 16 to August 12, 2010



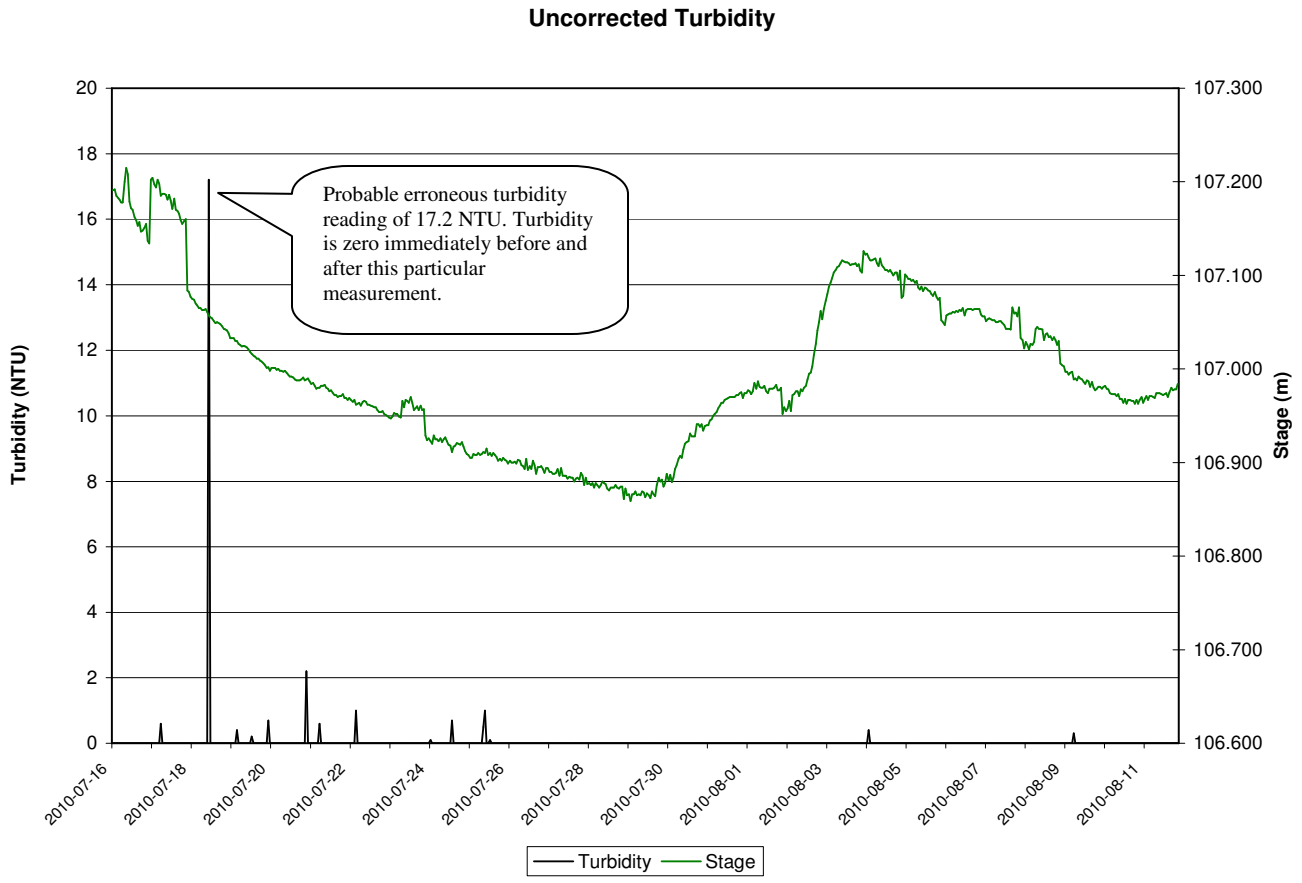
- A small correction of 0.7% was applied to the record for the saturation of dissolved oxygen. Raw and corrected data are presented in Figure 14.
- The corrected saturation of dissolved oxygen ranged from 88.5 to 102.2% for this deployment period reaching the low on August 11th at 4:30 am.
- The concentration of dissolved oxygen ranged from 8.12 to 9.44 mg/l for this deployment period with a median of 8.69 mg/l. All values fall below the CCME Guideline of 9.5 mg/l for the Protection of Early Life Stage, Cold Water Biota. Concern is likely not warranted during this time frame in summer when the early life stage biota has advanced sufficiently to a point where this concentration of oxygen is sufficient. No adverse effects on aquatic life were reported during this deployment period.

