

**Real Time Water Quality Report  
Duck Pond Operations  
(Teck Cominco Limited)  
Deployment Period 2008-10-16 to 2008-11-12**

**General**

- Water Resources Management Division (WRMD) staff monitors the real-time web page on a daily basis. Any unusual observations are investigated, with site visits being carried out as warranted.
- Management at Duck Pond Operations are informed of any significant water quality events or instrumentation problems by WRMD.
- Tributary to Gills Pond Brook Station is located 1700 m downstream of the final discharge point for the mine's Polishing Pond. This station is located such that any impacts from the mine discharge on receiving waters can be measured.
- East Pond Brook Station is located several kilometres downstream of the Tailings Management Area. This station is located such that any surface water impacts from the Tailing Management Area via seepage through Dam A may be measured.
- Monitoring Well After Tailings Dam Station is located near Tailings Dam A. This station is located such that any ground water impacts from the Tailing Management Area via seepage through Dam A may be measured.
- The two DataSondes (Tributary to Gills Pond Brook Station and East Pond Brook Station) are set up to measure Ammonium and Nitrate however, technical problems with the instrumentation render readings of these parameters unreliable. Therefore, these parameters will not be discussed or interpreted until the technical problems have been overcome and the data are reliable.
- Many of the graphs below show vertical lines from the data string to zero or the bottom of the graph. These lines indicate when a probe was off-line or removed from service.
- There was effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) throughout the deployment period.
- Raw (uncorrected) data has been used in the preparation of the graphs and subsequent discussion below.

**Maintenance and Calibration of Instrumentation**

- The regular DataSondes were deployed in Tributary to Gills Pond Brook and East Pond Brook on October 16, 2008, after being cleaned, serviced and freshly calibrated. Both instruments were deployed until November 12, 2008 (27 day period).
- The Quanta G probe remained deployed in Monitoring Well After Tailings Dam Station (MW1) since September 17, 2008, as this probe is intended for long term deployment.
- *In-situ* measurements of ambient water quality were undertaken with a freshly calibrated MiniSonde each time a DataSonde was installed or removed. No *in situ* measurements can be taken in the Monitoring Well.
- The comparative results between the MiniSonde and DataSonde values at the beginning and end of the deployment period are shown in **Table 1** for Tributary to Gill's Pond Brook and **Table 2** for East Pond Brook.

**Table 1: QA/QC Data Comparison Ranking During Deployment Period**

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Tributary to Gill's Pond Brook	2008-10-16	Installation	Good	Excellent	Excellent	Fair
	2008-11-02	Removal	Excellent	Good	Excellent	Good

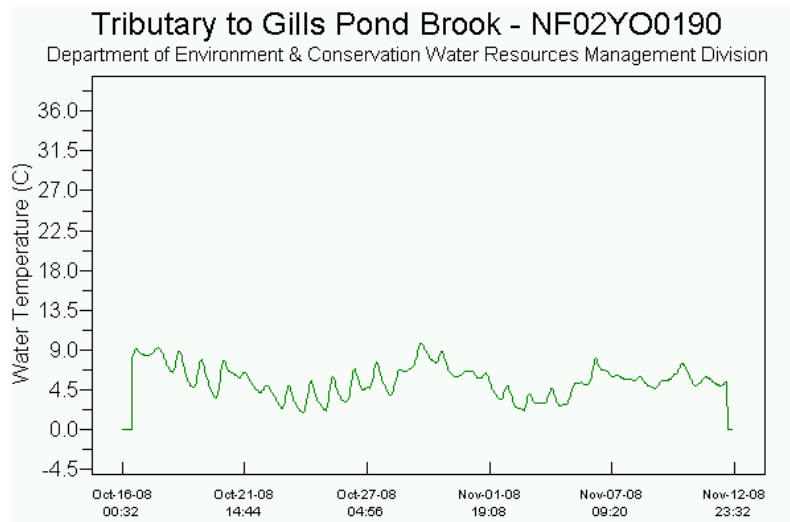
**Table 2: QA/QC Data Comparison Ranking During Deployment Period**

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
East Pond Brook	2008-10-16	Installation	Excellent	Excellent	Excellent	Excellent
	2008-11-02	Removal	Excellent	Good	Excellent	Excellent

