Real Time Water Quality Report
Teck Duck Pond Operations
Deployment Period 2009-06-24 to 2009-07-27

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 Teck 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) had initially been fitted with sensors designed to measure Ammonium and Nitrate. However, technical problems with the sensors rendered readings of these parameters unreliable over the long term. As no solution for this problem is presently available, these sensors have been removed from the instruments.
- The graphs below may sometimes 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) from June 24, 2009 to June 30, 2009, July 9, 2009 to July 16, 2009, and July 25, 2009 to the end of the deployment period.
- For Monitoring Well After Tailings Dam Station (MW1), there were two brief periods when data transmission was interrupted. This is evident on the graphs below.
- Raw (uncorrected) data has been used in the preparation of the graphs and subsequent discussion below.

Maintenance and Calibration of Instrumentation

- The regular **DataSondes®** usually deployed in Tributary to Gills Pond Brook and East Pond Brook were both returned from the vendor after regular Performance and Evaluation Testing. After being freshly calibrated, both instruments were deployed from June 24, 2009 until July 27, 2009; a 33 day period.
- The **Quanta G®** probe remained deployed continuously in Monitoring Well After Tailings Dam Station (MW1) since May 5, 2009. It is anticipated that this probe will remain deployed for up to six months at a time.
- *In-situ* measurements of ambient water quality were undertaken with a freshly calibrated **MiniSonde®** each time a **DataSonde®** was removed or deployed. 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.

Tributary to Gills Pond Brook Station (NF02YO0190)				
Date (yyyy-mm-dd)	**Parameter**	**MiniSonde® Data**	**DataSonde® Data**	**Rating**
2009-06-24 Installation	Temp (°C)	15.74	15.63	Excellent
	pH (units)	6.98	7.06	Excellent
	Sp. Conductivity (uS/cm)	56.4	57.9	Excellent
	Dissolved Oxygen (mg/L)	9.44	9.48	Excellent
	Turbidity (NTU)	0.05	0.2	Excellent
2009-07-27 Removal	Temp (°C)	18.01	17.85	Excellent
	pH (units)	6.78	6.93	Excellent
	Sp. Conductivity (uS/cm)	641.2	643.1	Excellent
	Dissolved Oxygen (mg/L)	8.95	9.06	Excellent
	Turbidity (NTU)	0.0	0.3	Excellent

Table 1

East Pond Brook Station (NF02YO0192)				
Date (yyyy-mm-dd)	**Parameter**	**MiniSonde® Data**	**DataSonde® Data**	**Rating**
2009-06-24 Installation	Temp (°C)	16.49	16.60	Excellent
	pH (units)	7.05	7.13	Excellent
	Sp. Conductivity (uS/cm)	24.60	25.0	Excellent
	Dissolved Oxygen (mg/L)	9.70	9.74	Excellent
	Turbidity (NTU)	0.0	0.0	Excellent
2009-07-27 Removal	Temp (°C)	18.45	18.38	Excellent
	pH (units)	6.64	7.11	Excellent
	Sp. Conductivity (uS/cm)	27.7	28.5	Excellent
	Dissolved Oxygen (mg/L)	9.23	9.37	Excellent
	Turbidity (NTU)	0.0	0.0	Excellent

Table 2

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) remained fairly constant throughout the deployment period. Temperature values ranged from a minimum of 10.07 ˚C to a maximum of 25.62 ˚C.

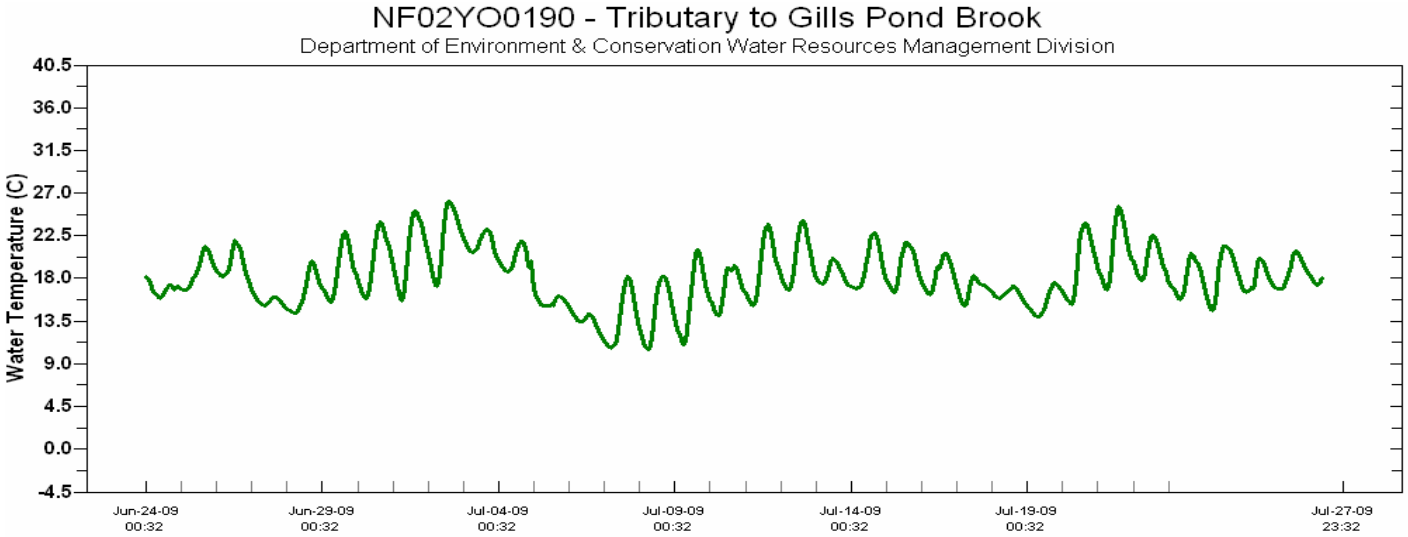

Figure 1

- Throughout the deployment period pH values (**Figure 2**) ranged from a minimum of 6.05 to a maximum of 7.22 with a few 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 around the lower limit of the recommended range. The sudden drop in pH around July 4, 2009 corresponds to an increase in runoff following a significant precipitation event.

