Real-Time Water Quality Deployment Report

Rattling Brook Network

May 5th, 2010 to June 10th, 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.
- This deployment report covers the period of May 5, 2010 to June 10, 2010; a period of 35 days.

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	May 5, 2010	Deployment	Excellent	Excellent	Excellent	Marginal	Excellent
	June 10, 2010	Removal	Excellent	Excellent	Excellent	Good	Excellent
Rattling Brook below Bridge	May 5, 2010	Deployment	Good	Excellent	Excellent	Fair	Excellent
	June 10, 2010	Removal	Fair	Excellent	Excellent	Good	Good
Rattling Brook Big Pond	May 5, 2010	Deployment	Excellent	Excellent	Excellent	Fair	Excellent
	June 10, 2010	Removal	Excellent	Excellent	Excellent	Good	Excellent

- Note: Ratings for Deployment are based entirely on Field Sonde to QAQC Sonde comparison. Grab samples were not taken upon deployment on may 5th, 2010.
- Dissolved oxygen rankings may not be representative. It appears that the QAQC Sonde DO probe may be suspect.

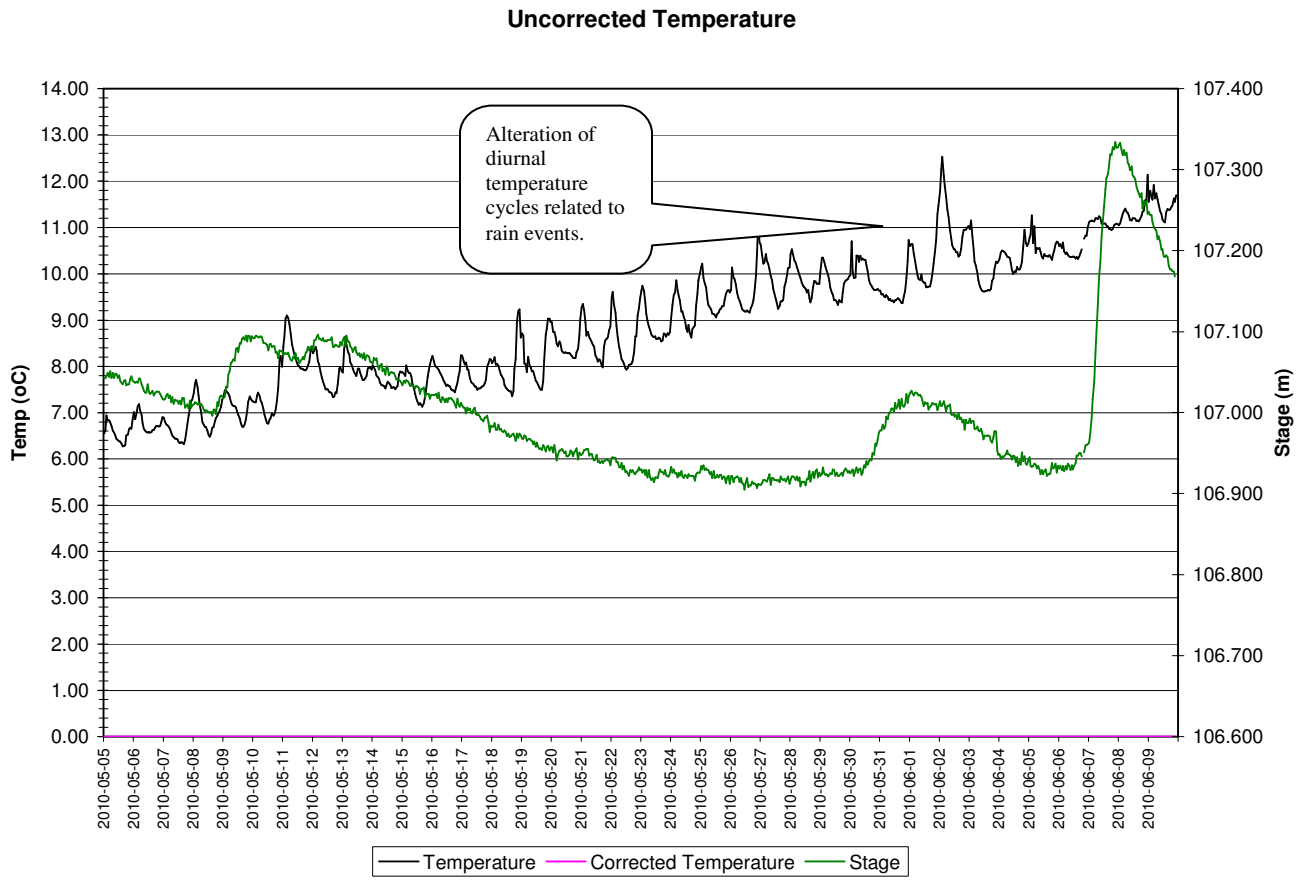
Data Interpretation

- The following Figures and discussion outlines fluctuations and events recorded by the three near real-time stations on Rattling Brook in Long harbour, Newfoundland and Labrador.

Rattling Brook Big Pond

- No correction was required for the temperature record at Big Pond during this deployment period since the Total Error did not exceed the data correction criterion.
- A steady rising trend from 6.27°C to 12.53°C is recorded during this deployment period in the expected fashion given the time of year.
- In conjunction with heavy precipitation events, a concurrent attenuation of the diurnal water temperature cycle is frequently observed. In Rattling Brook Big Pond, however, this effect is minimized due to the thermal buffering capacity of such a large body of water. An example of the attenuation in diurnal cycling is identified in Figure 1.

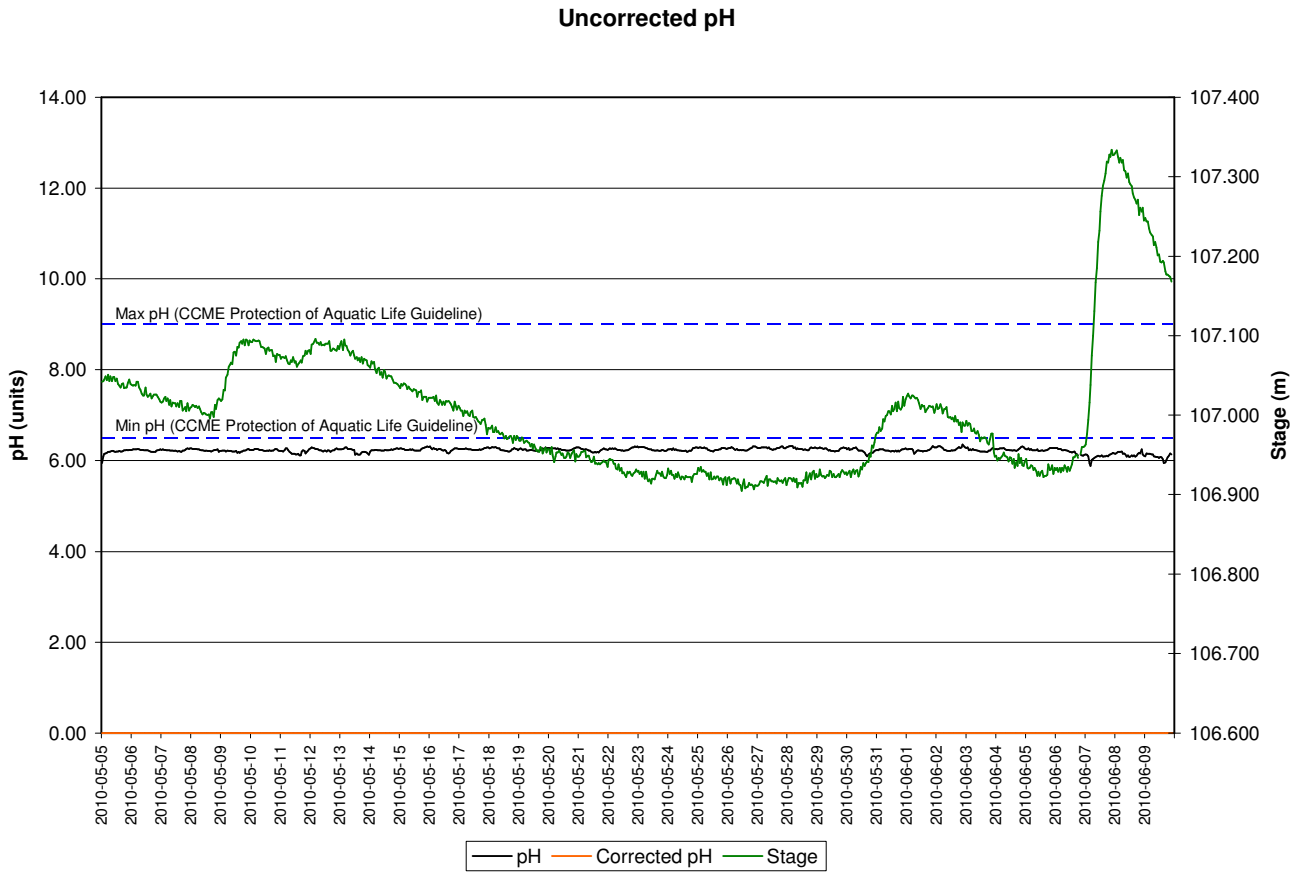
Figure 1: Water Temperature at Rattling Brook Big Pond from May 5, 2010 to June 10, 2010



- During this deployment, no correction was required to pH – the data presented is raw pH values.
- pH ranged from 5.88 to 6.35 with all values below the CCME Guideline of 6.5 for the Protection of Aquatic Life. Because Big Pond is largely undeveloped and waterbodies in this area of the province are slightly acidic, this is considered normal.