## Data Interpretation

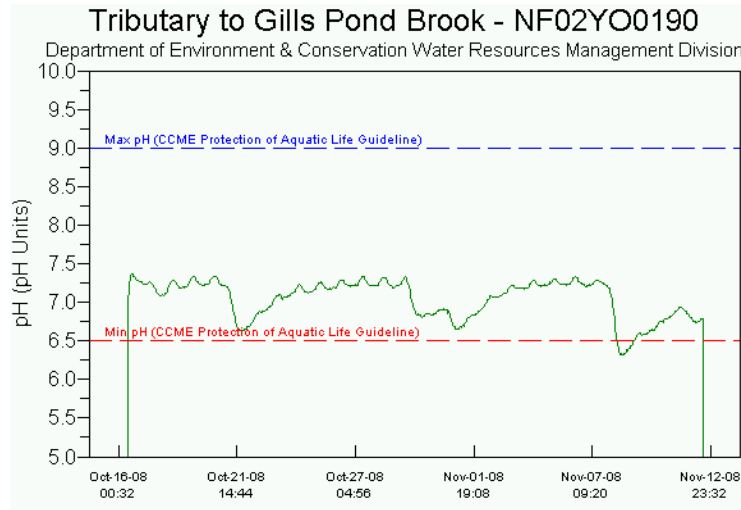
### TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of 1.94 °C to 9.73 °C over the deployment period with an obvious diurnal pattern.



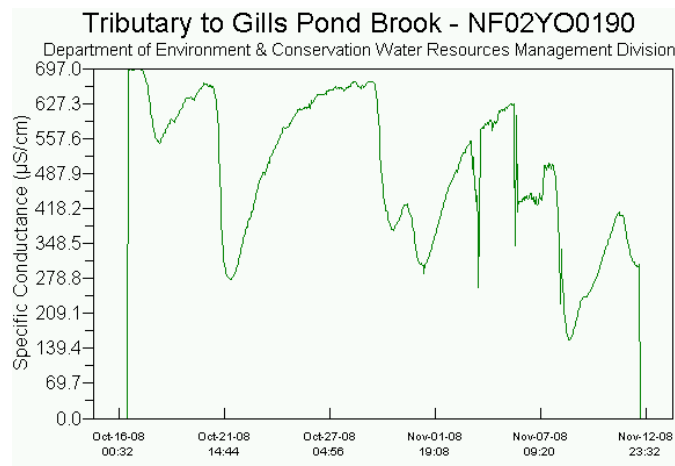
**Figure 1**

- pH values (**Figure 2**) remained fairly constant throughout the deployment period. The pH values ranged from a minimum of 6.32 to a maximum of 7.36 with most of the values falling within the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. The background pH of this stream is normally around the lower limit of the recommended range. Three dips in the pH correspond with increases in stream stage (**Figure 7**), which were the result of precipitation events.



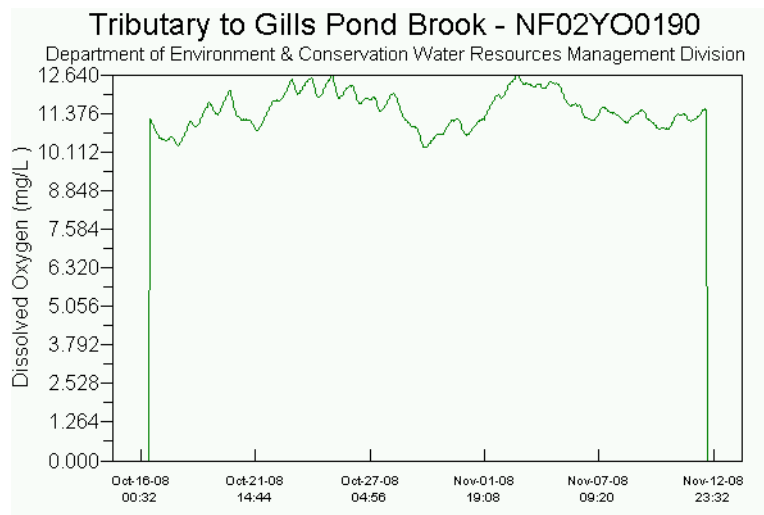
**Figure 2**

- The specific conductance (**Figure 3**) ranged from a minimum of 156.3  $\mu\text{S}/\text{cm}$  to a maximum of 697  $\mu\text{S}/\text{cm}$  over the deployment period. The bigger dips in conductivity correspond to increased stage and decreased pH, the result of precipitation. This highlights the fact that effluent from the Polishing Pond has a higher specific conductance than the runoff from precipitation.



