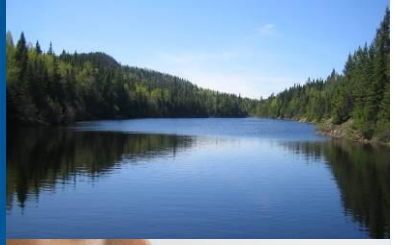




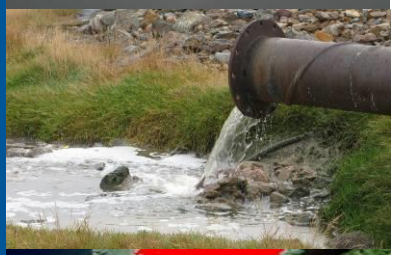


# Real Time Water Quality Report
# Teck Duck Pond Operations

## Deployment Period 2013-05-10 to 2013-06-11

**2013-06-25**

Newfoundland Labrador

**Government of Newfoundland & Labrador**
**Department of Environment and Conservation**
**Water Resources Management Division**

## 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.
- There was planned discharge of effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) for the entire deployment period. There was a brief period right around the beginning of the deployment period, when discharge was stopped or reduced, to facilitate calibration of the weir at Dam C.

## Maintenance and Calibration of Instrumentation

- The new **DataSondes®**(s/n 62268) for Tributary to Gills Pond Brook and (s/n 62267) for East Pond Brook were installed on May 10, 2013, after being freshly calibrated after winter storage, and remained deployed continuously until June 11, 2013; a 31 day period.
- The regular **MiniSonde®** (s/n 47591) was used for QA/QC purposes during the installation and removal of the instruments. It too, was cleaned and freshly calibrated prior to each use.
- The regular **Quanta G®** (s/n 00035) was deployed on October 3, 2012 and remained deployed continuously in Monitoring Well After Tailings Dam Station (MW1) all winter until the well thawed at surface. On May 14, 2013 it was removed and a new **Quanta G®** (s/n 00653) instrument having the same technical specifications was substituted, after being freshly calibrated. The reporting period for this well is May 10, 2013 until June 11, 2013; a 31 day period.

## Quality Assurance / Quality Control (QA/QC) Measures

- As part of the QA/QC protocol, 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. See **Table 1**.

| | Rank | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Excellent** | **Good** | **Fair** | **Marginal** | **Poor** |
| Temperature (oC) | <=+/-0.2 | >+/-0.2 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | <+/-1 |
| pH (unit) | <=+/-0.2 | >+/-0.2 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | >+/-1 |
| Sp. Conductance (µS/cm) | <=+/-3 | >+/-3 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |
| Sp. Conductance > 35 µS/cm (%) | <=+/-3 | >+/-3 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |
| Dissolved Oxygen (mg/L) (% Sat) | <=+/-0.3 | >+/-0.3 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | >+/-1 |
| Turbidity <40 NTU (NTU) | <=+/-2 | >+/-2 to 5 | >+/-5 to 8 | >+/-8 to 10 | >+/-10 |
| Turbidity > 40 NTU (%) | <=+/-5 | >+/-5 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |

**Table 1**

- For the Surface Water Stations, upon deployment and removal, a QA/QC **MiniSonde®** is usually temporarily deployed along side the Field **DataSonde®**. Values for each recorded parameter are compared between the two instruments. Based upon the difference between the parameters recorded by the Field **DataSonde®** and QA/QC **MiniSonde®** a qualitative statement (Ranking) is usually made on the data.
- The ranking at the beginning and end of the deployment period is shown in **Table 2** for Tributary to Gill's Pond Brook and **Table 3** for East Pond Brook.
- Because the deployment set-up for Well After Tailings Dam (MW1) is different, comparison with another instrument is not possible. In this case, one grab sample was collected when one instrument was removed and a second grab sample was collected when another instrument was deployed, and the ranking is calculated for pH and Specific Conductance based upon live data and laboratory data. The rankings in **Table 4** have both been determined when instruments were changed out on May 14, 2013, as opposed to the beginning and end of the reporting period.
- There was a "Fair" ranking for pH in Well After Tailings Dam (MW1) when the second instrument was deployed. This is typical of new deployments in this well. Refer to discussion on page 18.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

| Tributary to Gills Pond Brook Station (NF02YO0190) | | |
|---|---|---|
| **Date (yyyy-mm-dd)** | **Parameter** | **Ranking** |
| 2013-05-10 Installation | Temp ($^{o}$C) | Excellent |
| | pH (units) | Good |
| | Sp. Conductivity (µS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Excellent |
| | Turbidity (NTU) | Excellent |
| 2013-06-11 Removal | Temp ($^{o}$C) | Excellent |
| | pH (units) | Excellent |
| | Sp. Conductivity (µS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Good |
| | Turbidity (NTU) | Excellent |

**Table 2**

| East Pond Brook Station (NF02YO0192) | | |
|---|---|---|
| **Date (yyyy-mm-dd)** | **Parameter** | **Ranking** |
| 2013-05-10 Installation | Temp ($^{o}$C) | Excellent |
| | pH (units) | Excellent |
| | Sp. Conductivity (µS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Excellent |
| | Turbidity (NTU) | Excellent |
| 2013-06-11 Removal | Temp ($^{o}$C) | Excellent |
| | pH (units) | Excellent |
| | Sp. Conductivity (µS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Excellent |
| | Turbidity (NTU) | Good |

**Table 3**

| Well After Tailings Dam (MW1) Station (NF02YO0193) | | |
|---|---|---|
| **Date (yyyy-mm-dd)** | **Parameter** | **Ranking** |
| 2013-05-14 Removal | pH (units) | Excellent |
| | Sp. Conductivity (µS/cm) | Good |
| 2013-05-14 Installation | pH (units) | Fair |
| | Sp. Conductivity (µS/cm) | Excellent |

**Table 4**

## Data Interpretation

### TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of 3.51˚C to a maximum of 17.65˚C.
- There was no significant change in temperature over the deployment period.
- There appears to be little correlation with stage.