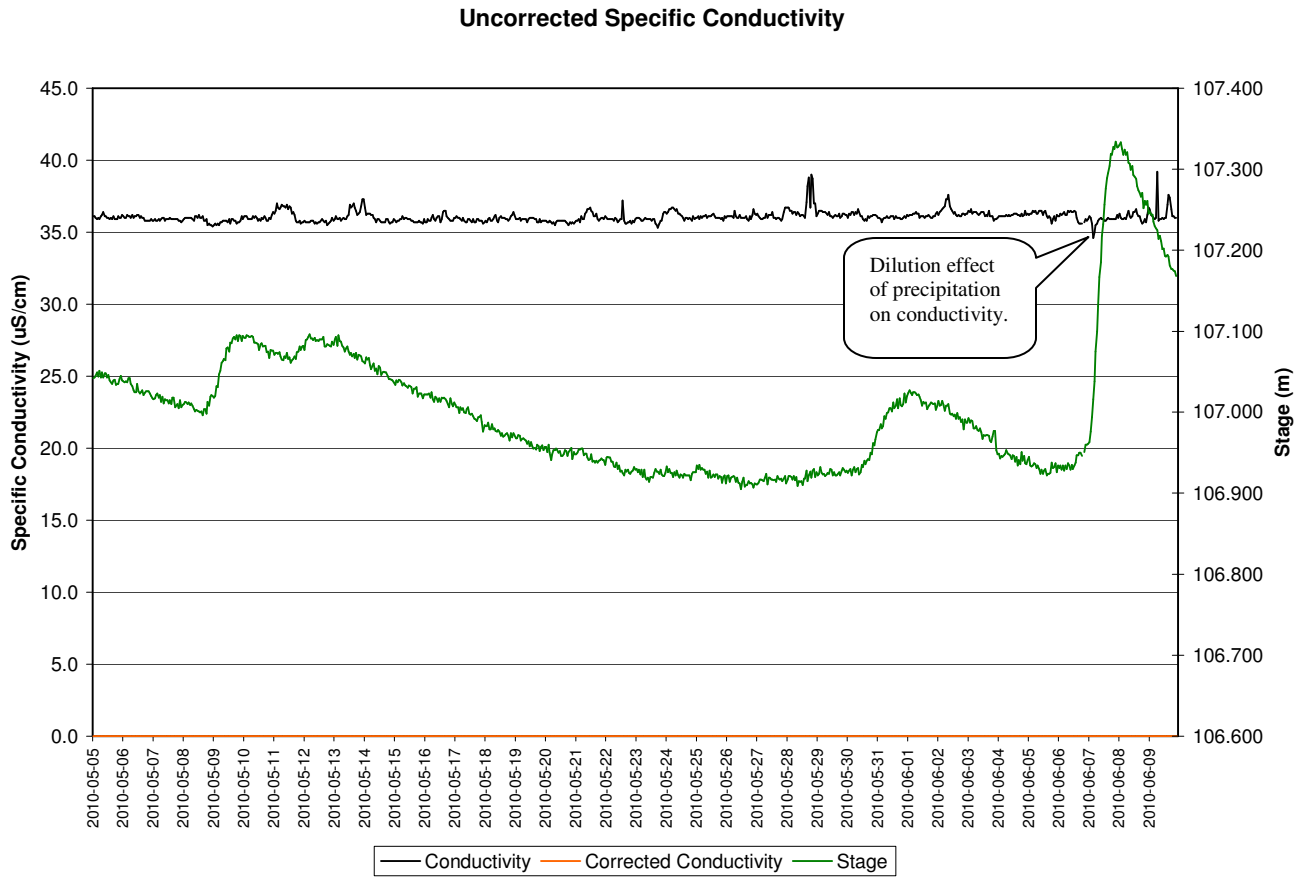
- No major fluctuations are seen in the record for pH during the deployment period.

Figure 2: pH at Rattling Brook Big Pond from May 5, 2010 to June 10, 2010



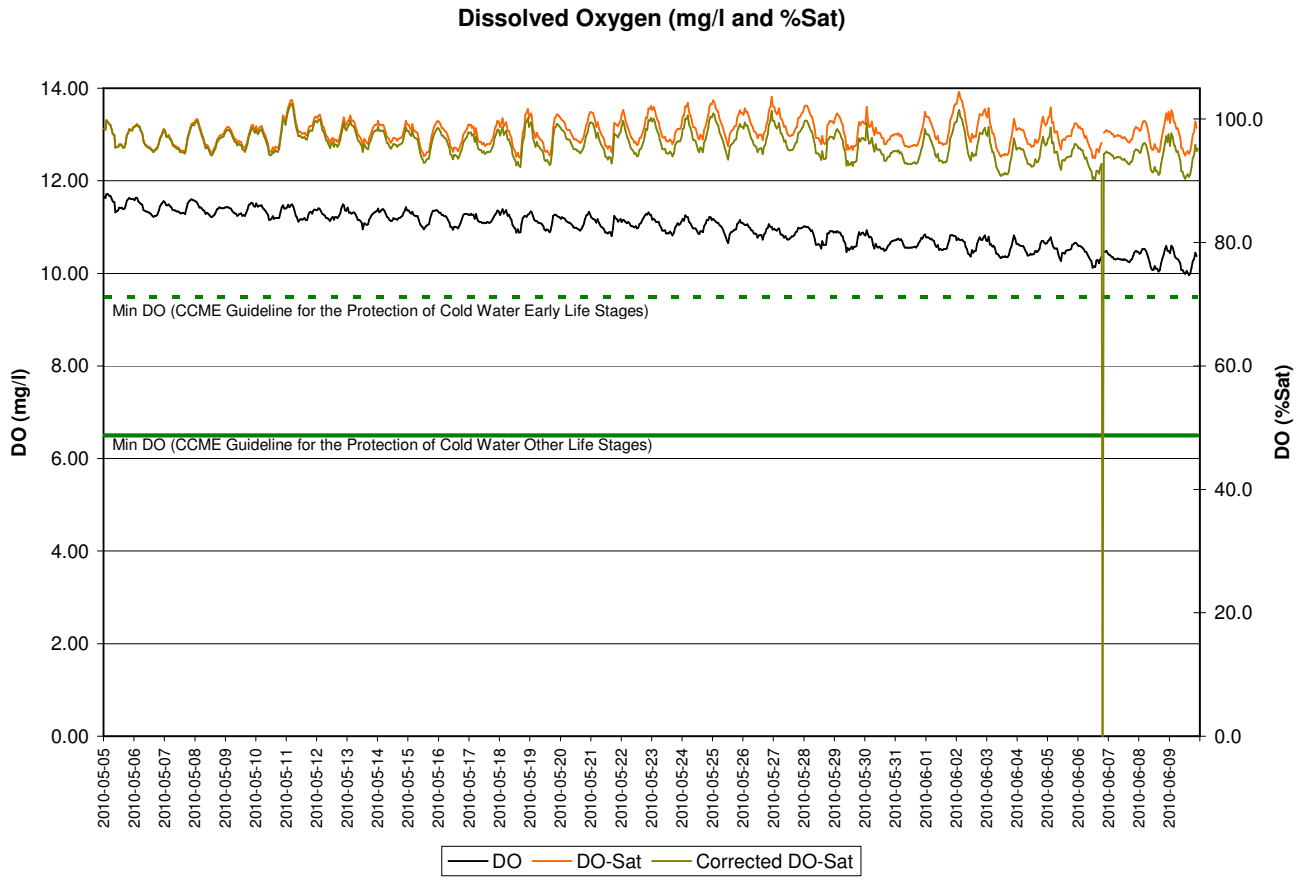
- No correction was required for Specific Conductivity for this deployment period since Total Error did not exceed the data correction criterion.
- Specific Conductivity ranged from 34.6 to 39.2 µS/cm from May 5th to June 10th with no significant fluctuations that cause concern. A slight drop and subsequent recovery in conductivity is recorded as a result of the dilution effect from heavy precipitation June 7th.