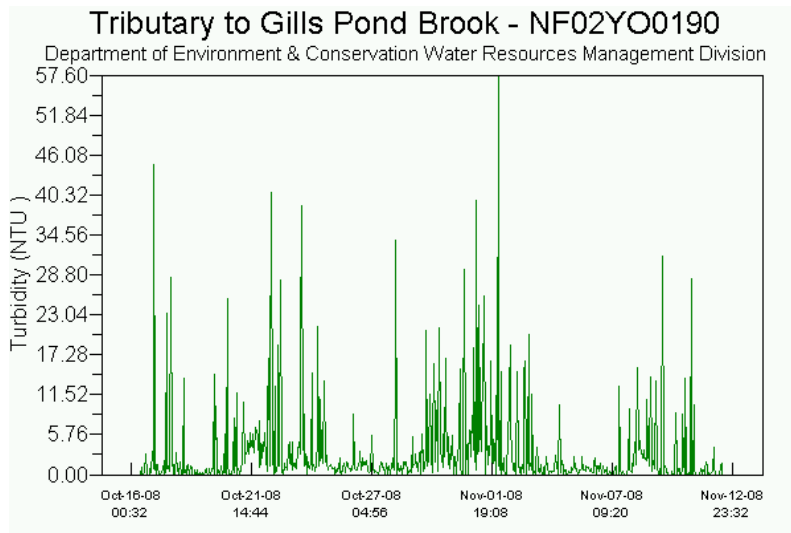
**Figure 3**

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 10.26 mg/L to a maximum of 12.64 mg/L over the deployment period. Dissolved oxygen variation is inversely proportional to water temperature. All dissolved oxygen values fall within the recommended CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L) now that water temperatures have cooled.



**Figure 4**

- The turbidity values (**Figure 5**) ranged from a minimum of 0.0 NTU to a maximum of 57.6 NTU over the deployment period. Turbidity values from grab samples and *in situ* measurements collected by staff of Department of Environment and Conservation and Duck Pond Mine returned results less than 1.5 NTU.
- Turbidity at this location was investigated thoroughly on October 16, 2008. Through more than 100 separate *in situ* measurements, it has been documented that turbidity values recorded higher in mid stream, in the deepest part of the pool where the DataSonde is usually deployed. Shallower parts of the pool, the edges of the stream, and downstream of the pool have little or no turbidity values recorded. It was observed that the deepest part of the pool has a higher water velocity and more turbulent flow, thus considerable air entrainment. See Figure 6. It has been confirmed with the equipment vendor, that air entrainment may result in false-positive turbidity values. Accordingly, the on-line real time turbidity graph for this station now contains the following comment “*Turbidity values may be exaggerated due to air entrainment (turbulent flow)*”.
- Subsequent deployments will endeavour to locate the DataSonde such that it is least impacted by the turbulent flow. However, in order to keep it submerged in the low flow periods, and keep it from freezing during winter deployment, it will have to be deployed in the deepest part of the pool, where it will undoubtedly continue to record artificially elevated turbidity values.
- Other options to minimize interference with turbidity will continue to be investigated.