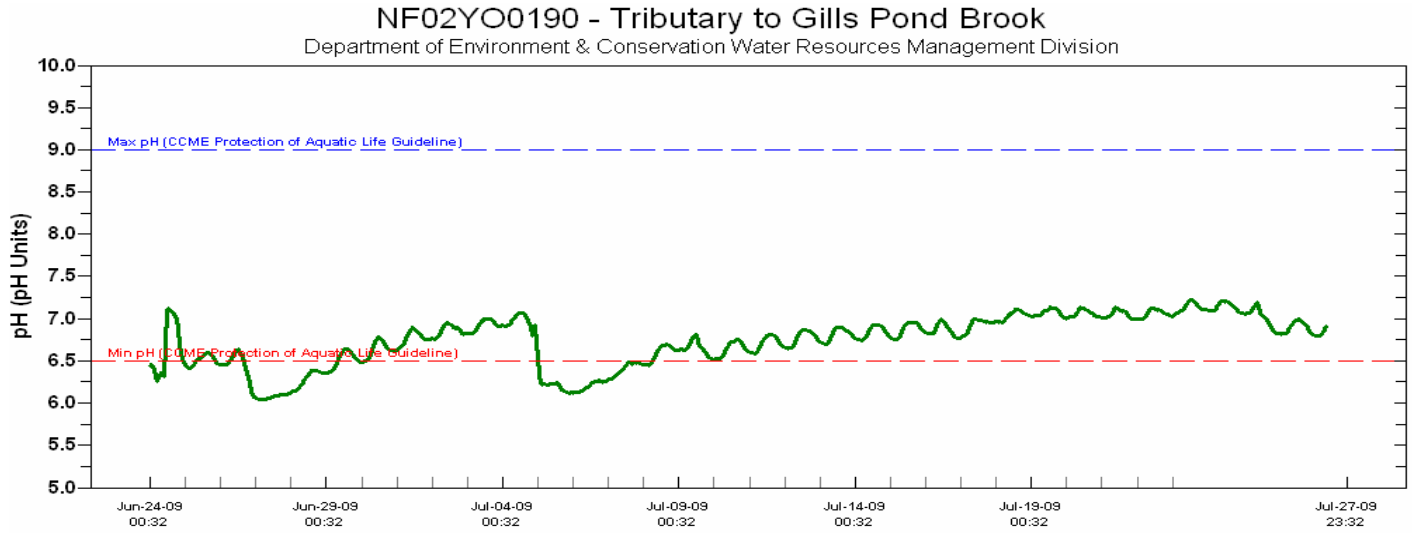

Figure 2

- The specific conductance **(Figure 3)** ranged from a minimum of 22.2 µS/cm to a maximum of 717.0 µS/cm over the deployment period. During the discharge periods from Polishing Pond June 24, 2009 to June 30, 2009, July 9, 2009 to July 16, 2009, and July 25, 2009 to the end of the deployment period, there are marked increases in conductivity. The 'V' shaped dip in conductivity around June 27, 2009 is the result of dilution caused by a significant precipitation event.

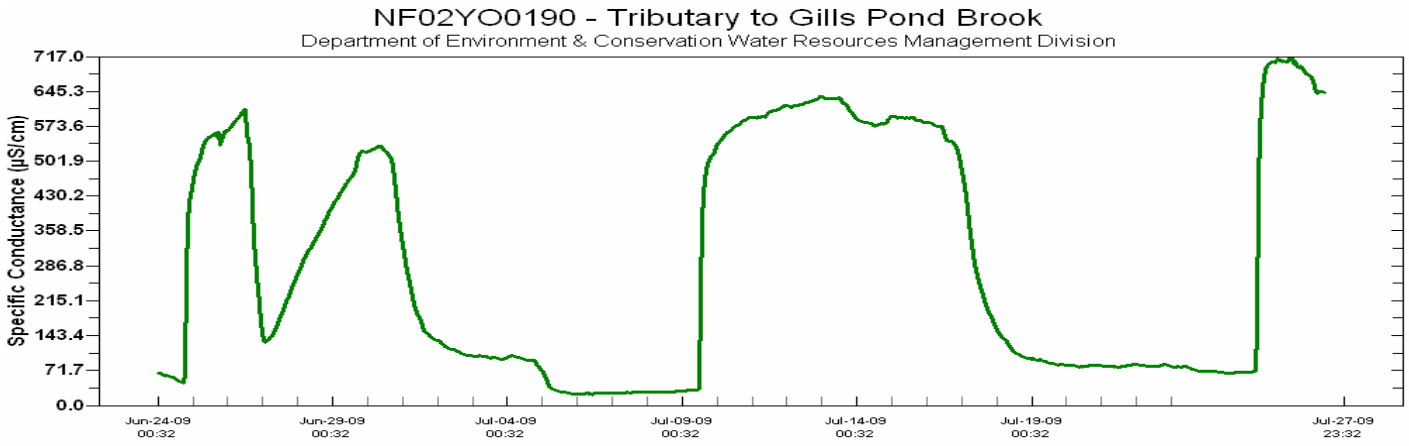

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 7.49 mg/L to a maximum of 10.33 mg/L over the deployment period. Dissolved oxygen is inversely proportional to water temperature. Throughout the deployment period, all dissolved oxygen values fell above the lower limit recommended by 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).

