

Real Time Water Quality Report Duck Pond Operations (Teck Cominco Limited)

Deployment Period 2008-01-11 to 2008-04-21

General

- The Water Resources Management Division's (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 Tailings 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 Tailings 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.
- A Quanta G monitoring probe has been removed from Monitoring Well After Tailings Dam Station due to the fact that this well freezes at surface during the winter months. This unit will be reinstalled once the well thaws in the late spring / early summer.
- There was no discharge of mine effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) during this deployment period.
- For Tributary to Gills Pond Brook Station there is a period of missing data from February 21, 2008 to March 3, 2008. For some parameters, there is also a vertical line on February 6, 2008. For East Pond Brook Station there are a number of brief periods of missing data, including a period from April 7 to April 14, 2008, and a number of vertical lines in the stage graph below the expected water level. These are the result of data transmission errors. This problem has been noted with staff of Environment Canada who are actively pursuing a fix to the problem.
- Raw (uncorrected) data has been used in the preparation of the graphs and subsequent discussion below.

Maintenance and Calibration of Instrumentation

- Following regular cleaning and calibration of the DataSondes at WRMD laboratory in Grand Falls – Windsor, the instruments were installed in both Tributary to Gills Pond Brook and East Pond Brook, on January 11, 2008 and remained deployed until April 21, 2008 (101 day period).
- This period was longer than normal as it was impractical to remove the DataSondes from under the significant ice and snow cover.
- This extended winter deployment was undertaken as a test to document the water quality trends in these two streams over the winter period when there was no discharge from the mine (normal ambient conditions) and to assess the suitability of these devices for extended deployment under winter conditions. However, due to significant ice damage at other locations during this winter, future deployment under freezing conditions is not recommended.

- *In-situ* measurements of ambient water quality were undertaken with a freshly calibrated MiniSonde each time a DataSonde was installed or removed.
- 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	2008-01-11	Installation	Excellent	Excellent	Poor	Poor
	2008-04-21	Removal	Excellent	Good	Poor	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	2008-01-11	Installation	Good	Poor	Poor	Excellent
	2008-04-21	Removal	Excellent	Marginal	Fair	Good

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) remained near zero throughout the entire deployment period. This was due to the fact that for the entire period the DataSonde was under near continuous ice cover. Temperature values ranged from a minimum of -0.27 °C to 0.39 °C over the deployment period.