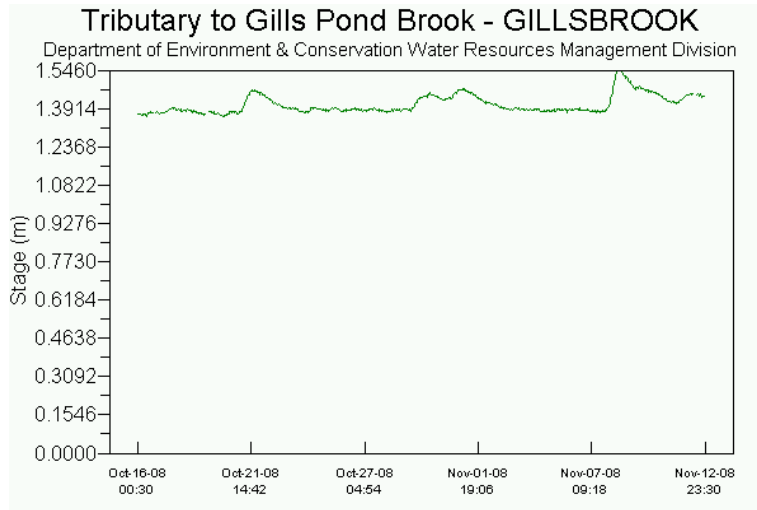


**Figure 5**



**Figure 6**

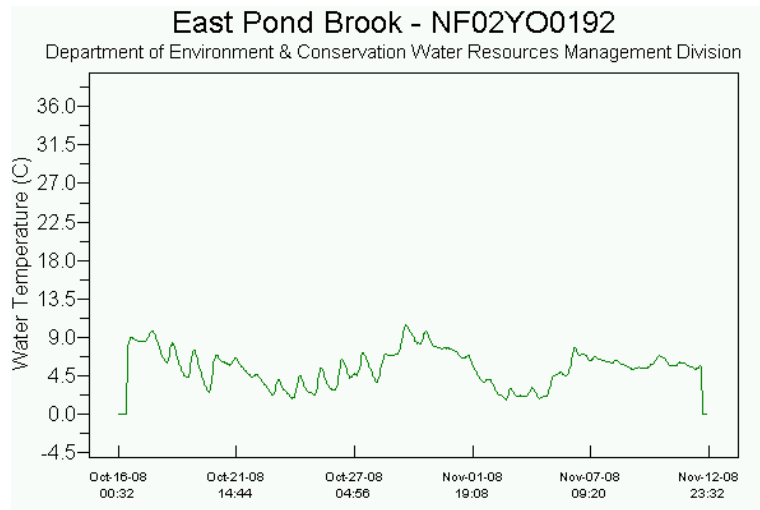
- The stage (**Figure 7**) or water level ranged from a minimum of 1.36 m to a maximum of 1.55 m over the deployment period. As discharge from Polishing Pond was constant over the deployment period, the peaks in stage correspond to precipitation events. A similar pattern is obvious from East Pond Brook stage data as well (**Figure 13**).



**Figure 7**

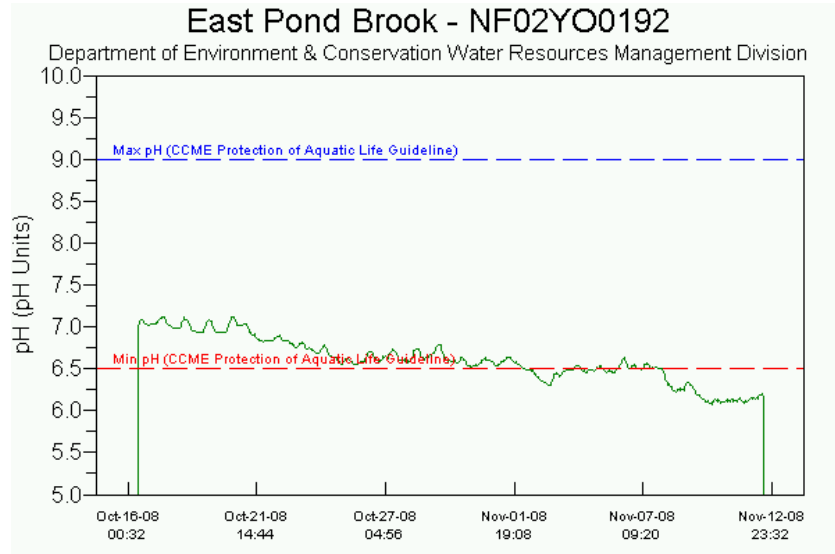
### **EAST POND BROOK**

- The water temperature (**Figure 8**) ranged from a minimum of 1.66 °C to a maximum of 10.40 °C over the deployment period, with an obvious diurnal pattern.