Figure 3: Specific Conductivity at Rattling Brook Big Pond from May 5, 2010 to June 10, 2010



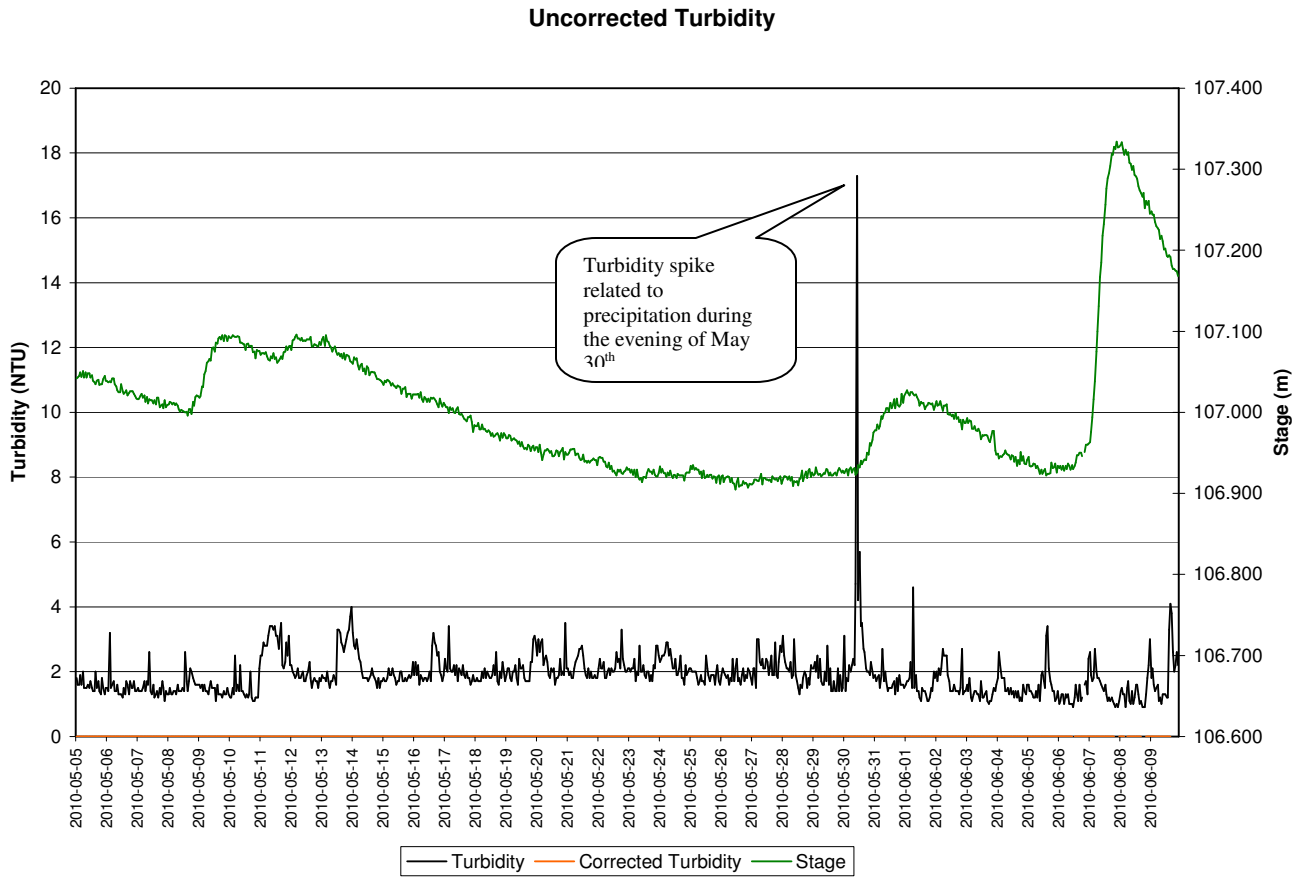
- A correction of -3.8% was applied to the record for dissolved oxygen per cent saturation.
- The saturation of dissolved oxygen ranged from 90.3 to 102.4%. Values above 100% may be associated with turbulent water conditions or photosynthetic processes from aquatic vegetation.
- A general decline in the concentration of dissolved oxygen led to a range of 11.71 to 9.96 mg/l DO. This trend is a seasonal one associated closely with the increase in water temperature. All values are above the CCME Guidelines for the Protection of Aquatic Life.

Figure 4: Dissolved Oxygen at Rattling Brook Big Pond from May 5, 2010 to June 10, 2010



- Turbidity at Rattling Brook Big Pond is presented as raw data for this deployment period.
- Turbidity at Rattling Brook Big Pond is low-grade and highly variable, ranging from 0.9 to 17.3 NTU over the deployment period. The median turbidity reading for this deployment period was 1.8 NTU.
- Following the rain event on May 30th and 31st, turbidity fell slightly for the remainder of the deployment, probably due to dilution.

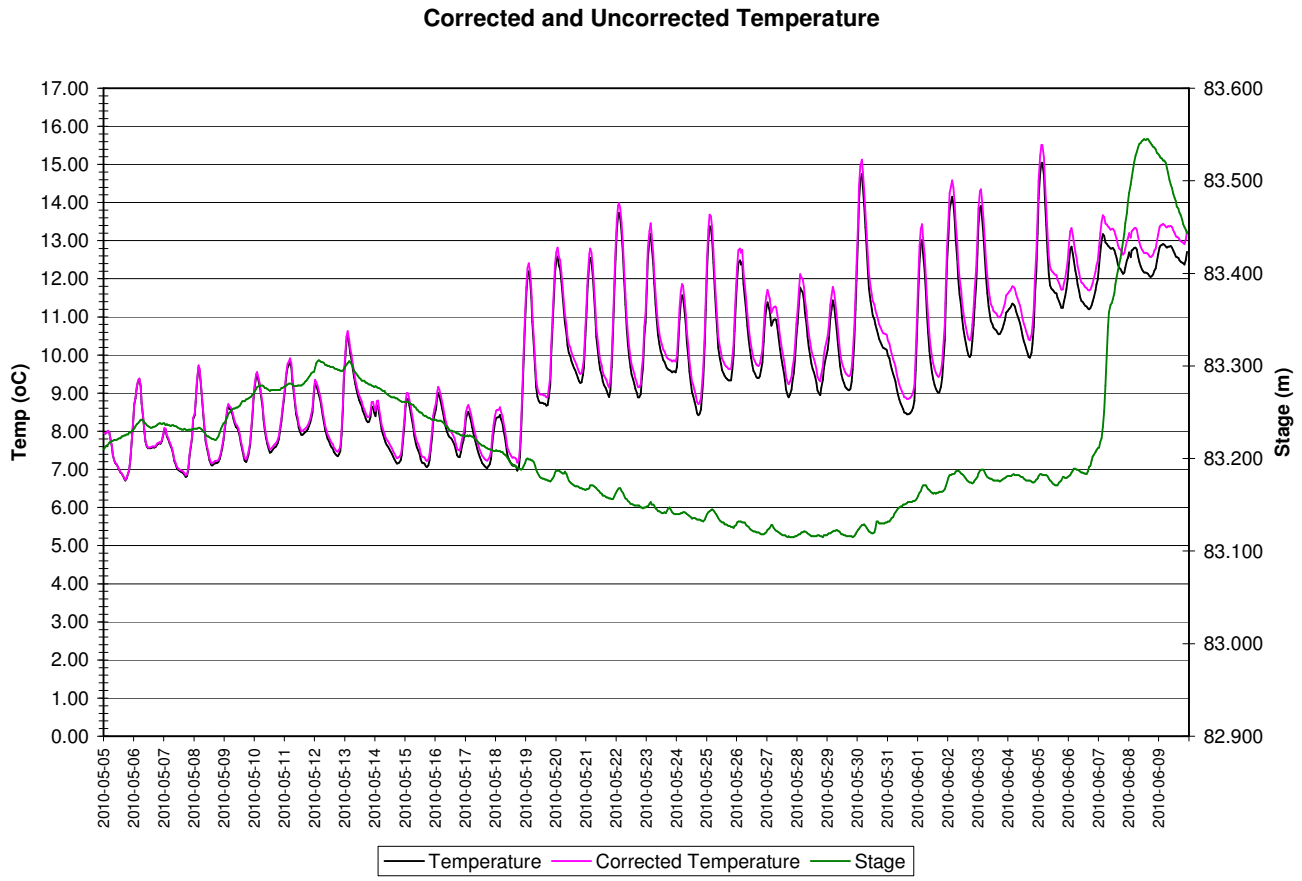
Figure 5: Turbidity at Rattling Brook Big Pond from May 5, 2010 to June 10, 2010