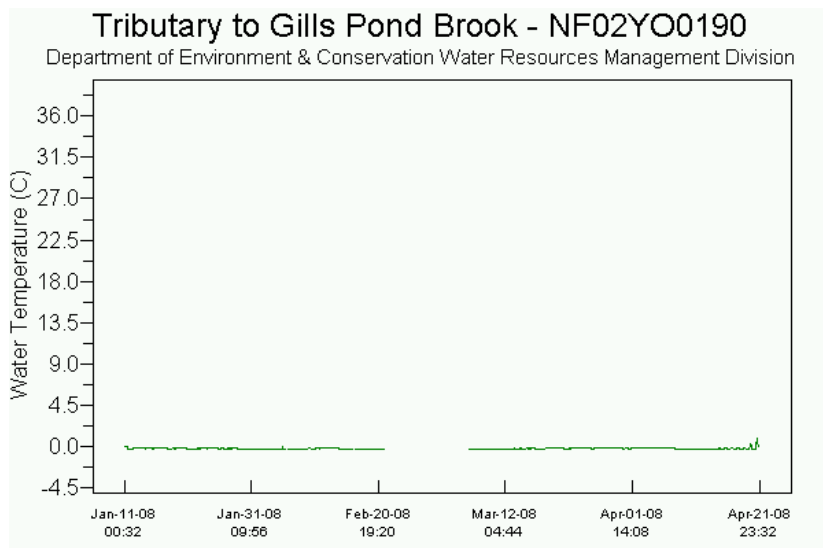


Figure 1

- pH values (**Figure 2**) generally decreased throughout the deployment period. There were notable drops in pH following January 28, 2008 and February 18, 2008, which subsequently recovered to normal levels. These pH changes were the result of increased runoff following brief periods of mild (mean daily temperature above 0°C) weather. Following March 12, 2008 there is a notable decrease in pH which is likely due to fouling of the sensor during the long deployment period. At the end of the deployment period, the pH on the deployed DataSonde was 5.15, while a freshly calibrated replacement probe had a pH of 5.93 a difference of 0.78 units. The vertical line on the right side of the graph indicates the first couple of readings with the replacement probe. The pH values ranged from a minimum of 4.87 to a maximum of 6.61 with most of the values falling 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 lower than the recommended range.

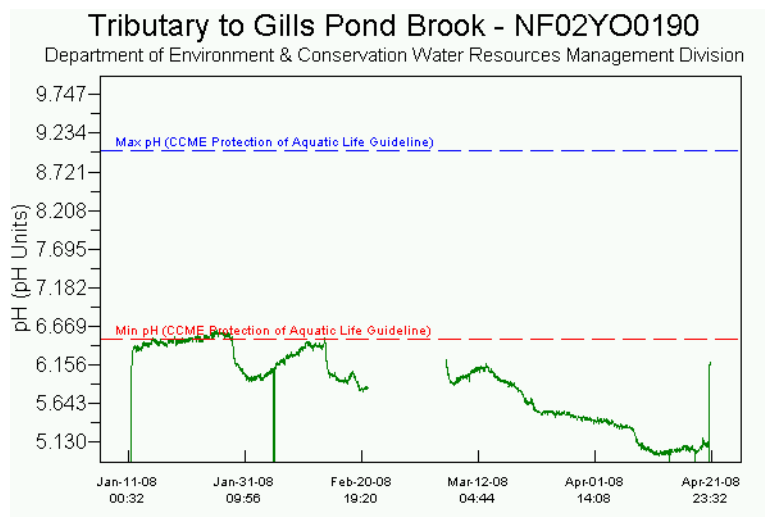


Figure 2

- The specific conductance (**Figure 3**) ranged from a minimum of 13.7 $\mu\text{S}/\text{cm}$ to a maximum of 54.5 $\mu\text{S}/\text{cm}$ over the deployment period. This variation in conductance is normal for periods when there is no discharge from the Polishing Pond, with the evident variation being the result of changes in runoff following periods of mild weather.

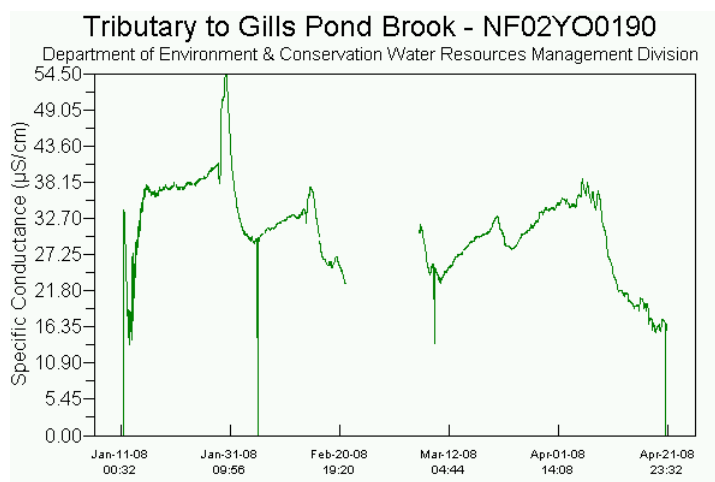


Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 11.75 mg/L to a maximum of 14.71 mg/L over the deployment period. The mean Dissolved Oxygen remained fairly constant over the deployment period with only minor variations coinciding with observed changes runoff and other monitored parameters. 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).