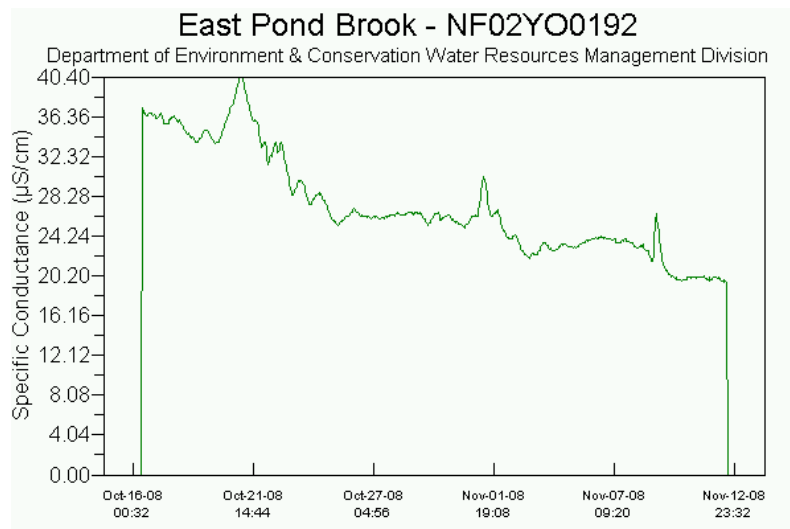
**Figure 8**

- pH values (**Figure 9**) decreased over the deployment period, ranging between 6.07 and 7.02. As the deployment period progressed, pH values fell below the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. The background pH of this stream is normally quite low, with this profile being typical.



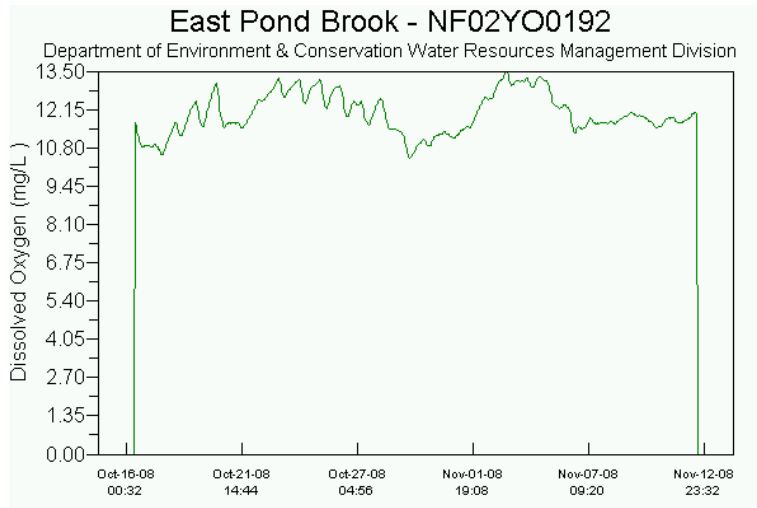
**Figure 9**

- The specific conductance (**Figure 10**) decreased over the deployment period, ranging from a minimum of 19.4  $\mu\text{S}/\text{cm}$  to a maximum of 40.4  $\mu\text{S}/\text{cm}$ . Usually, there is an inversely proportional relationship to the stage or water level. See Figure 13. However, in this example, there are spikes in specific conductance which correspond to spikes in the stage.



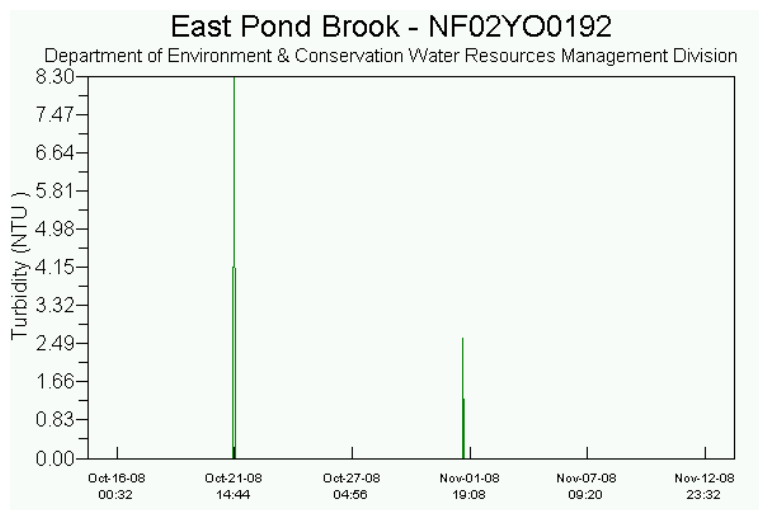
**Figure 10**

- The dissolved oxygen (**Figure 11**) values ranged from a minimum of 10.42 mg/L to a maximum of 13.50 mg/L over the deployment period. Dissolved oxygen levels are generally inversely proportional to water temperature. All dissolved oxygen values fall within the recommended CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* for dissolved oxygen (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L).