Rattling Brook below Bridge

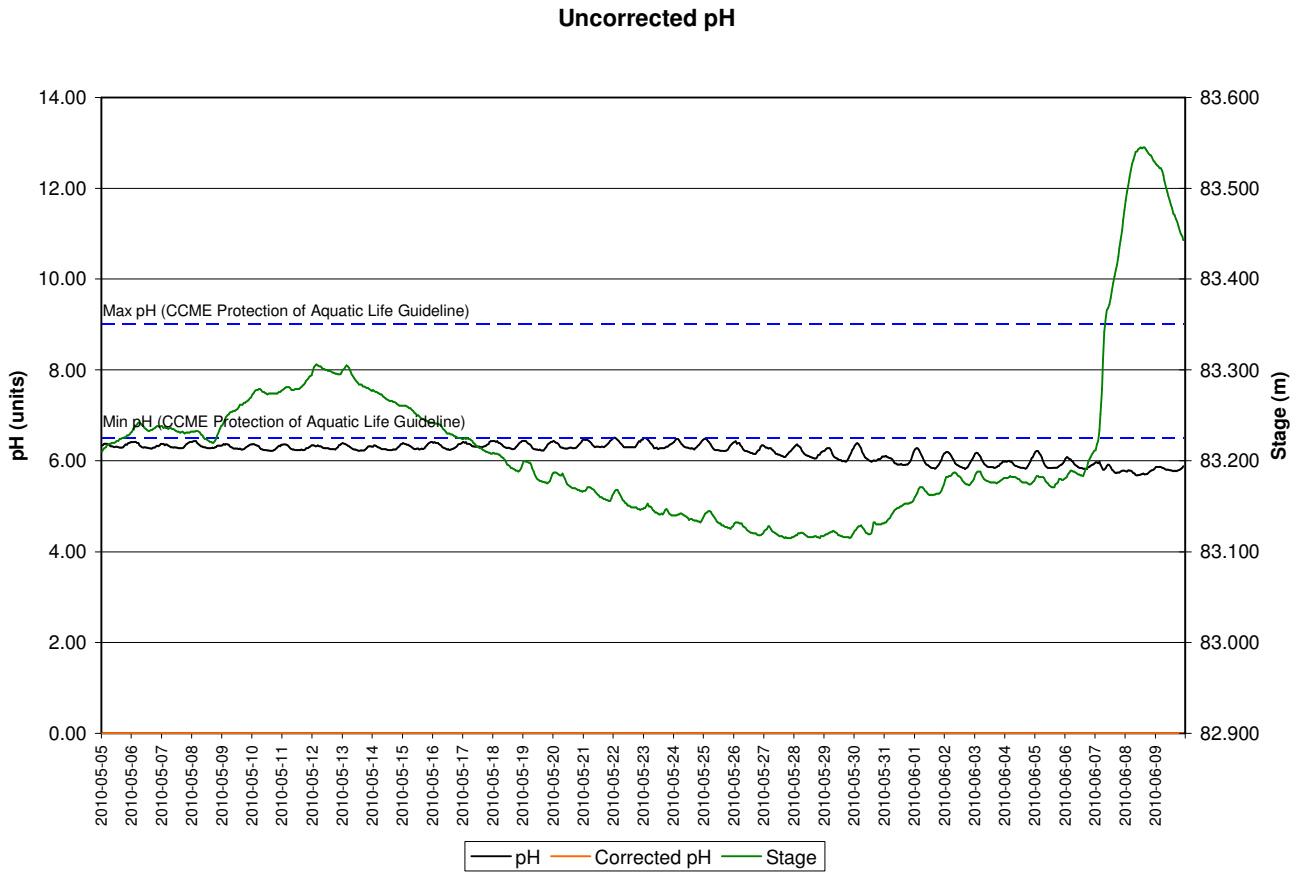
- A correction of 0.54°C was added to the record for temperature based on biofouling error. Raw and corrected data is presented for comparison.
- Temperature at Rattling Brook below Bridge ranged from 6.72 to 15.52°C and presented an obvious increasing trend as expected for the spring season. The upper range in temperature at below Bridge is much higher than that of Rattling Brook Big Pond due to the heat capacity of such a large body of water upstream. Rattling Brook proper flows over shallow riffles and pools and presents a water body easier to warm with greater surface area to volume ratio.

Figure 6: Water Temperature at Rattling Brook below Bridge from May 5, 2010 to June 10, 2010



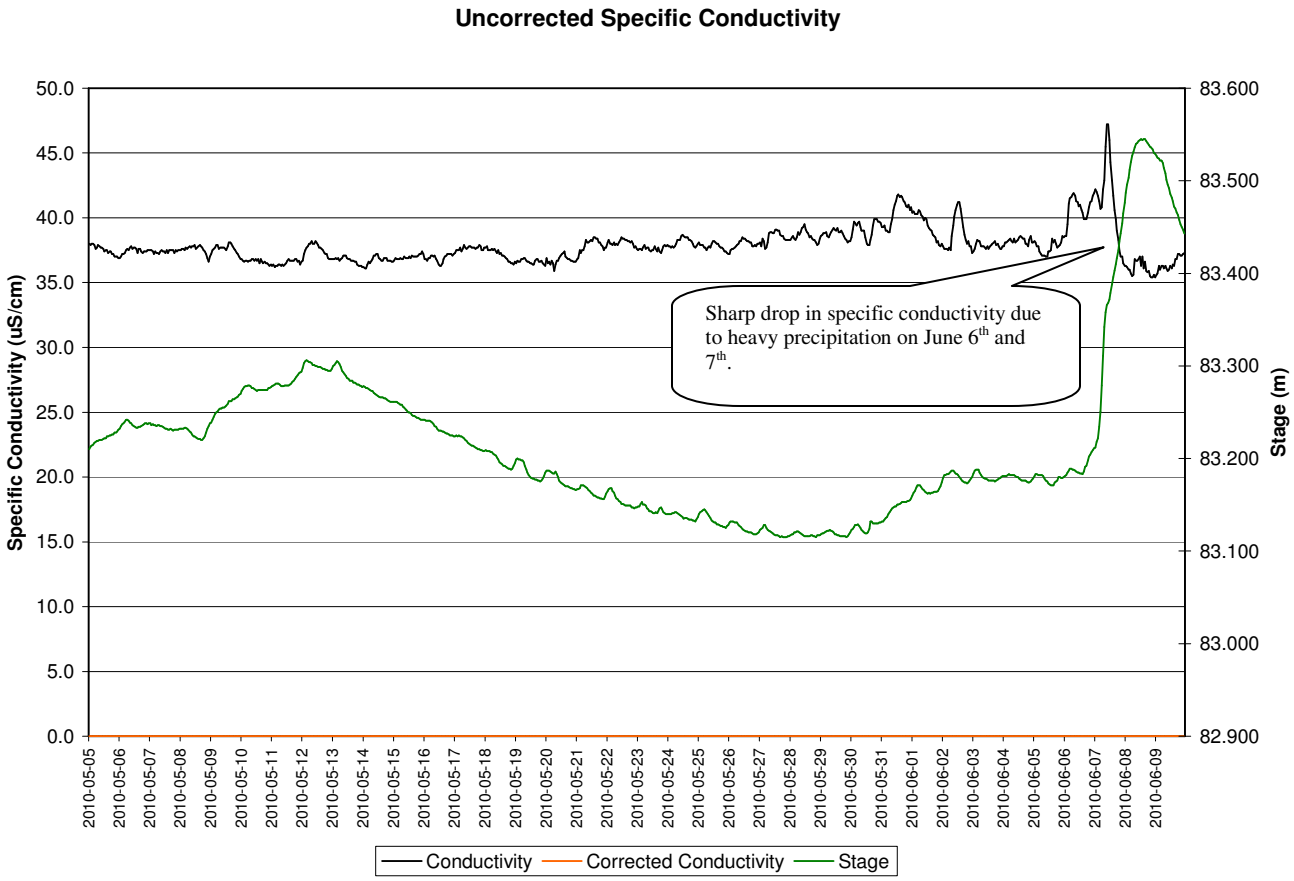
- No correction was required for pH during this deployment period. The data presented are raw pH values.
- pH ranged from 5.68 to 6.51 for this deployment period and showed a slight declining trend towards the end of the deployment.
- Only four values were found to be within the CCME Guidelines for the Protection of Aquatic Life for this deployment period. This is as expected, however, for this stream system. No major fluctuations in values were recorded.