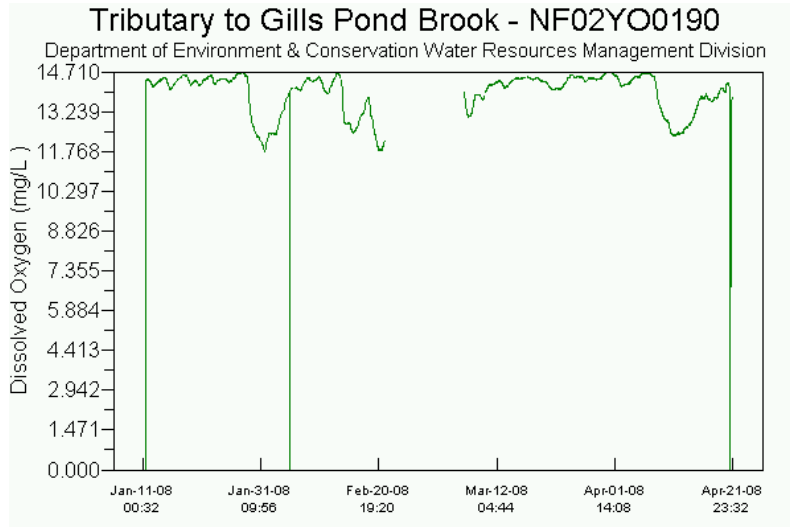


Figure 4

- The turbidity values (**Figure 5**) ranged from a minimum of 0.0 NTU to a maximum of 486 NTU. Typically, however, throughout the deployment period, turbidity values remained below 75 NTU with the exception of one peak (486 NTU) on April 18, 2008. This peak coincided peak spring runoff, when any remaining ice in the main channel was moved downstream. It is interesting to note, that even during winter conditions, under the cover of snow and ice, and without any water discharged from the Polishing Pond, turbidity in this small stream is quite variable. A different probe will be installed at this location during the next deployment period, to assess whether or not these turbidity values might be anomalous errors related to instrument performance.

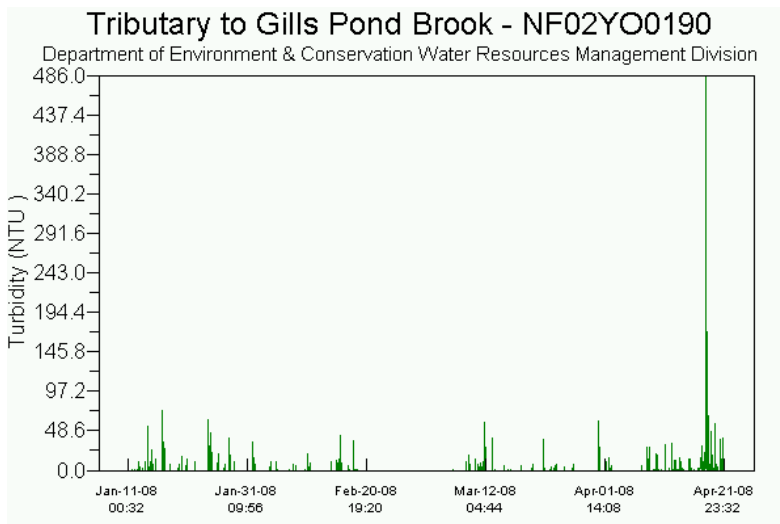


Figure 5

- The stage (**Figure 6**) or water level ranged from a minimum of 1.21 m to a maximum of 5.13 m. The massive peaks shown on the graphs around the end of January and around February 18 would be anomalous values likely due to the backwater effects under ice cover. Actual peak stage would not likely be any higher than 1.6 m.