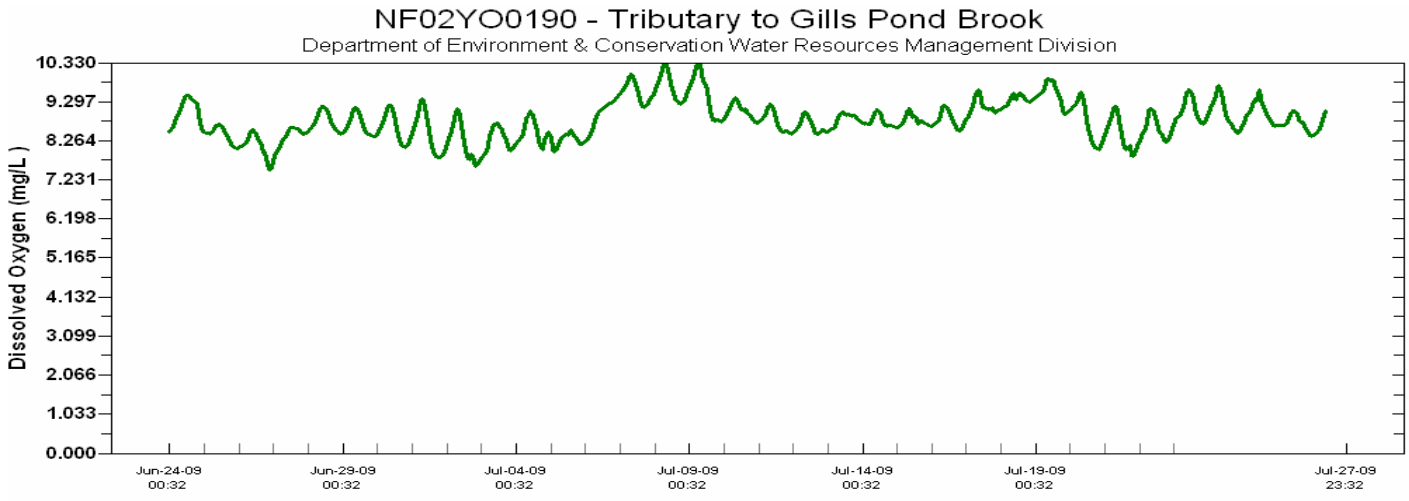

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 176.0 NTU. Higher turbidity values correspond to periods of discharge from the Polishing Pond, precipitation events and high stage. Based upon previous investigation, it has been determined that turbidity values may be artificially increased due to air entrainment during high flows. 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)"*. *In situ* turbidity measurements throughout this period were all less than 0.78 NTU which is considered normal for this type of stream.

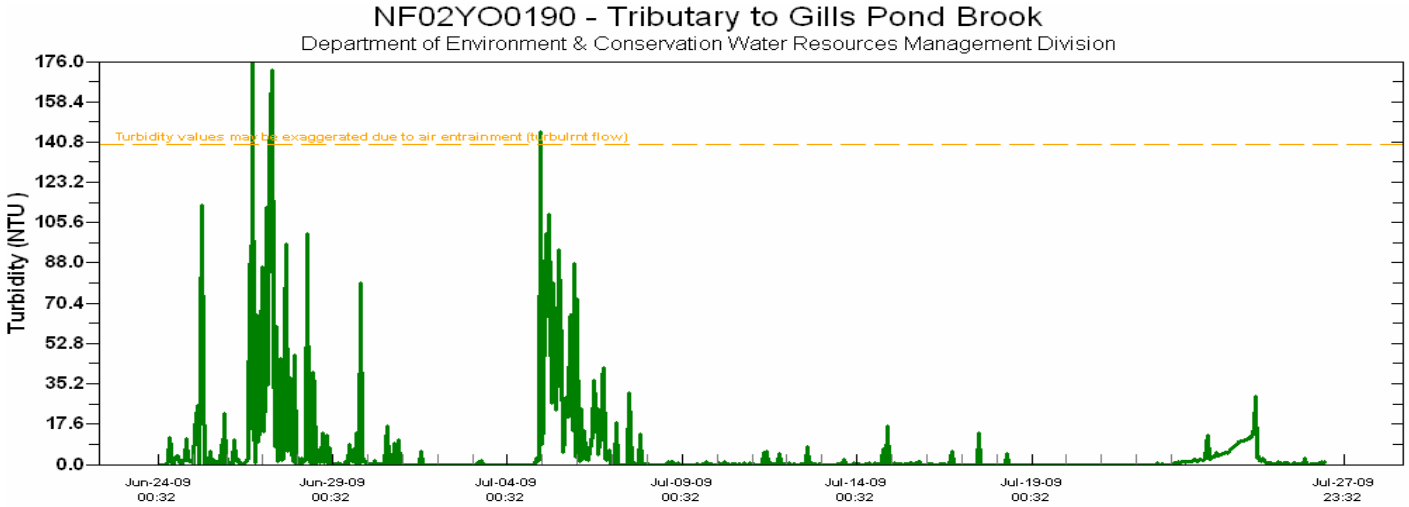

Figure 5

- The stage (**Figure 6)** or water level ranged from a minimum of 1.23 m to a maximum of 1.70 m with the highest peaks corresponding to discharge from Polishing Pond and precipitation events.