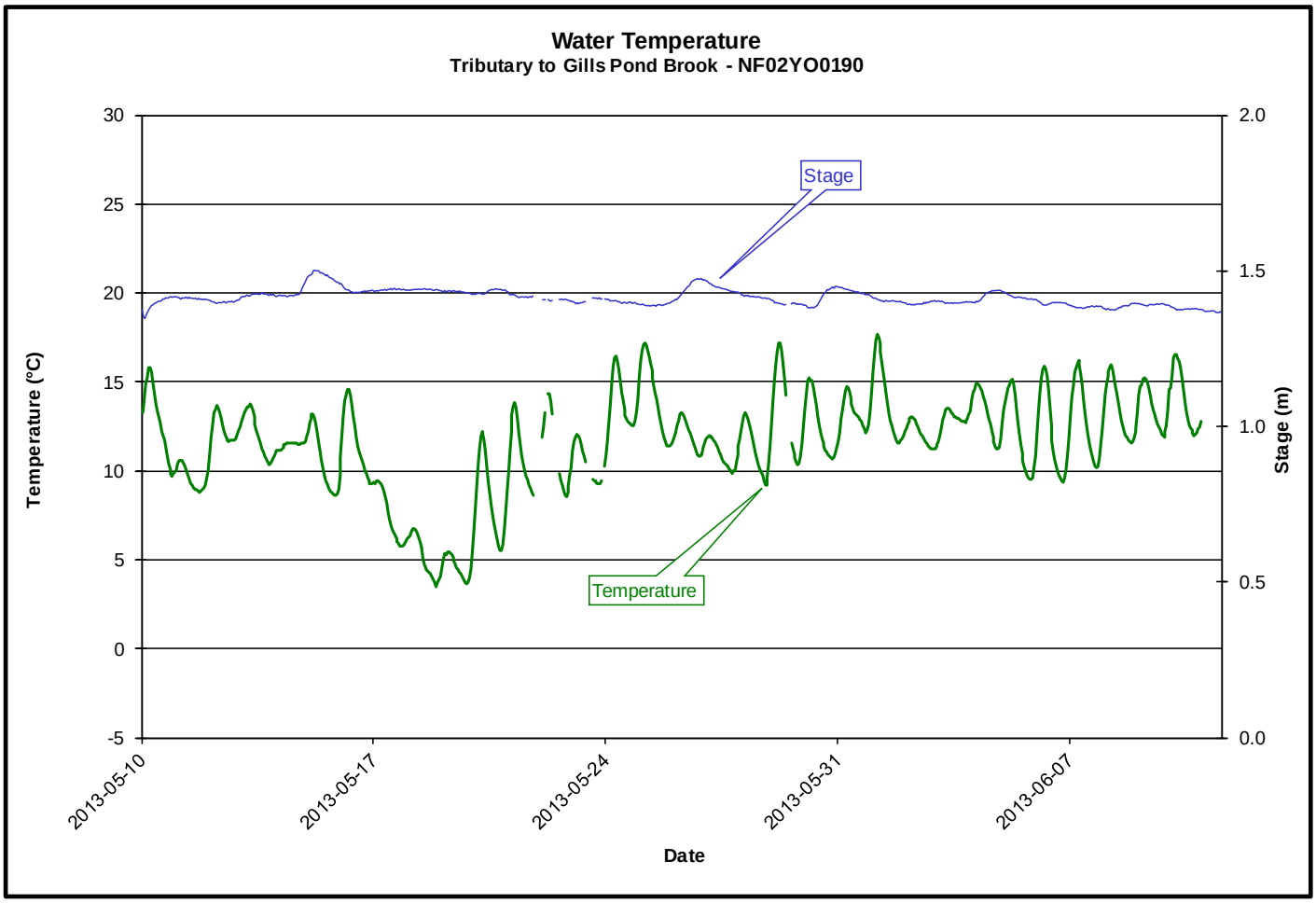


**Figure 1**

- Throughout the deployment period, pH values (**Figure 2**) ranged from a minimum of 6.00 to a maximum of 6.95 with all values around the lower limit of the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- An inverse relationship with stage is obvious during several events throughout the deployment period.
- There is a slight increase in pH throughout the deployment period.
- The background pH of this stream is normally around the lower limit of the recommended range.