Figure 14: Dissolved Oxygen at Rattling Brook Big Pond from July 16 to August 12, 2010



- Turbidity at Rattling Brook Big Pond was found to be quite low during the whole deployment period with a few intermittent peaks above the background level of 0 NTU.
- Turbidity reached a maximum of 17.2 NTU on July 19th at 12:30am. This peak is probably erroneous since there was no notable weather conditions at this time and the 16 hours before and after this reading are recorded at 0 NTU. Such short-duration peaks are generally related to some debris hindering the turbidity sensor.

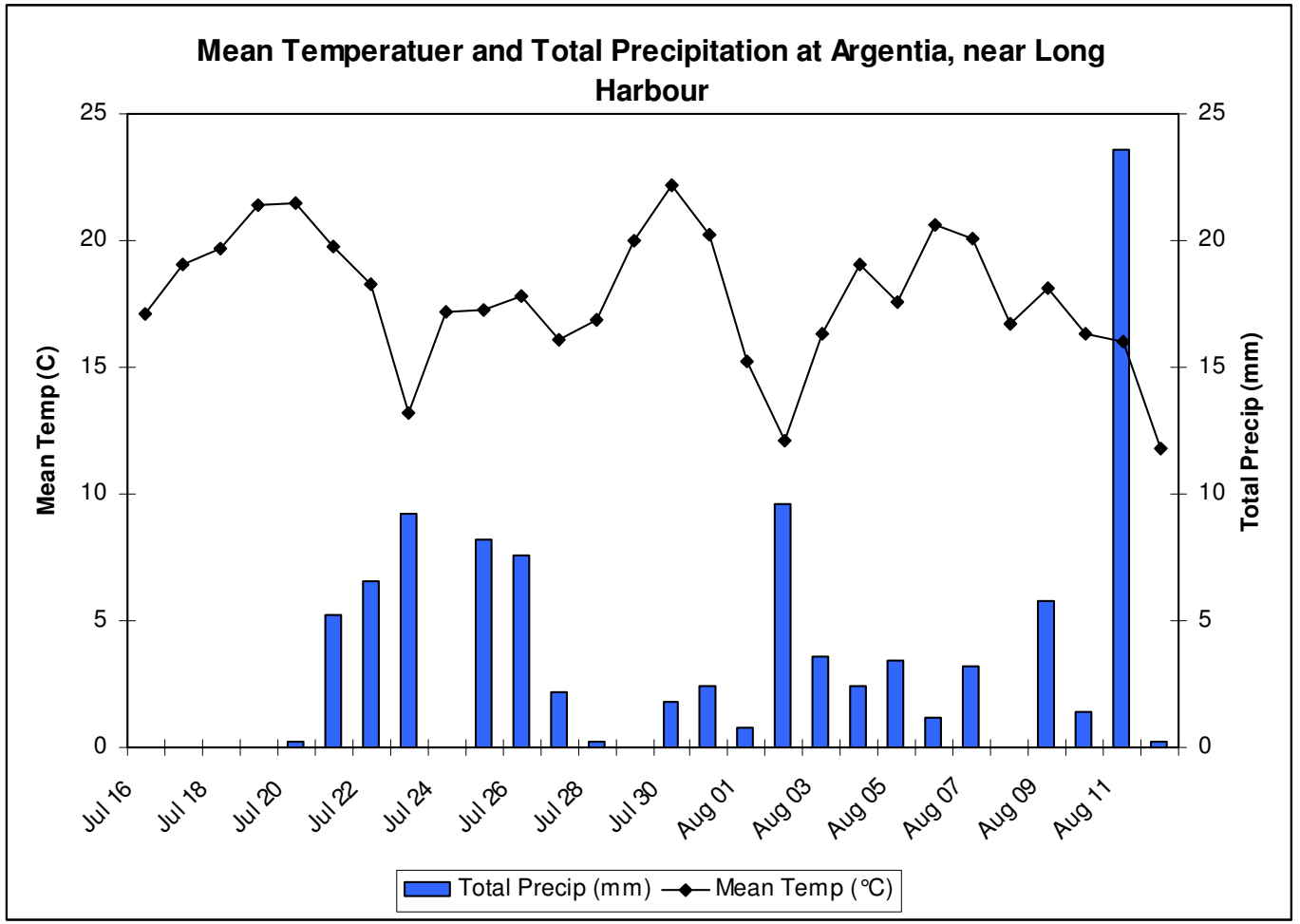
Figure 15: Turbidity at Rattling Brook Big Pond from July 16 to August 12, 2010



Conclusion

- No significant water quality events were recorded at the Rattling Brook Network for the period beginning on July 16, 2010 and ending August 12, 2010.
- A turbidity sensor malfunction required the changeout of an instrument at Rattling Brook below Bridge station on July 29th, resulting in the inability to generate correction data for this station. The original equipment will be redeployed once it is received from the manufacturer.

Appendix



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