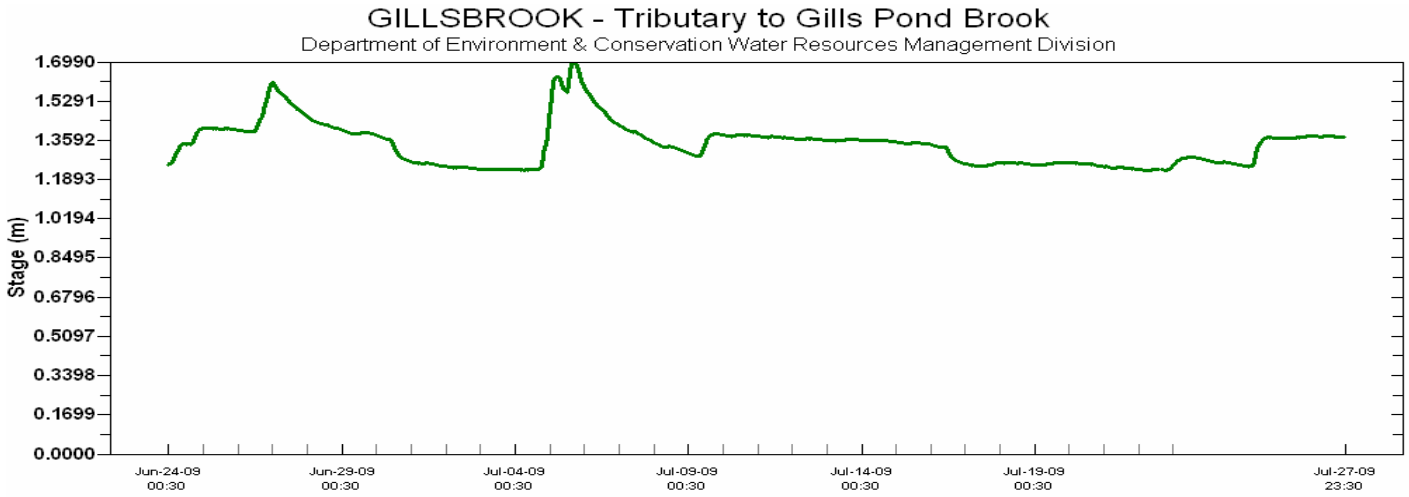

Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) remained fairly constant throughout the deployment period, ranging from a minimum of 12.33 ˚C to a maximum of 26.60 ˚C.

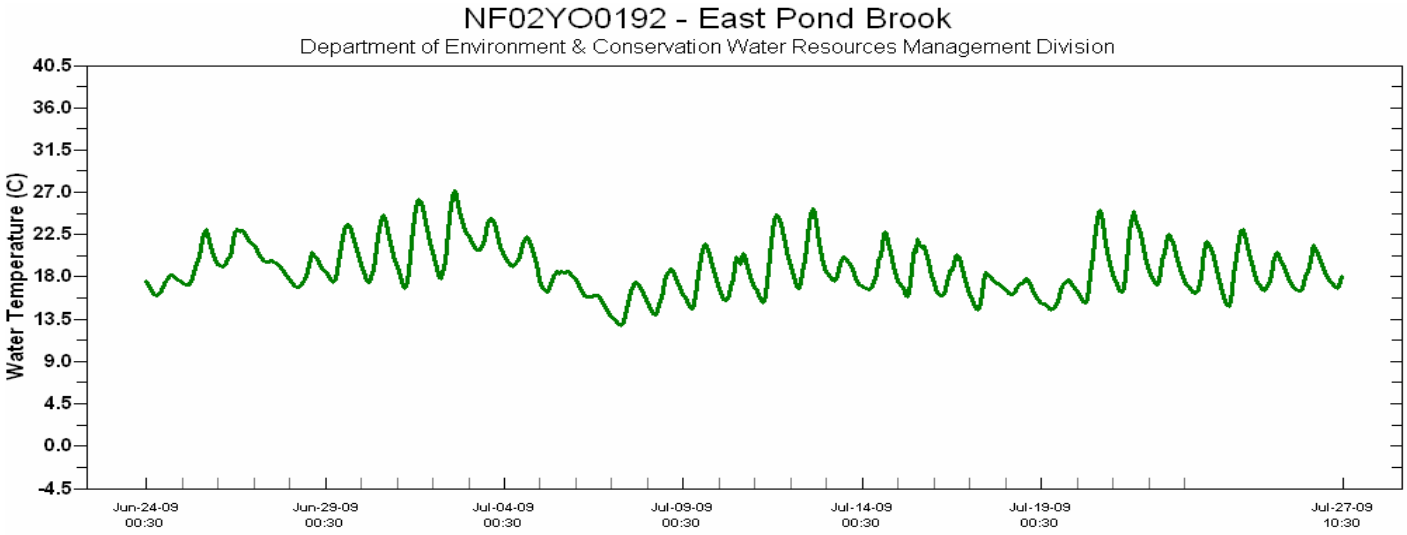

Figure 7

- pH values (**Figure 8**) ranged between a minimum of 6.19 and maximum of 7.19, remaining fairly constant over the deployment period. For most of the deployment period, pH values were above the lower limit of 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. The dip in pH following July 4, 2009 corresponds to an increase in runoff following a significant precipitation event.