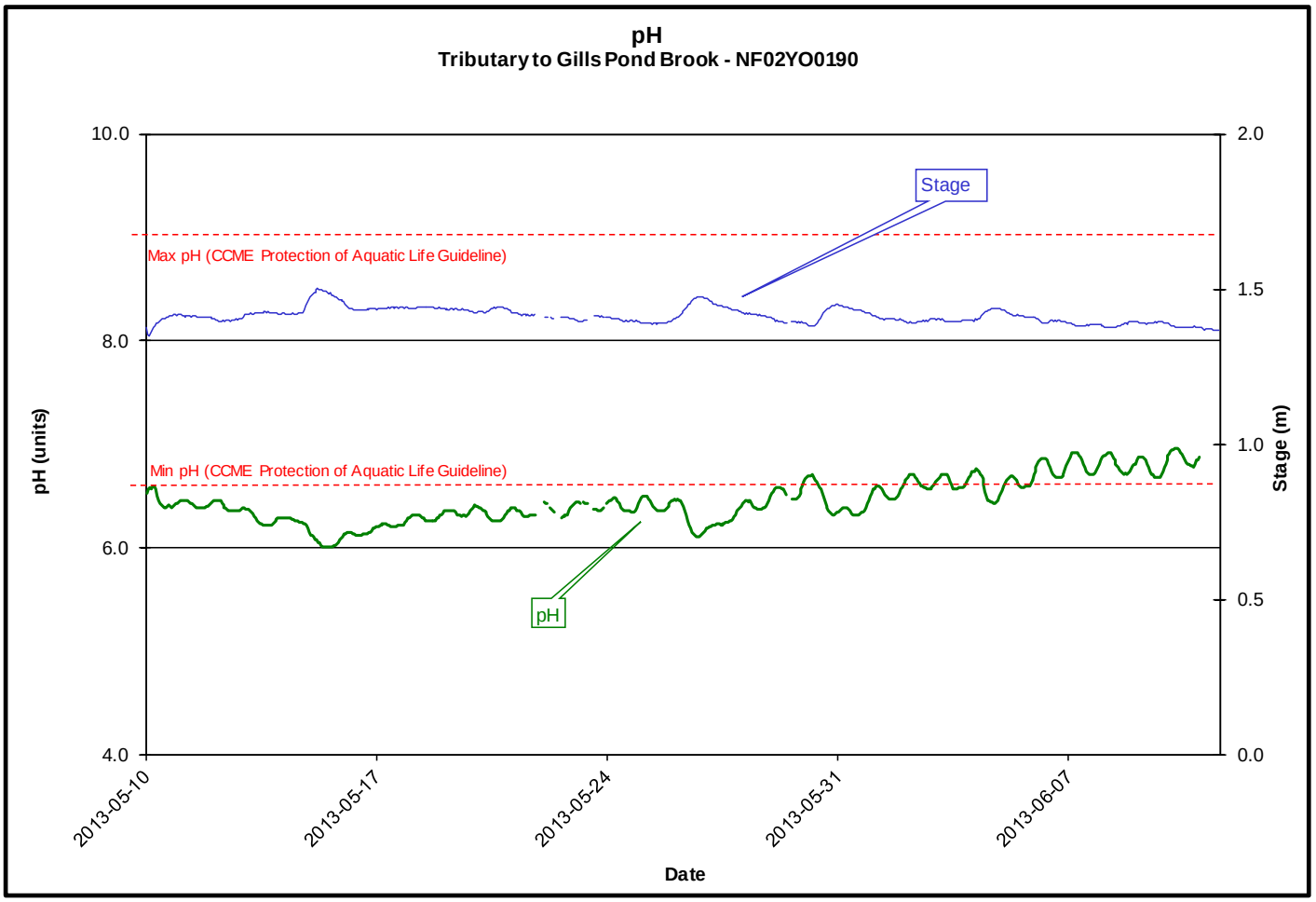


**Figure 2**

- The specific conductivity **(Figure 3)** ranged from a minimum of 389.0 µS/cm to a maximum of 1010.0 µS/cm over the deployment period.
- There is a minor and short term decrease in specific conductivity at the very beginning of the deployment period which corresponds to a brief cessation or reduction of discharge from the polishing pond for calibration of the discharge weir at Dam C (Polishing Pond).
- An inverse relationship with stage is obvious over several events over the deployment period. Precipitation events effectively cause a dilution effect in the stream's specific conductivity, which was elevated from natural background levels throughout the entire deployment period.

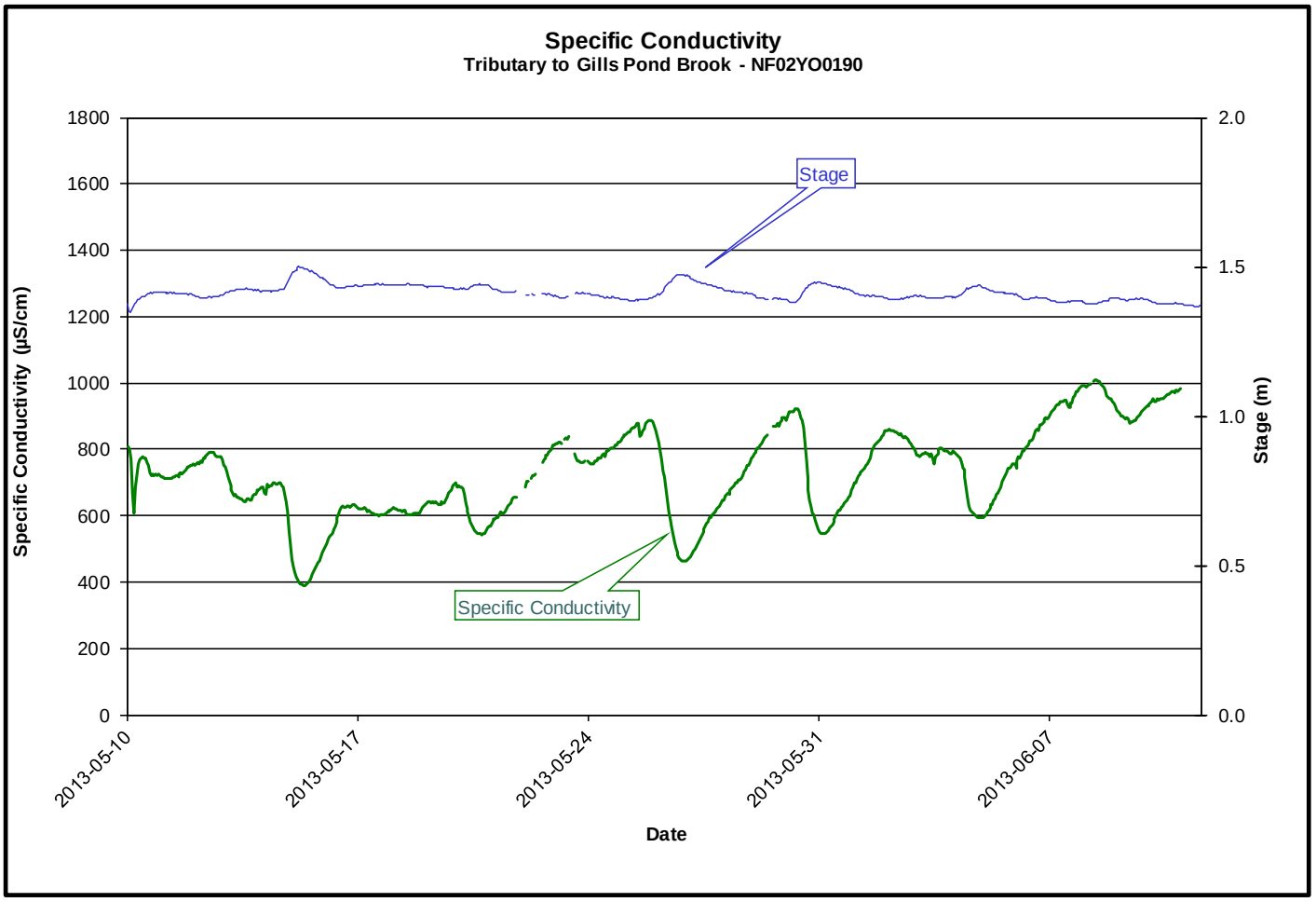


**Figure 3**

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 8.79 mg/L to a maximum of 11.71 mg/L over the deployment period, with the percent saturation ranging between 83.6 and 96.3.
- Dissolved oxygen is generally inversely proportional to water temperature.
- Nearly all of the dissolved oxygen values fell near the upper 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).
- Based upon the fact that Dissolved Oxygen % saturation had minimal change over the deployment period, we can be confident that the Dissolved Oxygen mg/L values are accurate.