**Figure 11**

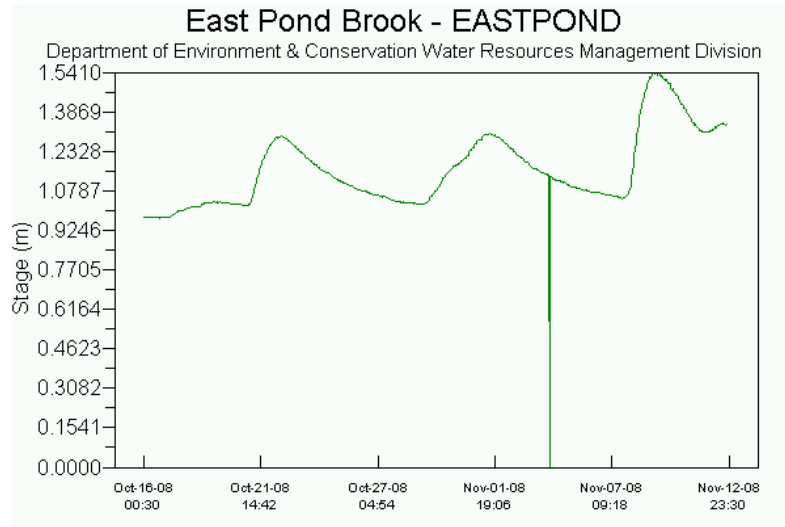
- The turbidity values (**Figure 12**) ranged from 0 NTU to 8.3 NTU throughout the deployment period. There were two (2) minor peaks. As these turbidity measurements were not sustained, there is no water quality impairment. Higher values can be attributed to natural sediment and debris in the stream.



**Figure 12**



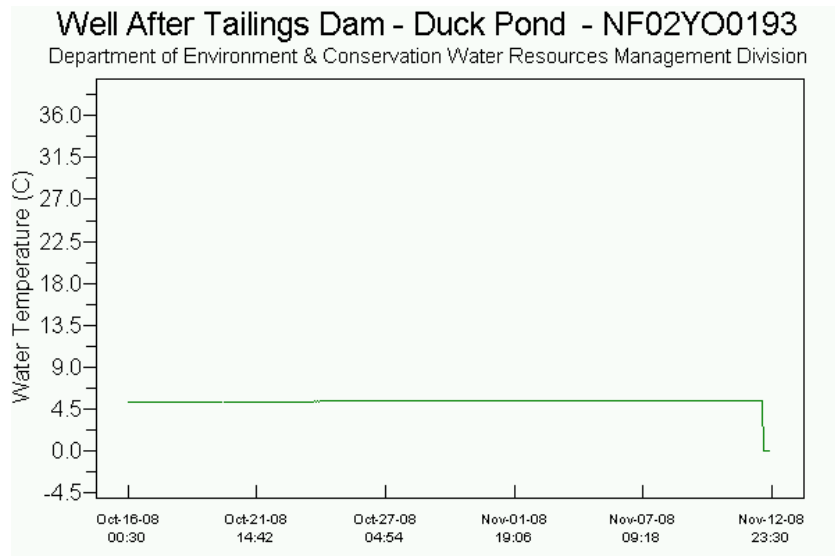
- The stage (**Figure 13**) or water level ranged from a minimum of 0.97 m to a maximum of 1.54 m. This range is normal for this stream and would simply represent runoff from precipitation. The peaks correspond to precipitation events.