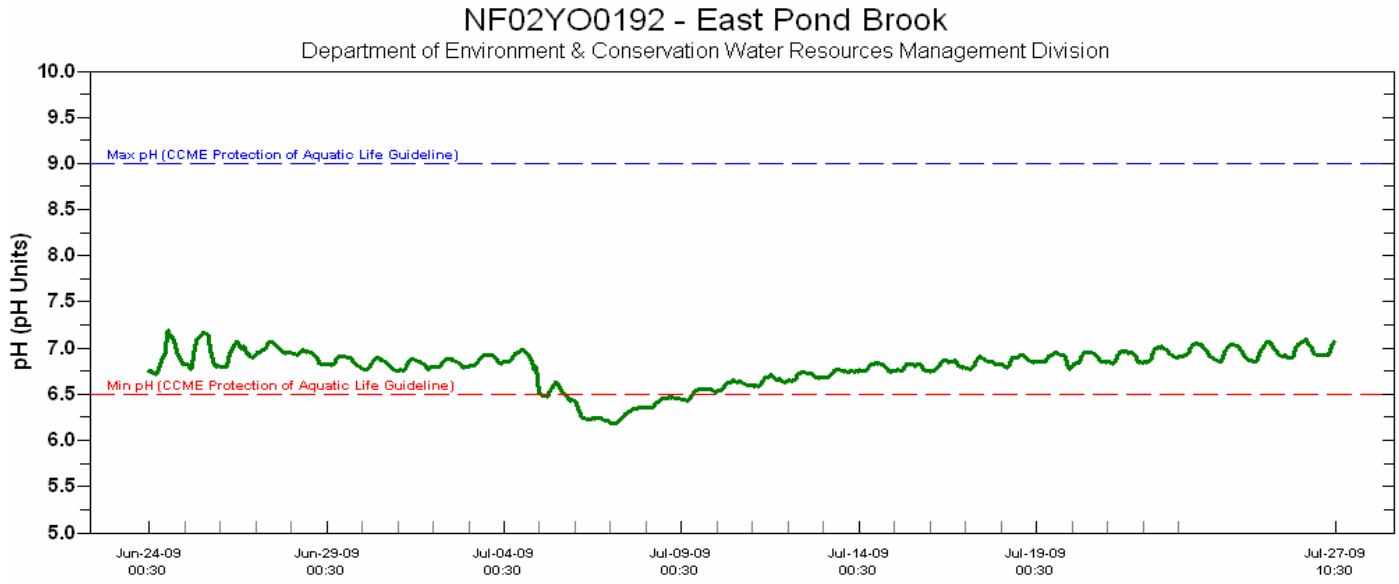

Figure 8

- The specific conductance **(Figure 9)** ranged from a minimum of 17.4 µS/cm to a maximum of 31.4 µS/cm. Lowest conductivity values correspond to periods of precipitation and high runoff.

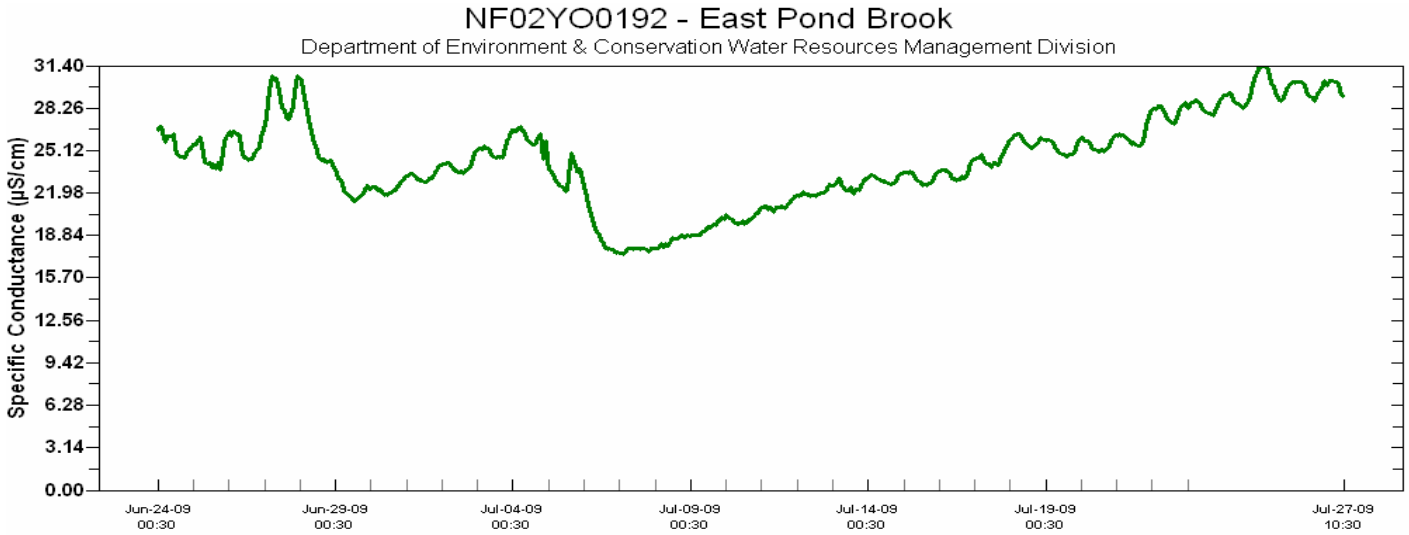

Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 7.82 mg/L to a maximum of 10.11 mg/L over the deployment period. Dissolved oxygen is inversely proportional to water temperature. Throughout the deployment period, all dissolved oxygen values fell above the lower limit recommended by 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).