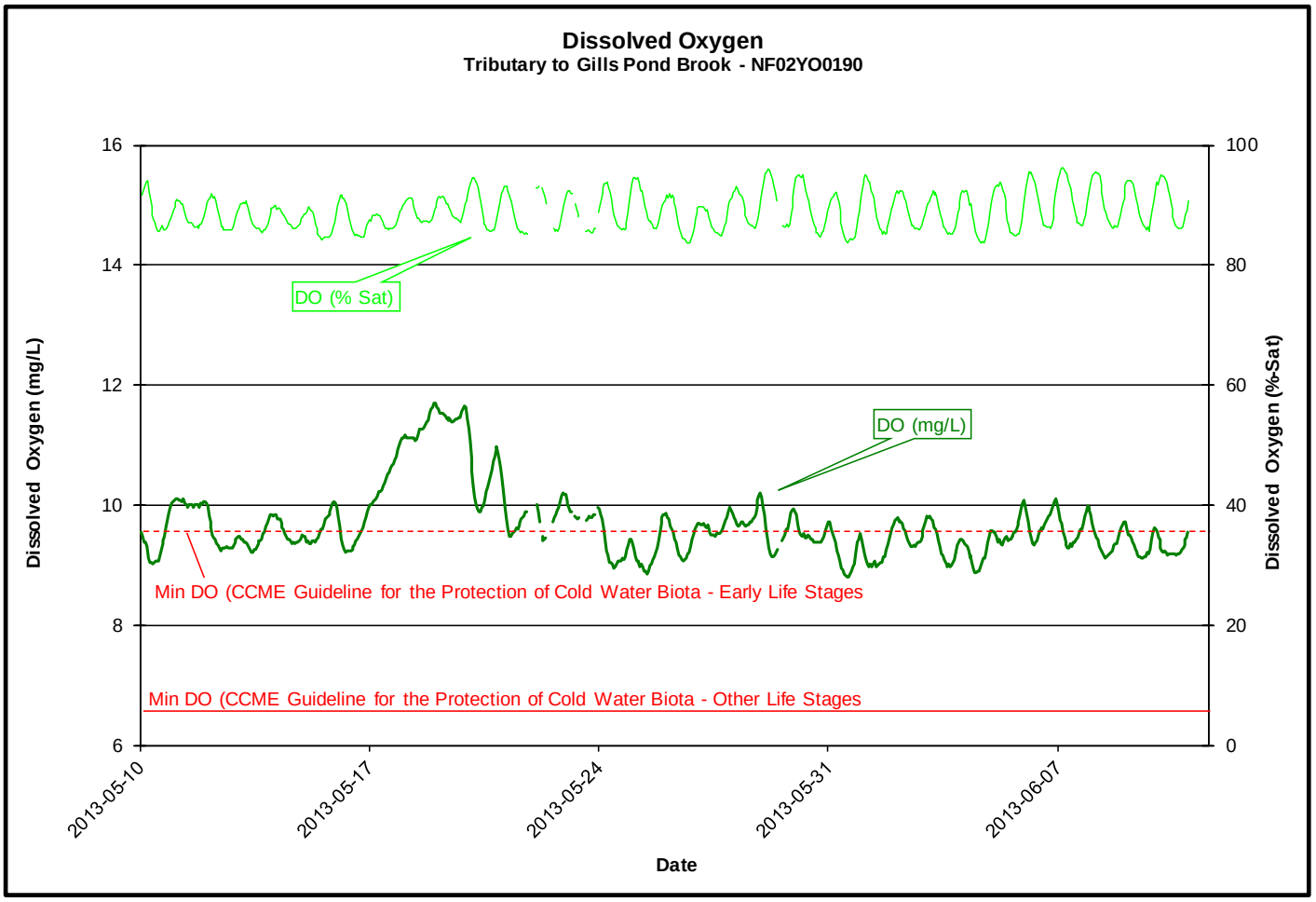


**Figure 4**

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 7.1 NTU.
- Based upon previous investigation, it has been determined that turbidity values may be artificially increased due to air entrainment during higher flows.
- All turbidity values including the minor turbidity spikes are likely due to air bubbles or natural in-stream debris passing over the sensor.
- Neither in-situ nor grab sample measurements nor visual observation indicated turbidity issues.