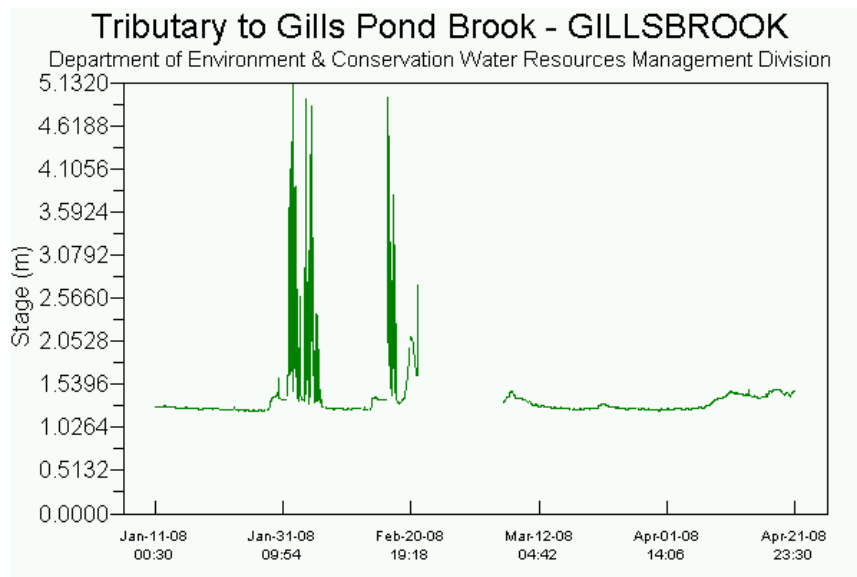


Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) remained constant near zero during the entire deployment period. This is due to the fact that there was significant, but not continuous, ice cover in the stream for nearly all the deployment period. Temperature values ranged from a minimum of -0.15°C to a maximum of -0.10°C .

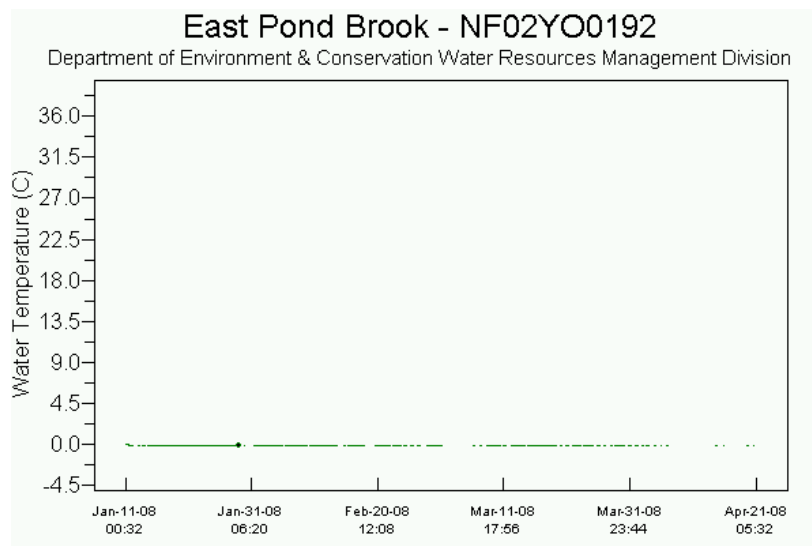


Figure 7

- pH values (**Figure 8**) remained fairly constant between 5.74 and 6.76 throughout the deployment period. As with Tributary to Gills Brook station, the variations in pH are related to weather and runoff. There appeared to be little fouling of the pH probe during this period. Throughout the coldest part of the winter, most of the values fall 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.