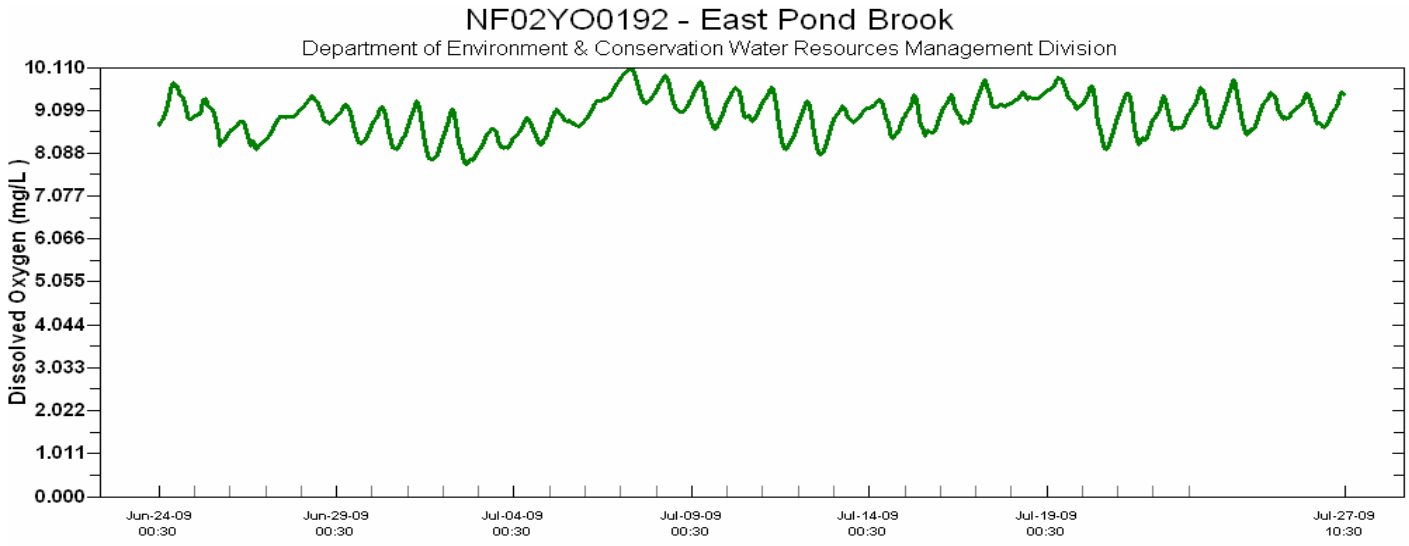

Figure 10

- The turbidity values **(Figure 11)** ranged from a minimum of 0.0 NTU to a maximum of 1448.0 NTU. The initial few readings of 3000.0 NTU correspond to the errors from the older probe, which was removed earlier on the day of deployment. The high turbidity values (June 25, 2009 to June 28, 2009) are likely due to leafy debris caught in the sensor as there were no unusually high *in situ* measurements, and no evidence of water quality impairment.

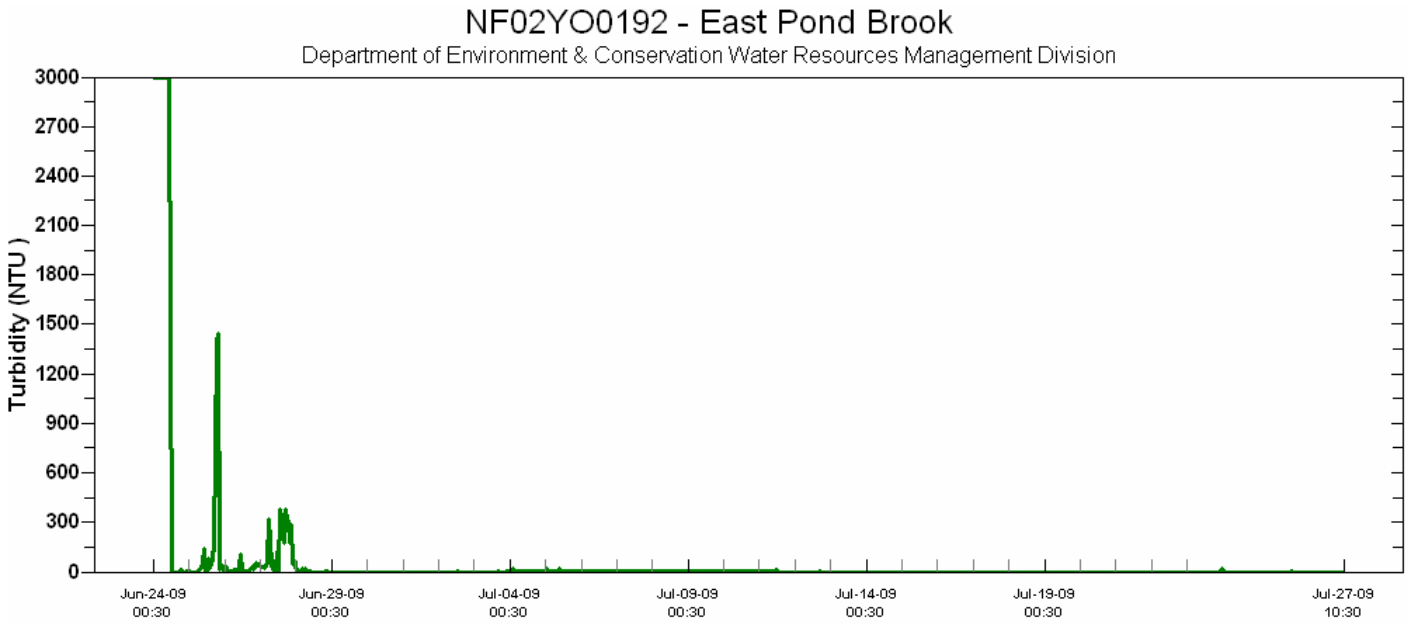

Figure 11

- The stage **(Figure 12)** or water level ranged from a minimum of 0.97 m to a maximum of 1.80 m. The highest peaks are the result of precipitation.