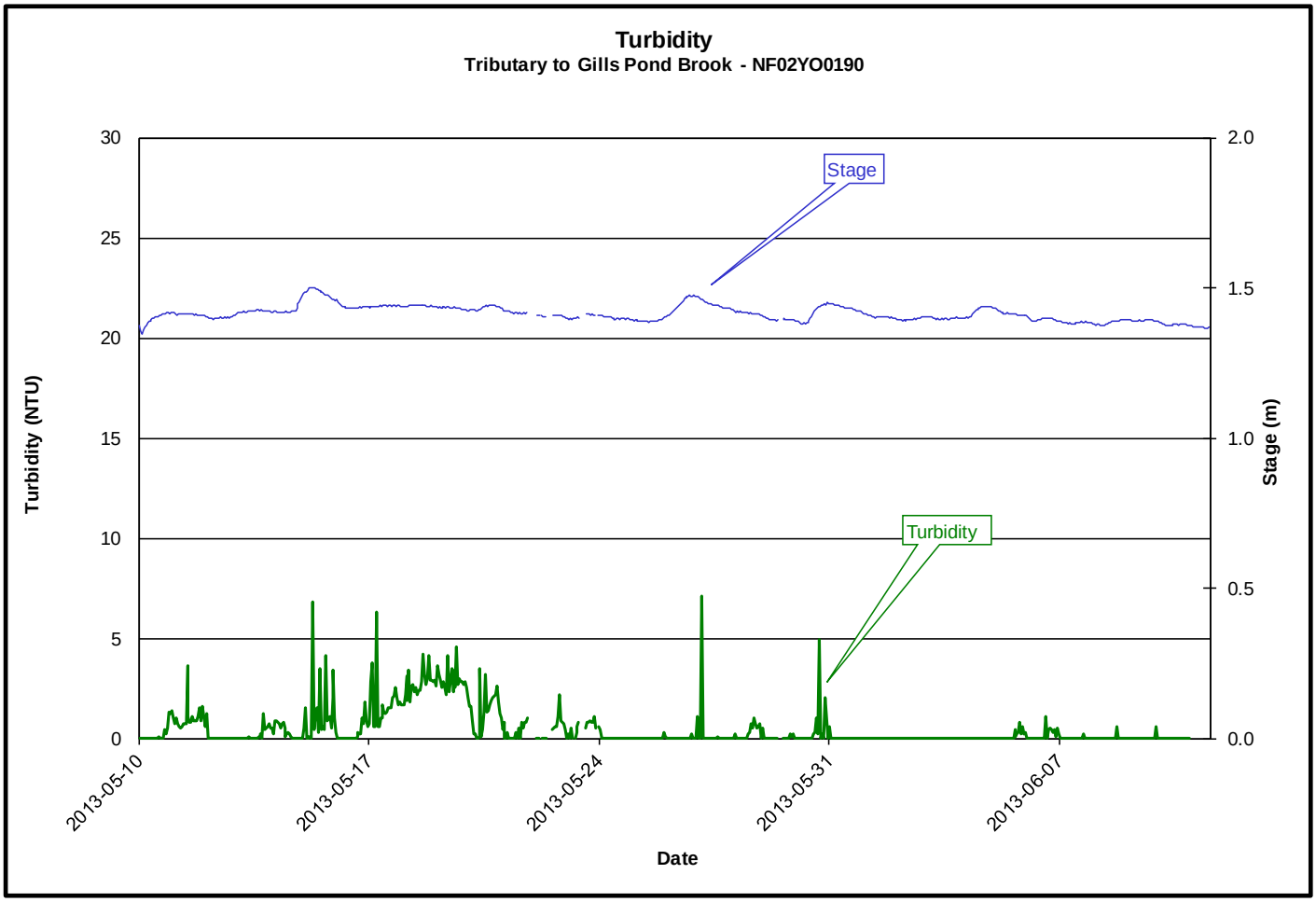


**Figure 5**

- The stage or water level ranged from a minimum of 1.35 m to a maximum of 1.50 m. The flow or discharge ranged from a minimum of 0.22 $m^3/s$ to a maximum of 1.04 $m^3/s$ (**Figure 6)**.
- The peaks in stage and flow are resultant from precipitation/runoff events.
- The rapid decrease in stage and flow at the onset of the deployment period is the result of when discharge was stopped or reduced, to facilitate calibration of the weir at Dam C (Polishing Pond).
- All values are within the normal range.