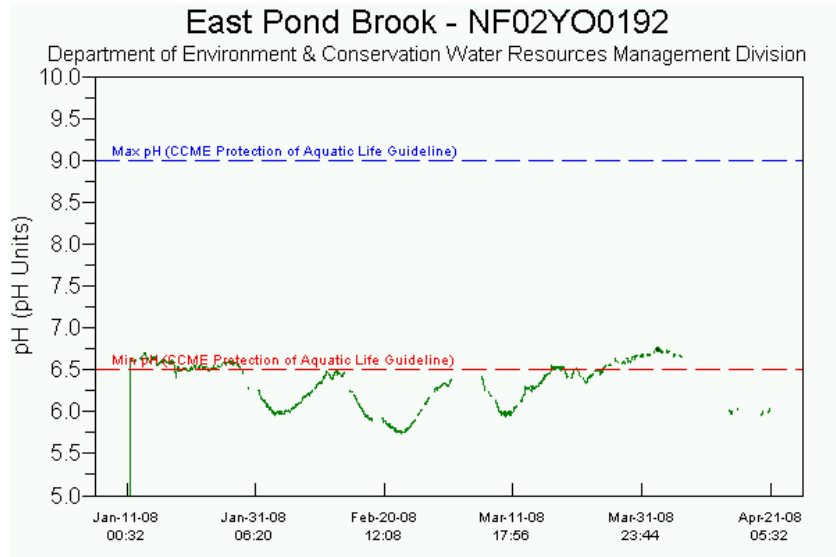


Figure 8

- The specific conductance (**Figure 9**) ranged from a minimum of 11.9 $\mu\text{S}/\text{cm}$ to a maximum of 28.4 $\mu\text{S}/\text{cm}$ over the deployment period. This normal variation is inversely proportional to the stage or water level. See Figure 12.

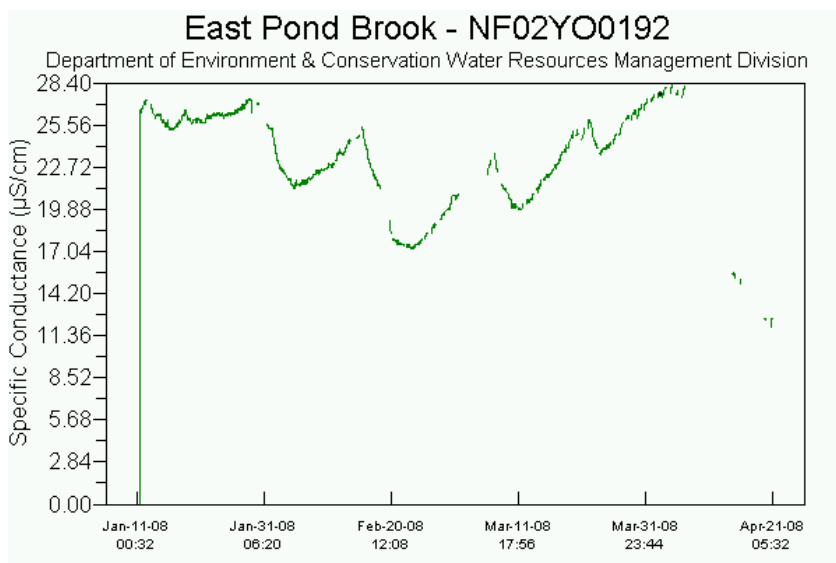


Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 12.67 mg/L to a maximum of 14.73 mg/L over the deployment period. Again, changes in Dissolved Oxygen are similar to other water quality parameters and are related to weather and runoff. 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).

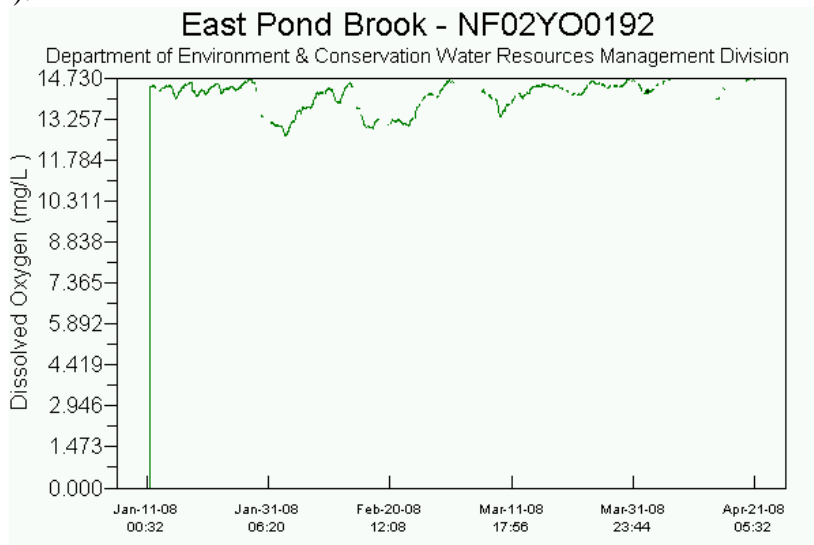


Figure 10

- The turbidity values (**Figure 11**) are constant at 0 NTU throughout the deployment period. This lack of variability is suspect, particularly given what is being observed at Tributary to Gills Pond Brook Station. Assessment of turbidity at this site will be the subject of further investigation.