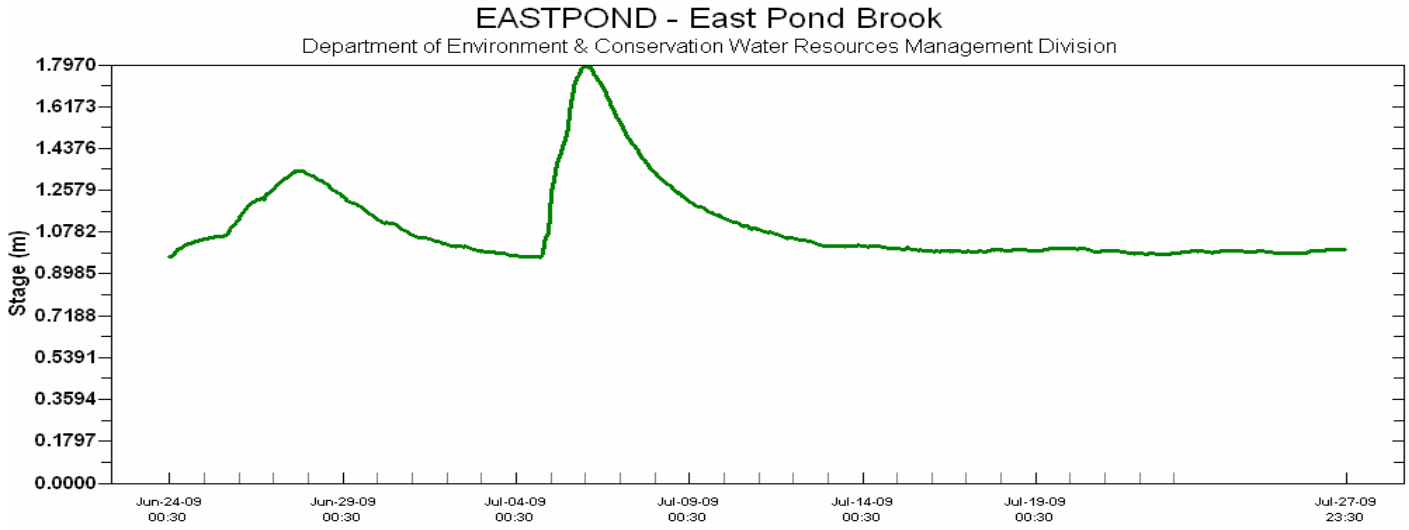

Figure 12

WELL AFTER TAILING DAM A

- Throughout the deployment period, water temperature (**Figure 13**) remained constant ranging between 4.76 ^{o}C and 4.81 ^{o}C.

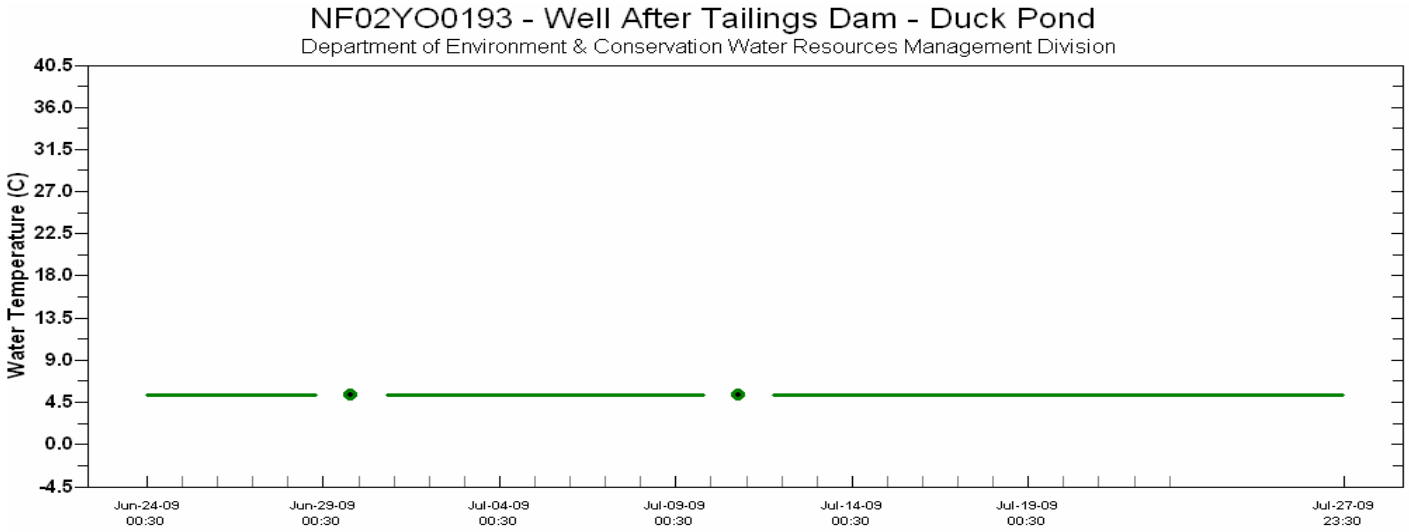

Figure 13

- The pH **(Figure 14)** remained constant between a minimum of 8.75 and 8.81 throughout the deployment period.

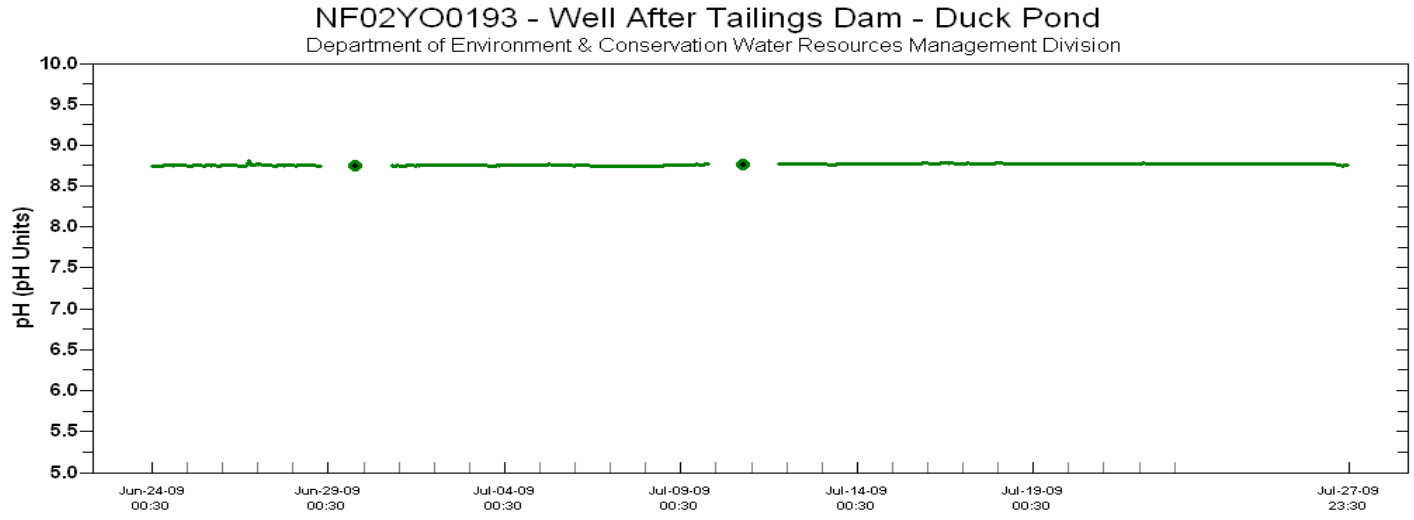

Figure 14

- Specific Conductance (**Figure 15**) remained fairly constant over the deployment period ranging from a minimum of 0.431 mS/cm to a maximum of 0.443 mS/cm.