Figure 7: pH at Rattling Brook below Bridge from May 5, 2010 to June 10, 2010



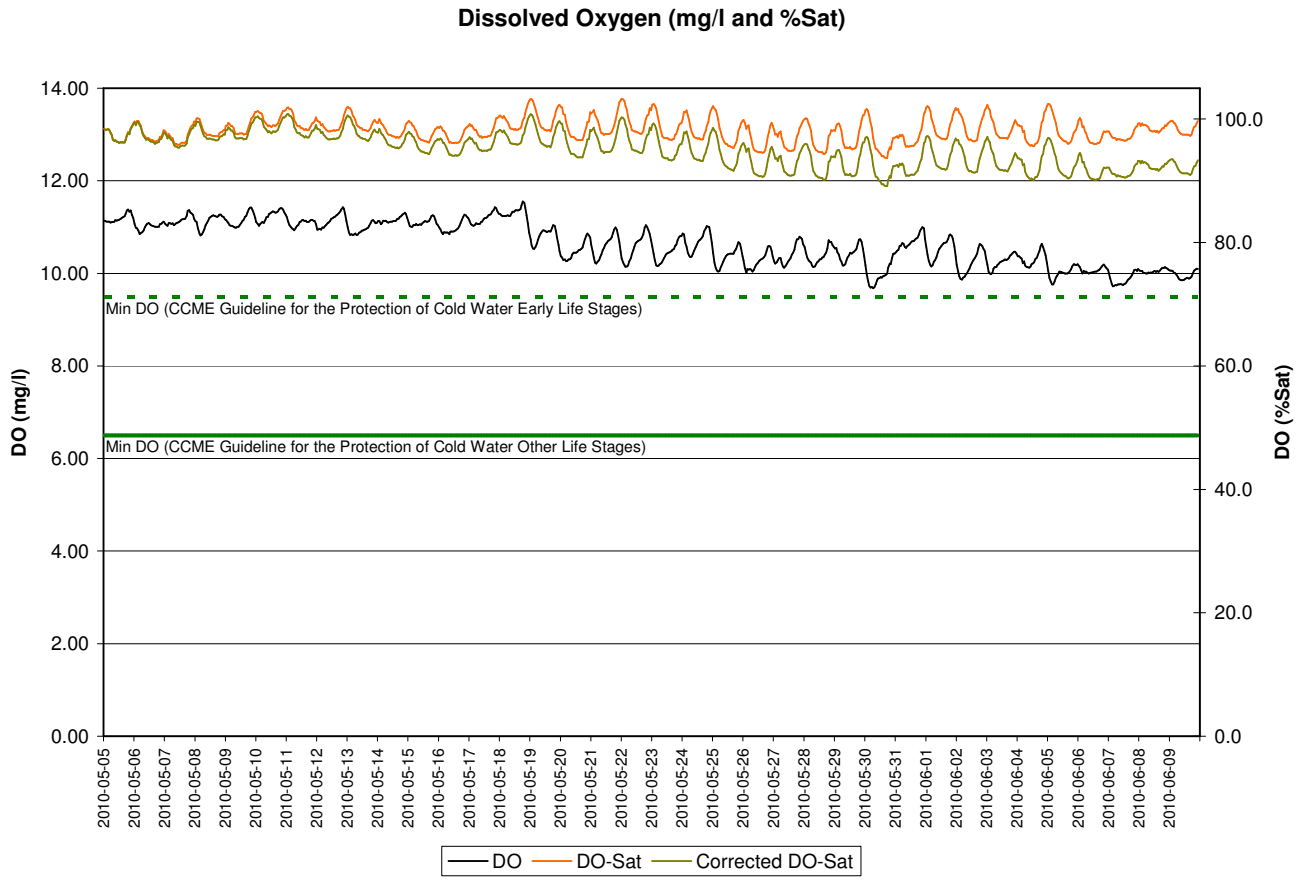
- No correction was required for specific conductivity for this deployment; the data presented are raw values.
- Specific conductivity was largely stable during this deployment period and ranged from 35.4 to 47.2 µS/cm. As stage level declines through mid-deployment, conductivity increases and then levels off between May 1st and June 6th after a series of moderately rainy days. A sharp decline on June 6th is associated with heavy precipitation of ~55 mm over 48 hours.

Figure 8: Specific Conductivity at Rattling Brook below Bridge from May 5, 2010 to June 10, 2010



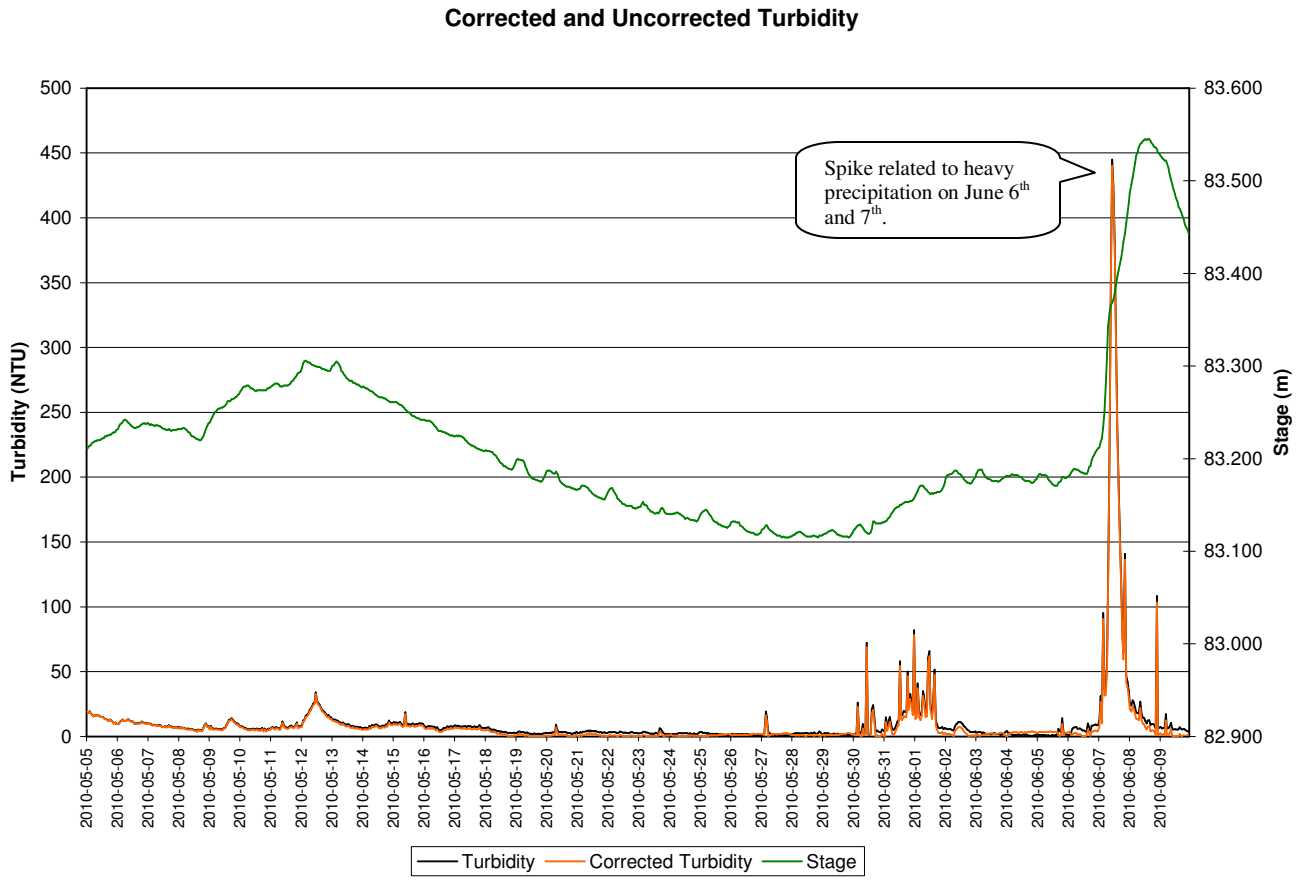
- A correction of -6.4% was applied to the record for %-saturation of dissolved oxygen.
- Oxygen saturation at Rattling Brook below Bridge ranged from 89.1 to 100.8% during this deployment period while the concentration ranged from 11.55 to 9.68 mg/l in a notable downward trend. Such a trend is closely associated with the increase in water temperature over the same duration.