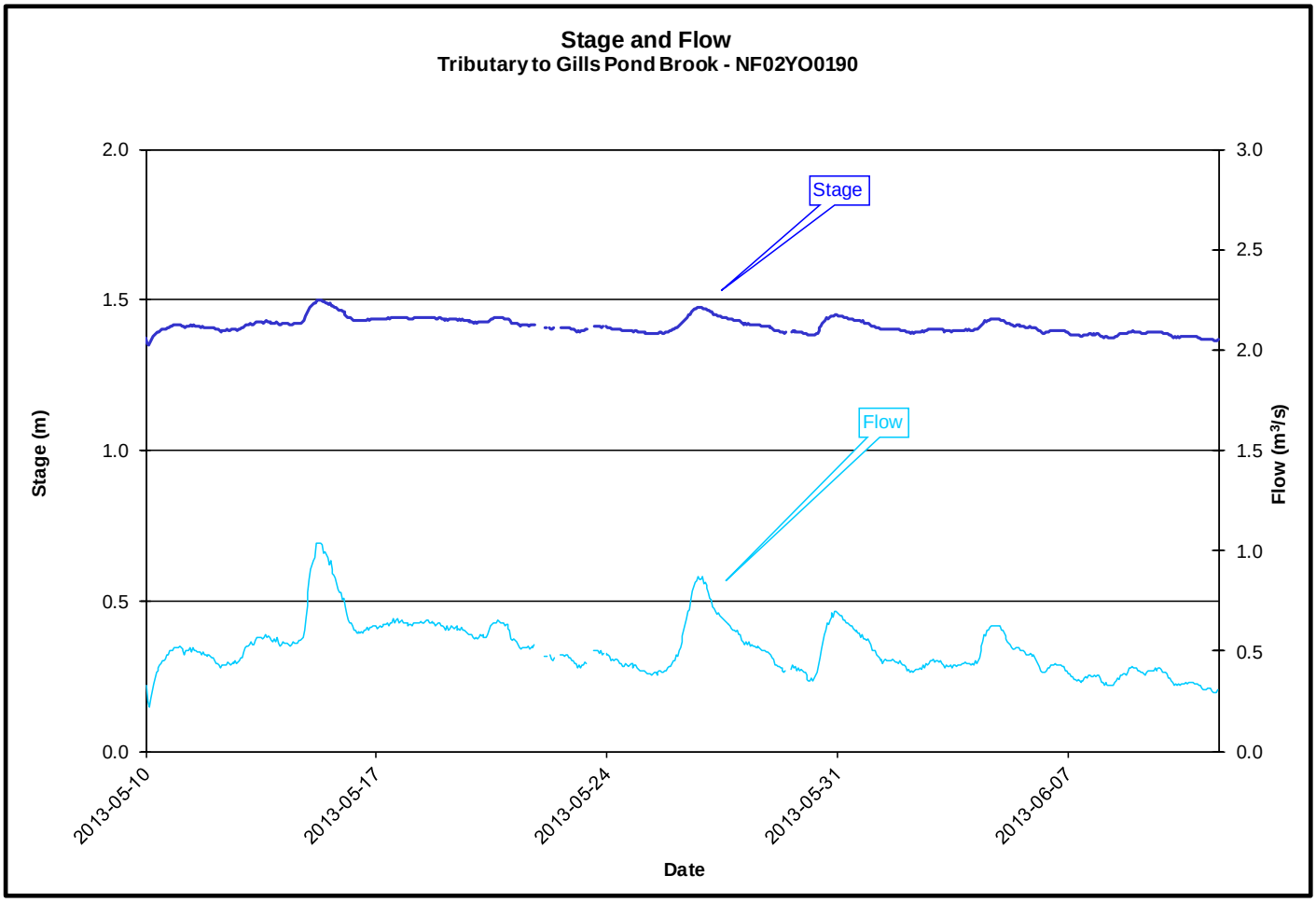


**Figure 6**

## EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 2.93 ˚C to a maximum of 17.90 ˚C.
- Temperature increased slightly over the deployment period.
- There appears to be little correlation with stage

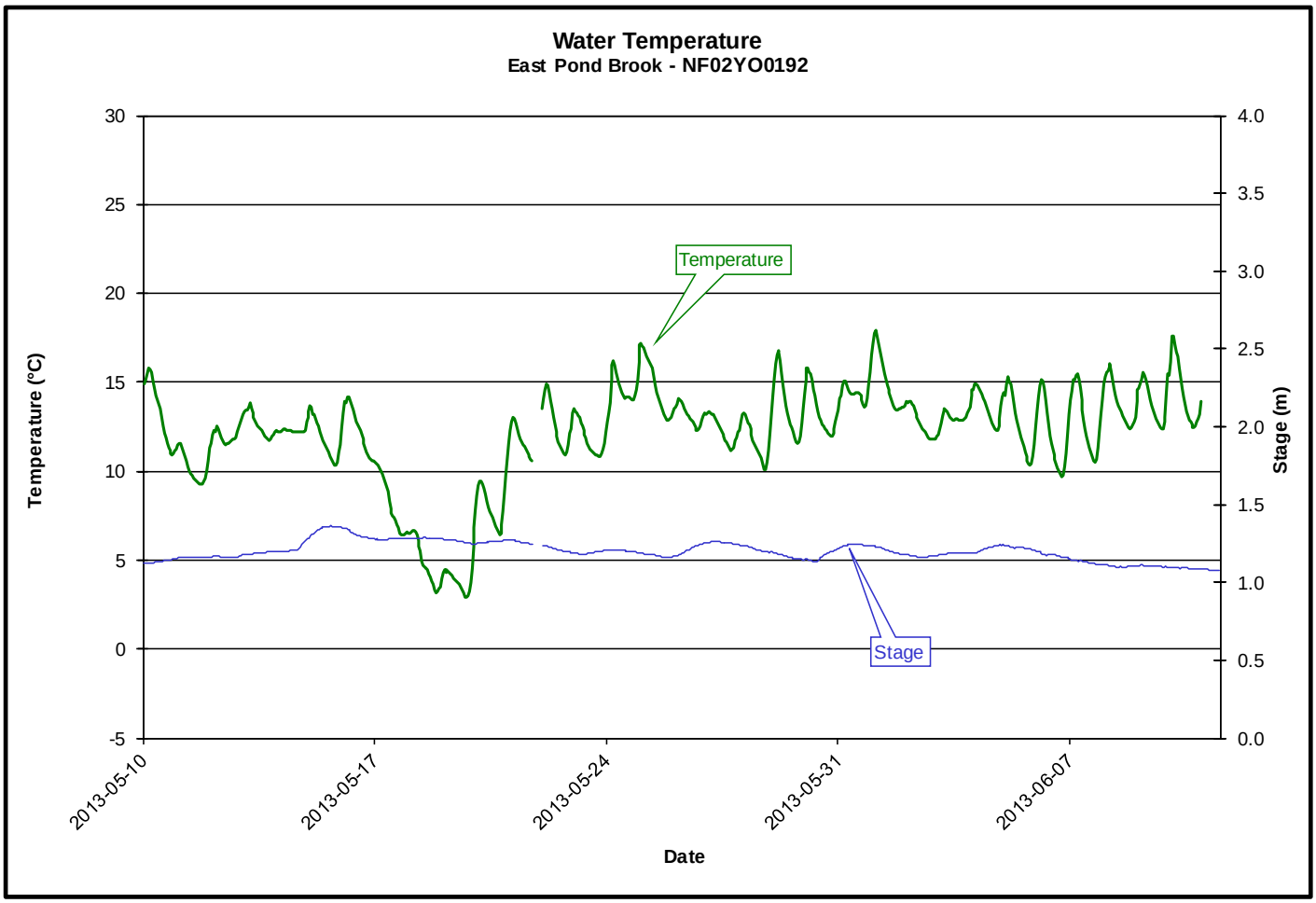


**Figure 7**

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 6.38 to a maximum of 6.78, with very little variation over the deployment period.
- pH values were all near 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, and values near and below the lower limit are not unusual.