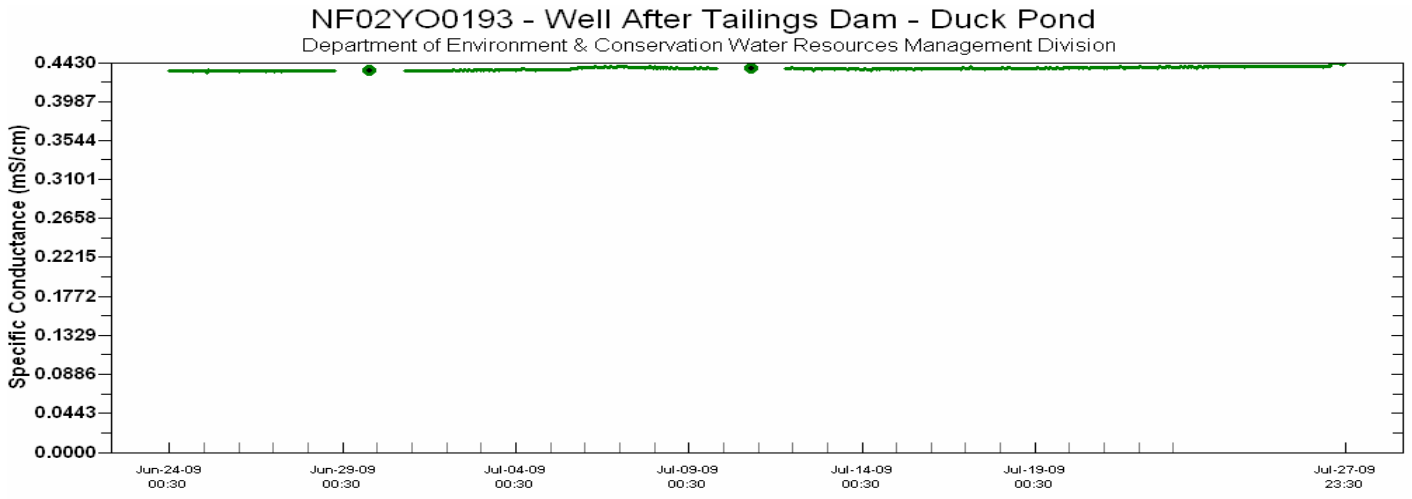

Figure 15

- The water level (**Figure 16**) remained constant throughout the deployment period, ranging from a minimum of 271.00 m to a maximum of 271.11 m.

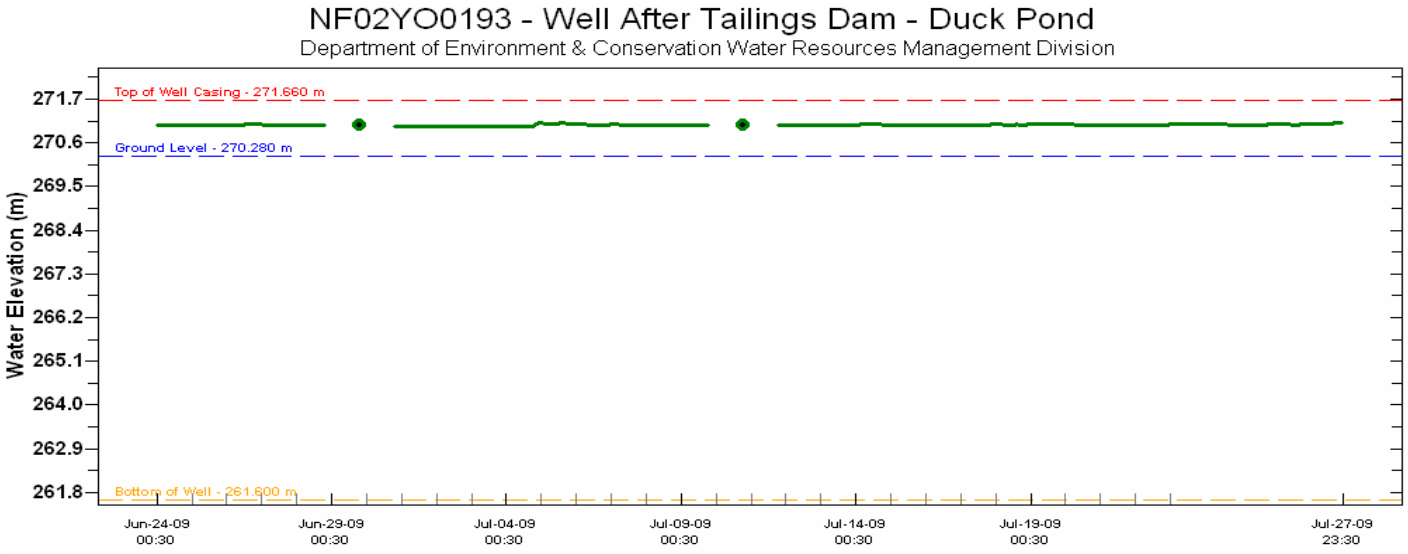

Figure 16

Prepared by:

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