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from May 5, 2010 to June 10, 2010



- A correction of -5.1 NTU was added to the turbidity record at below Bridge station for this deployment period.
- The range of turbidity from May 5th to June 10th was 0.0 to 440.3 NTU (median = 3.6 NTU). Most values were found to be relatively low and tended to peak during precipitation when increased flow from surrounding areas is expected.
- The deployment peak indicated on Figure 10 is related to heavy precipitation on June 6th and 7th and corresponds to the peak in Stage level.

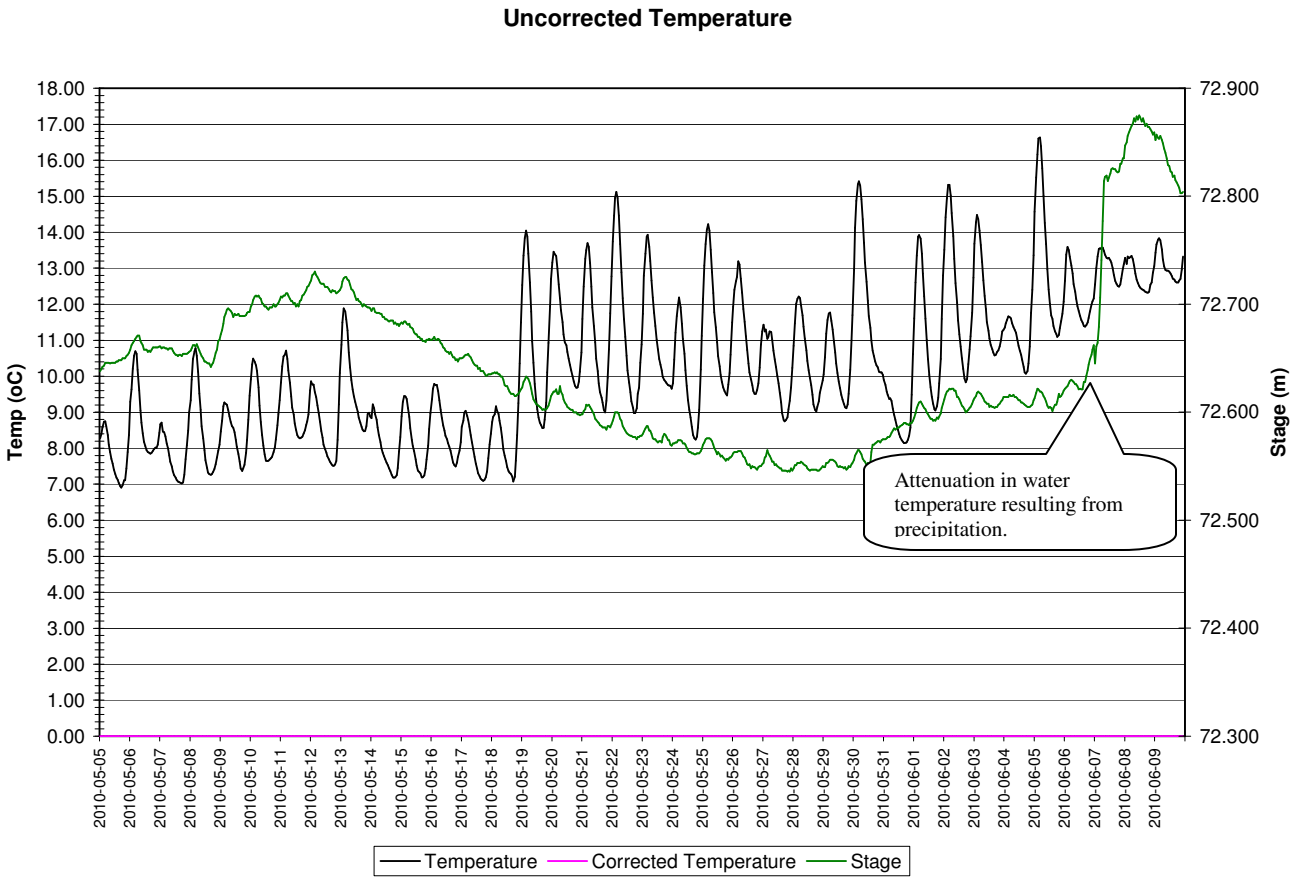
Figure 10: Turbidity at Rattling Brook below Bridge from May 5, 2010 to June 10, 2010



Rattling Brook below Plant Discharge

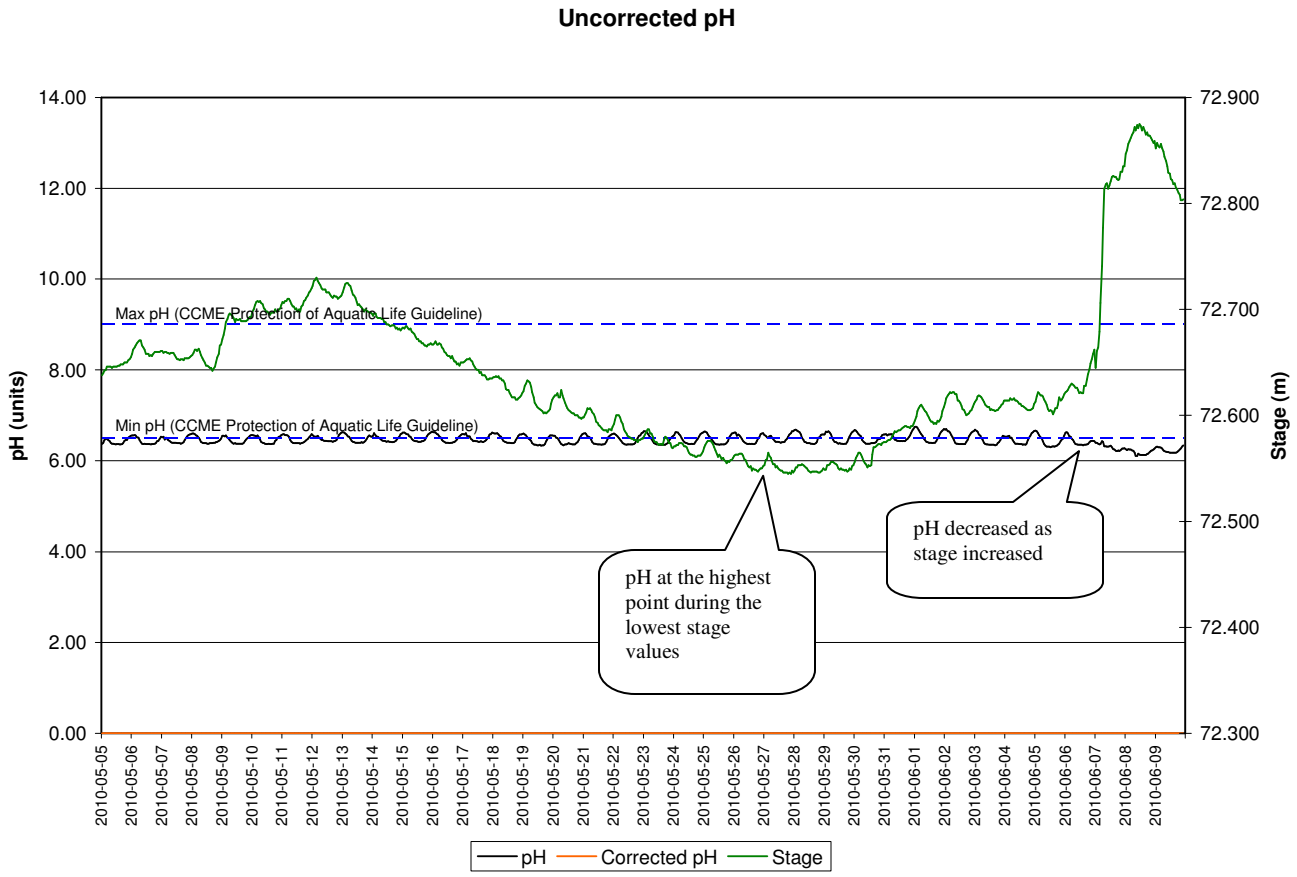
- No correction was required for the record of temperature for this deployment period and the raw data is presented.
- A range of 6.90 to 16.63°C was recorded in water temperature, showing a significant upward trend as expected for spring time. Slightly larger daily cycles than those recorded at Bridge station are prominent at Plant Discharge station. As water flows from Bridge to Plant Discharge station, the stream profile changes such that water lower in the river system is more prone to atmospheric interaction and temperature variation.