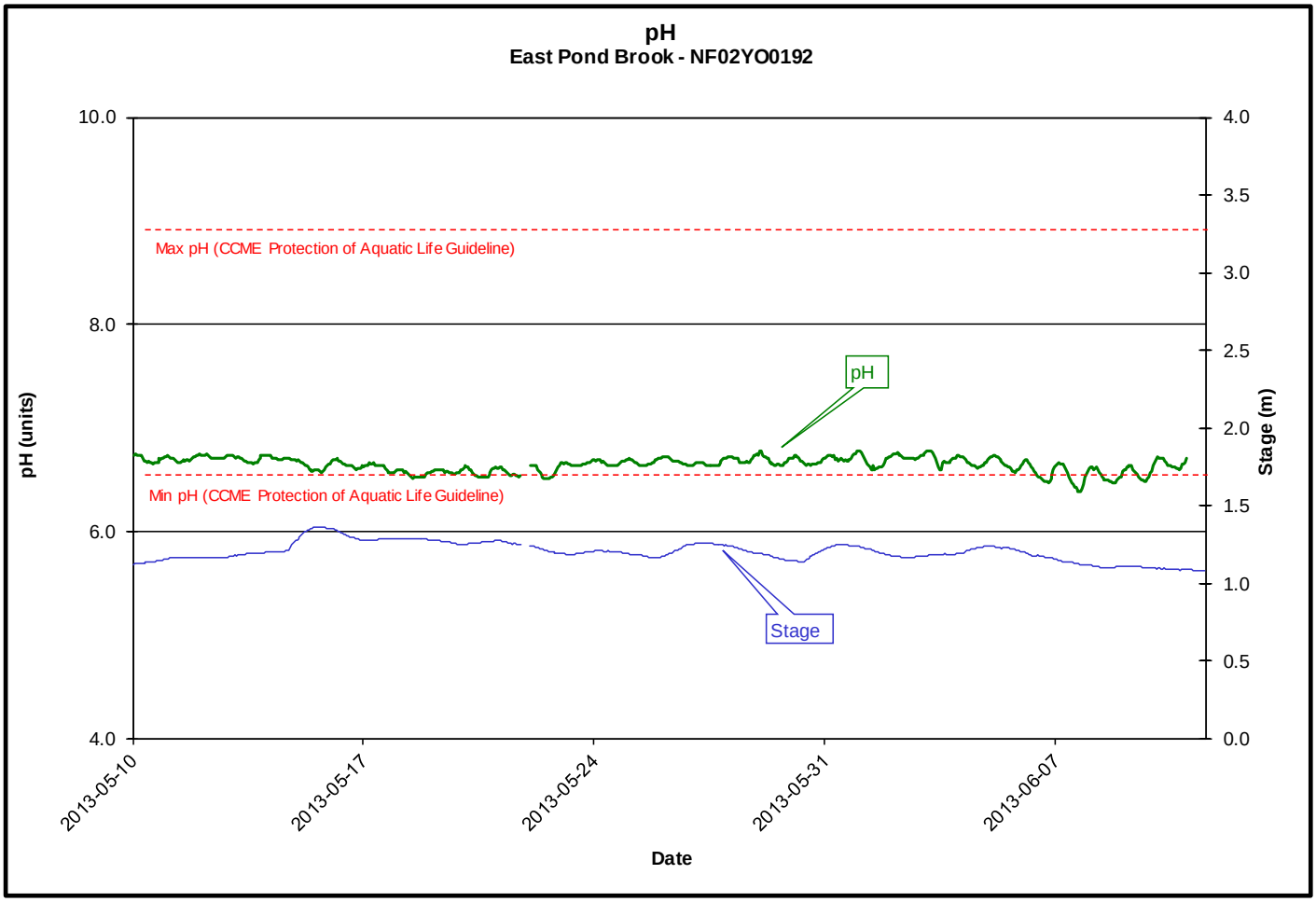


**Figure 8**

- The specific conductivity **(Figure 9)** ranged from a minimum of 18.3 µS/cm to a maximum of 31.5 µS/cm, with very little variation over the deployment period.
- There does not appear to be any correlation with stage.
- All values are within the normal range.