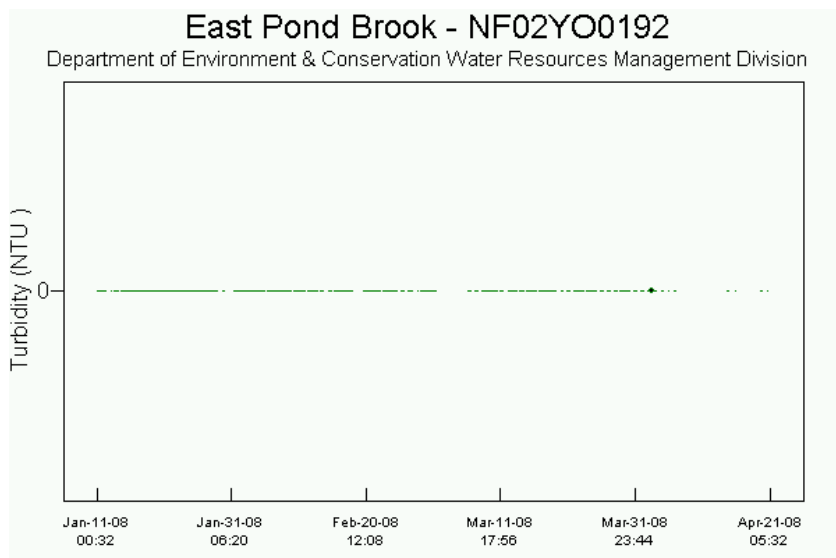


Figure 11

- The stage (**Figure 12**) or water level ranged from a minimum of 1.00 m to a maximum of 2.42 m (peak on March 17, 2008). The peak on March 17, 2008 is an anomaly likely due to the backwater effects under ice cover. Maximum water level would be in the order of 1.65 m during high flows.

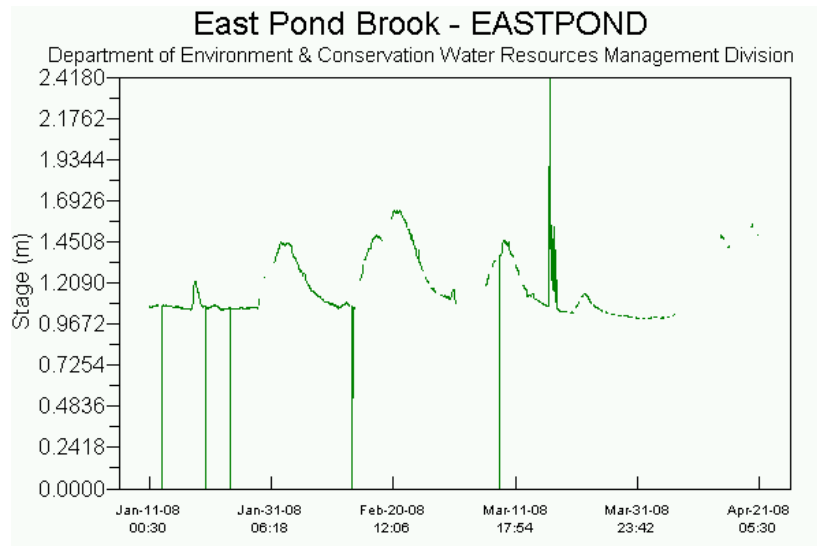


Figure 12

WELL AFTER TAILING DAM A

- Due to the instrument being removed prior to freeze-up, there is no data for this period.

Prepared by:

Robert Wight
Environmental Scientist
Department of Environment and Conservation
Tel: 709-292-4280
Fax: 709-292-4365
e-mail: robertwight@gov.nl.ca