**Figure 13**

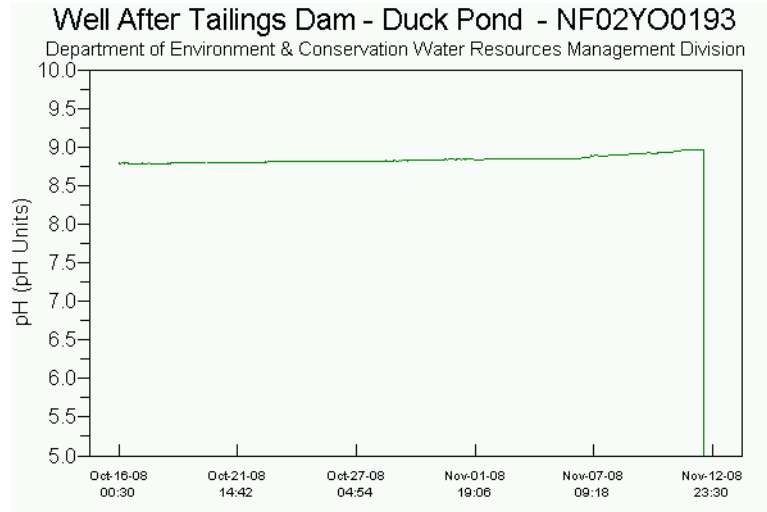
**WELL AFTER TAILING DAM A**

- Throughout the deployment period, water temperature (**Figure 14**) remained constant ranging between 5.24 °C and 5.46 °C.



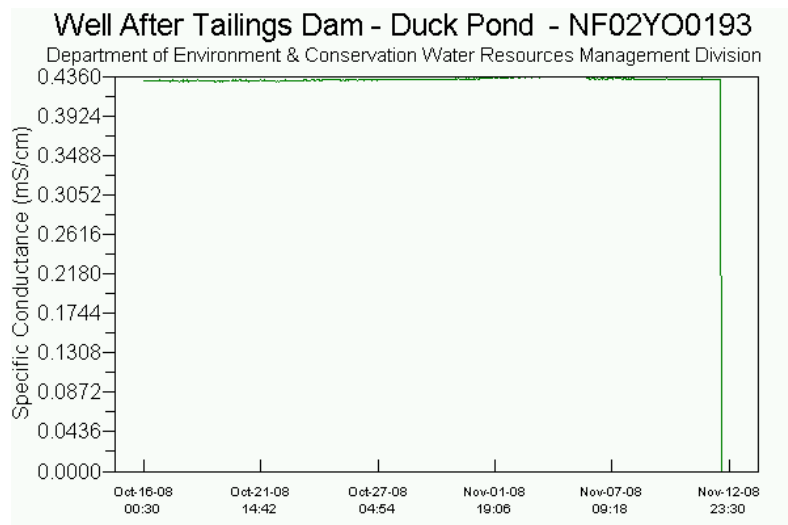
**Figure 14**

- pH (**Figure 15**) increased slightly throughout the deployment period, ranging from a minimum of 8.78 to a maximum of 8.97. This deployment period did not show the initial decrease and subsequent recovery in pH, as has been evident over the last number of deployment periods. This is because this instrument was not removed, nor the well purged and sampled prior to the deployment period. This instrument is intended for long term deployment.



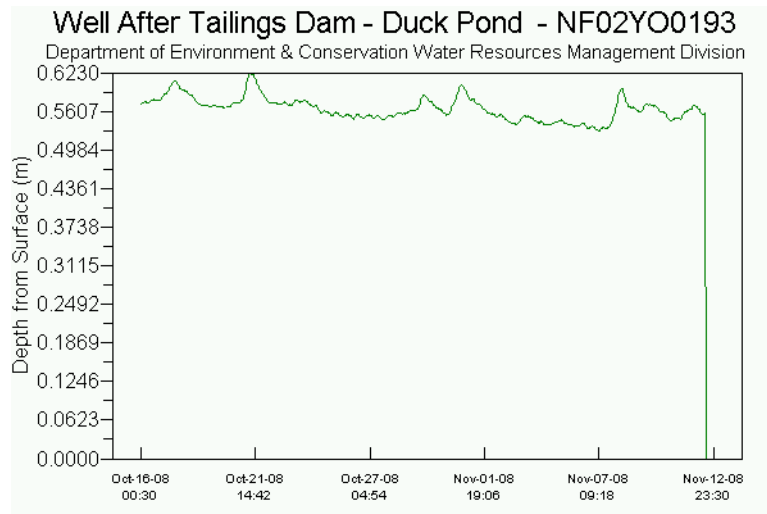
**Figure 15**

- Specific Conductance (**Figure 16**) remained very constant over the deployment period ranging from a minimum of 0.430 mS/cm to a maximum of 0.436 mS/cm.



**Figure 16**

- The water level (**Figure 17**) remained fairly constant throughout the deployment period, ranging from 0.529 m to 0.623 m. The peaks correspond very closely to peaks in stage at Tributary to Gills Pond Brook (**Figure 7**) and are similar to peaks in stage at East Pond Brook (**Figure 13**). This indicates that water level in this well is influenced by precipitation



**Figure 17**

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