Figure 11: Water Temperature at Rattling Brook below Plant Discharge from May 5, 2010 to June 10, 2010



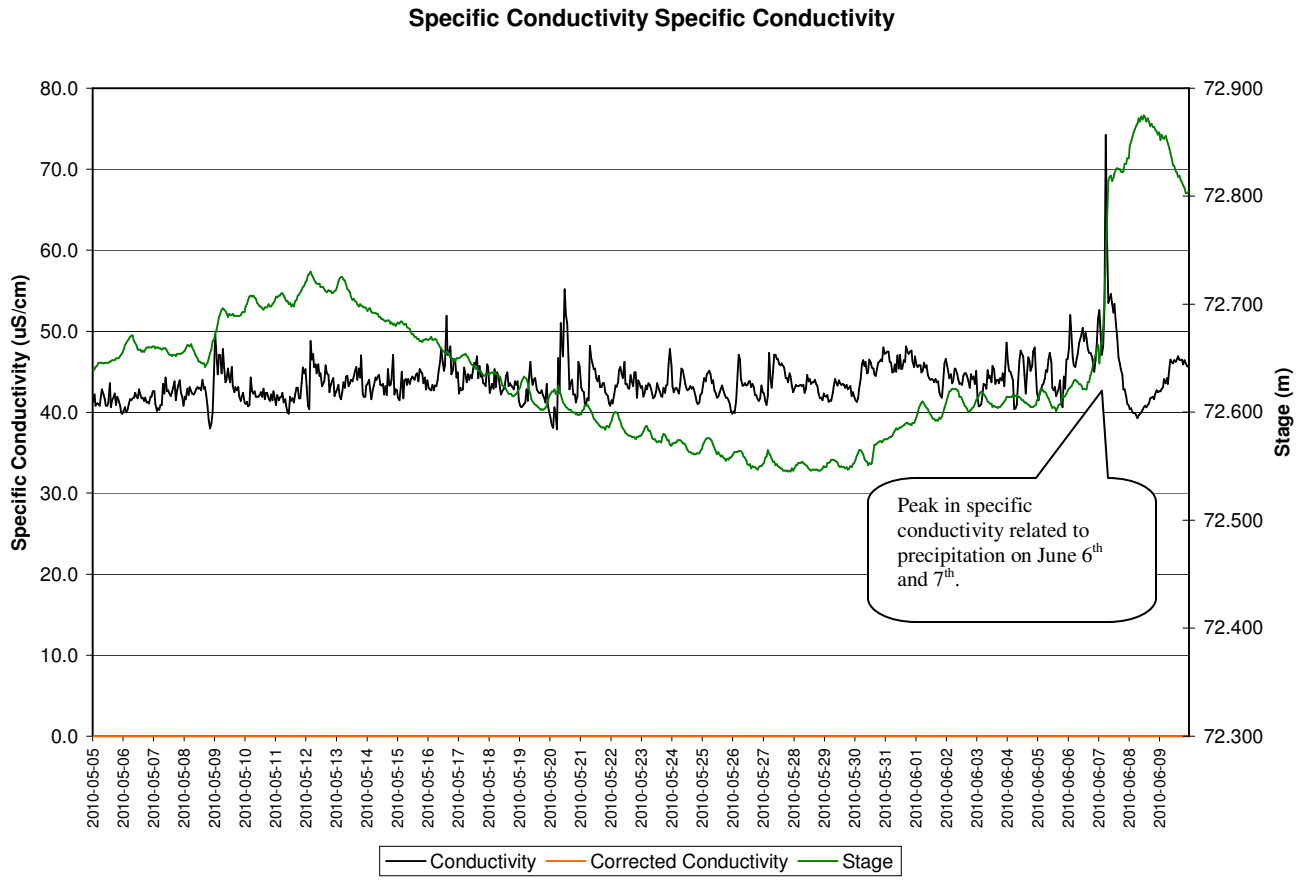
- No correction was applied to pH for this deployment and the data presented below are raw pH values.
- pH ranged from 6.11 to 6.75 with a median (6.44) just below the CCME Guideline for the protection of aquatic life. Examination of Figure 12 shows that the daily maximums are frequently above 6.5 but fall below in the evening and overnight.
- Slightly acidic values are expected for this region of the province and no concern is warranted.

Figure 12: pH at Rattling Brook below Plant Discharge from May 5, 2010 to June 10, 2010



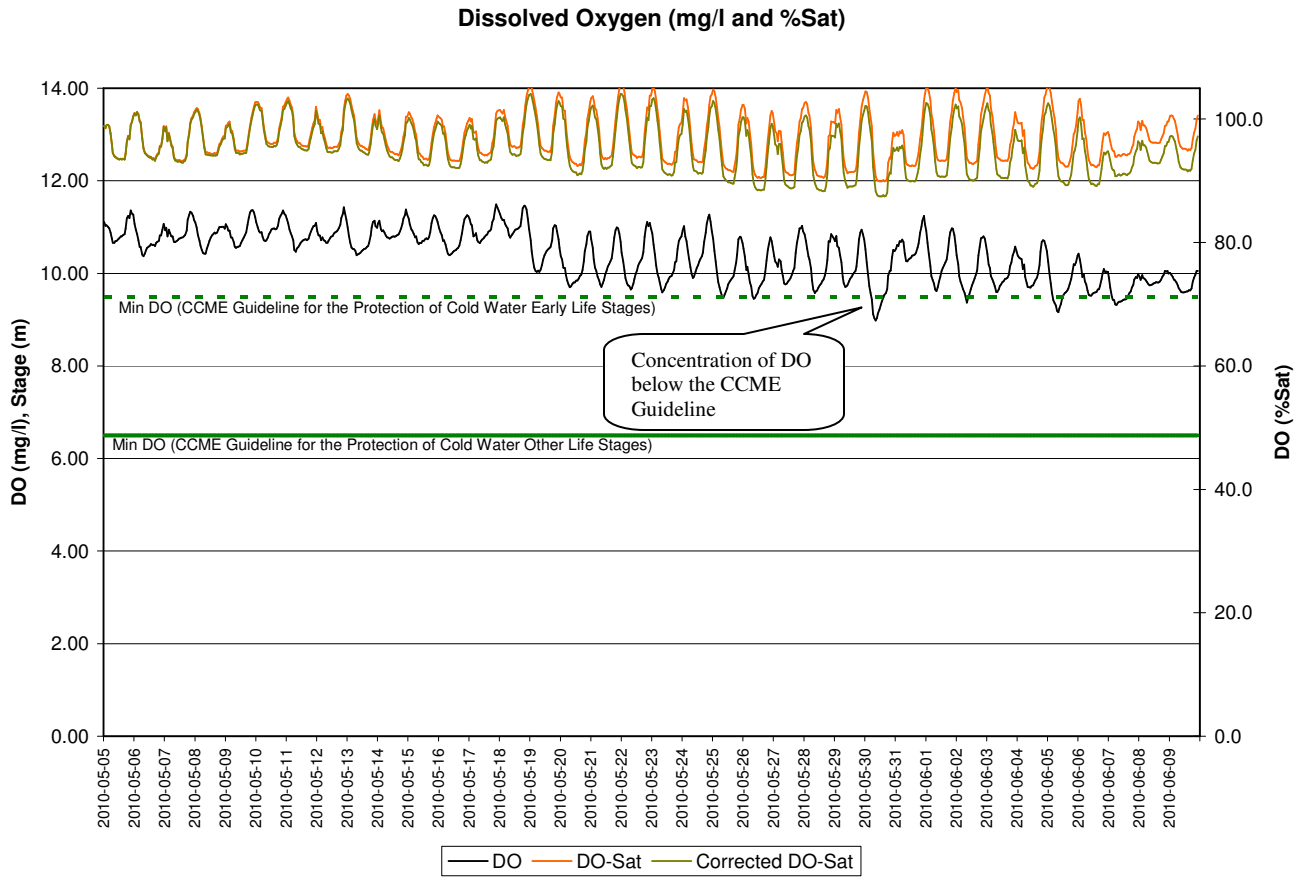
- A correction was not applied to Specific Conductivity for this deployment as the data correction criterion was not exceeded.
- A slight increase in conductivity is seen throughout the 35 day deployment period and ranged from 37.9 to 74.2 µS/cm. The deployment peak was reached on the evening of June 7th following heavy precipitation.

Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from May 5, 2010 to June 10, 2010



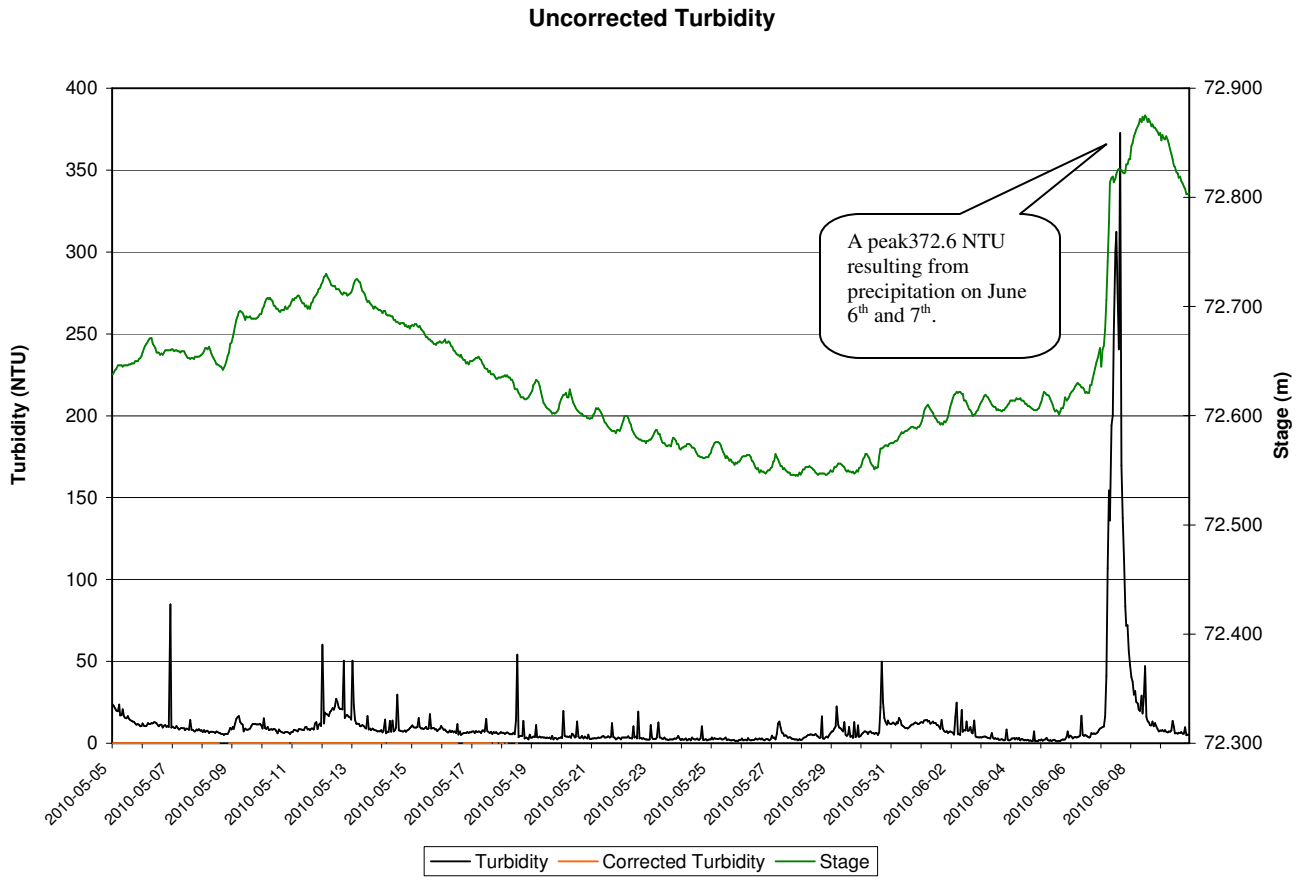
- Saturation of dissolved oxygen was corrected with a factor of -3.40% in this report. Figure 14 presents the raw and corrected saturation values.
- Saturation ranged from 87.5 to 104.1%. Values less than 100% are likely related to biological consumption of oxygen. Saturation is lowest at night when oxygen use through respiration by plants and animals exceeds that produced by photosynthesis. Conversely, photosynthesis produces a surplus of oxygen in the daytime resulting in higher values of saturation.
- The concentration of dissolved oxygen ranged from 8.98 to 11.49 mg/l with a few instances of DO values below the CCME Guidelines for the Protection of Aquatic Life (Early Life Stages, Cold Water Biota). This guideline is based on the most sensitive organism assumed to be resident within the water body in its most sensitive life stage. This situation will be monitored closely.

Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from May 5, 2010 to June 10, 2010



- A correction was not applied to the turbidity record for this deployment period and the data presented in Figure 15 are raw values.
- Values from 1.1 to 372.6 NTU (median = 6.9 NTU) were recorded during this deployment period. No trend is immediately identified in turbidity, up or down. Peaks outlined in Figure 15 appear to result from rain events.

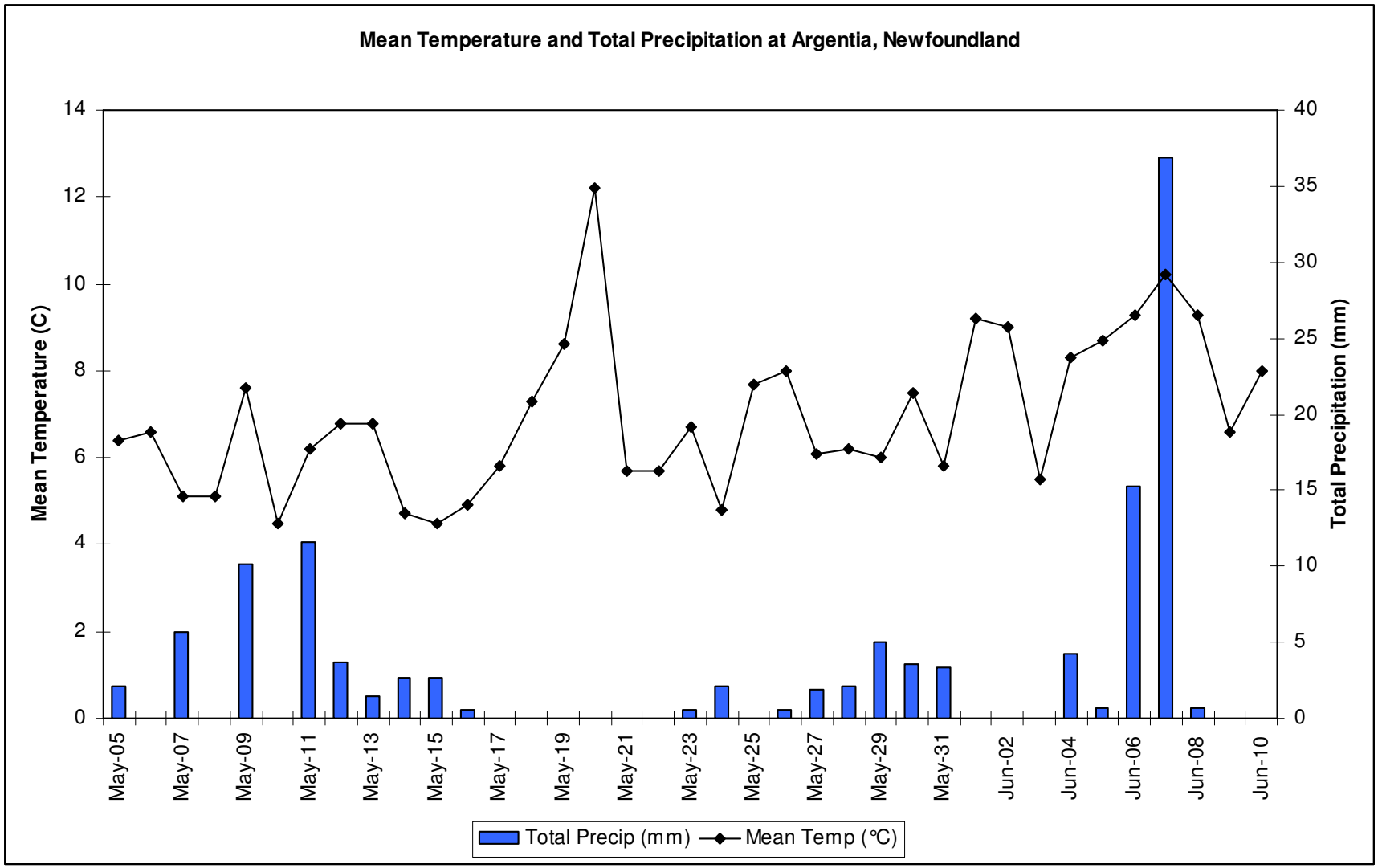
Figure 15: Turbidity at Rattling Brook below Plant Discharge from May 5, 2010 to June 10, 2010



Conclusions

- During the change to a new analytical laboratory, the QAQC grab sampling procedure was put on hiatus. Because of this, the QAQC rankings for deployment on May 5th were based solely on Field Sonde – QAQC Sonde comparisons. The protocol will resume in the near future.
- Occasional instances of DO mg/l dropping below the CCME Guideline for the Protection of Early Life Stage Cold Water Biota have been recorded. This will be monitored closely in the future.

Appendix



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