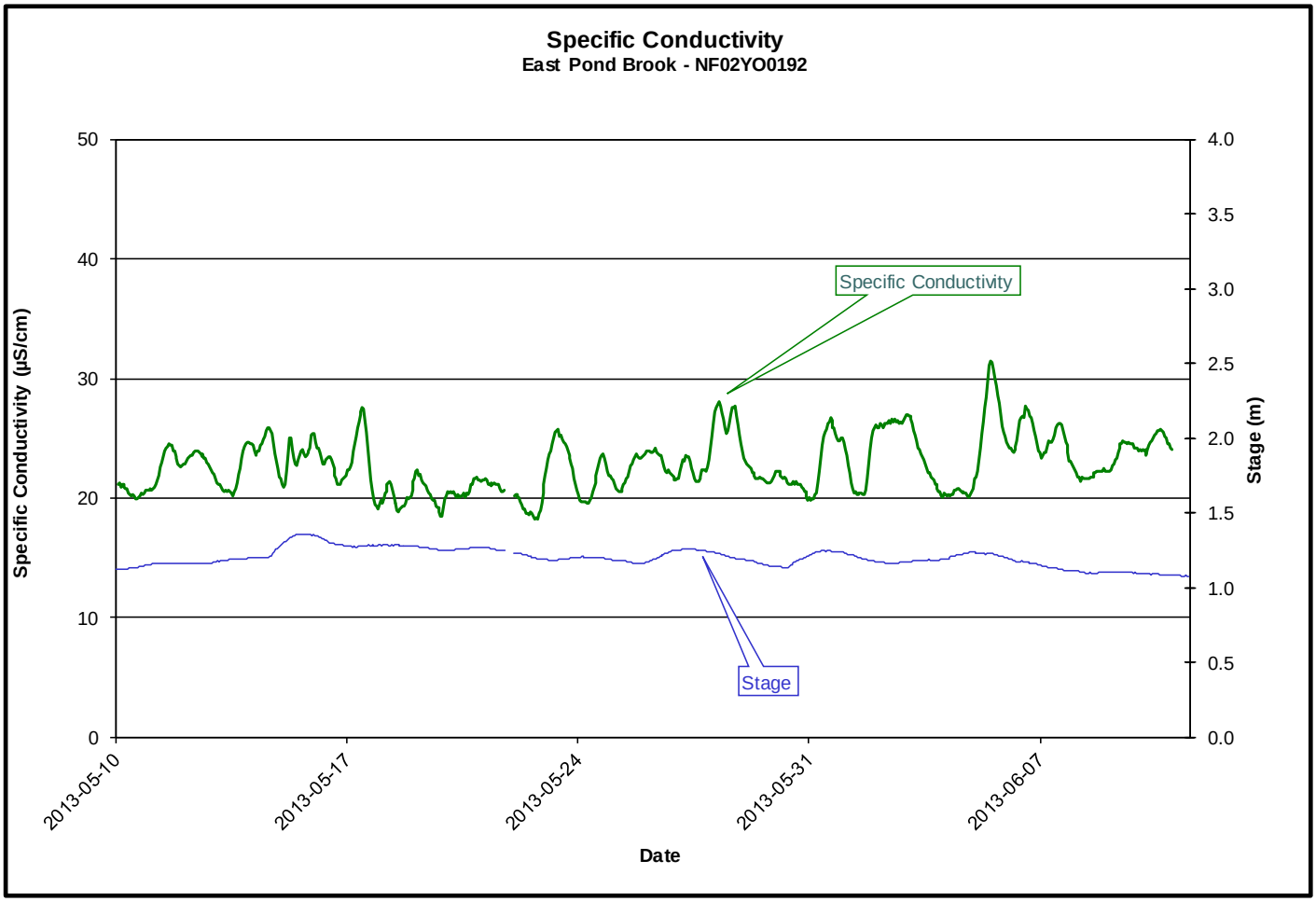


**Figure 9**

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 8.96 mg/L to a maximum of 12.55 mg/L over the deployment period, with the percent saturation ranging between 90.5 and 96.5.
- Dissolved oxygen is generally inversely proportional to water temperature.
- Throughout the deployment period, nearly all dissolved oxygen values fell above the upper 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).
- Based upon the fact that Dissolved Oxygen % Saturation had limited drift, we can be confident that the Dissolved Oxygen mg/L values are accurate.

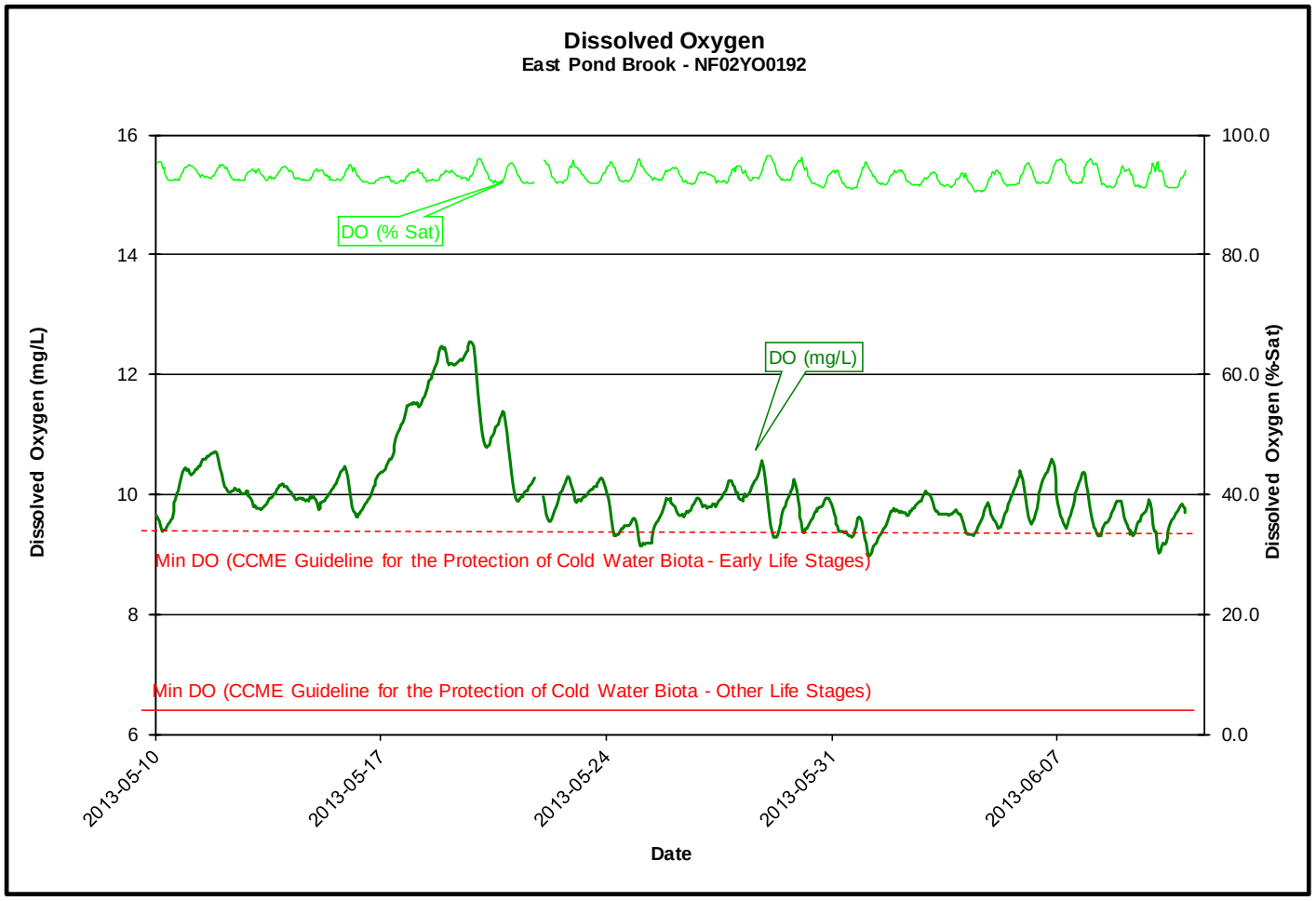


**Figure 10**

- The turbidity values (**Figure 11**) ranged from a minimum of 0.1 NTU to a maximum of 4.7 NTU.
- The values recorded by this particular sensor are slightly higher than have been typically recorded by other sensors used at this location. This anomaly will be investigated when the unit is next sent for performance testing and evaluation.
- Neither in-situ nor grab sample measurements nor visual observation indicated turbidity issues.

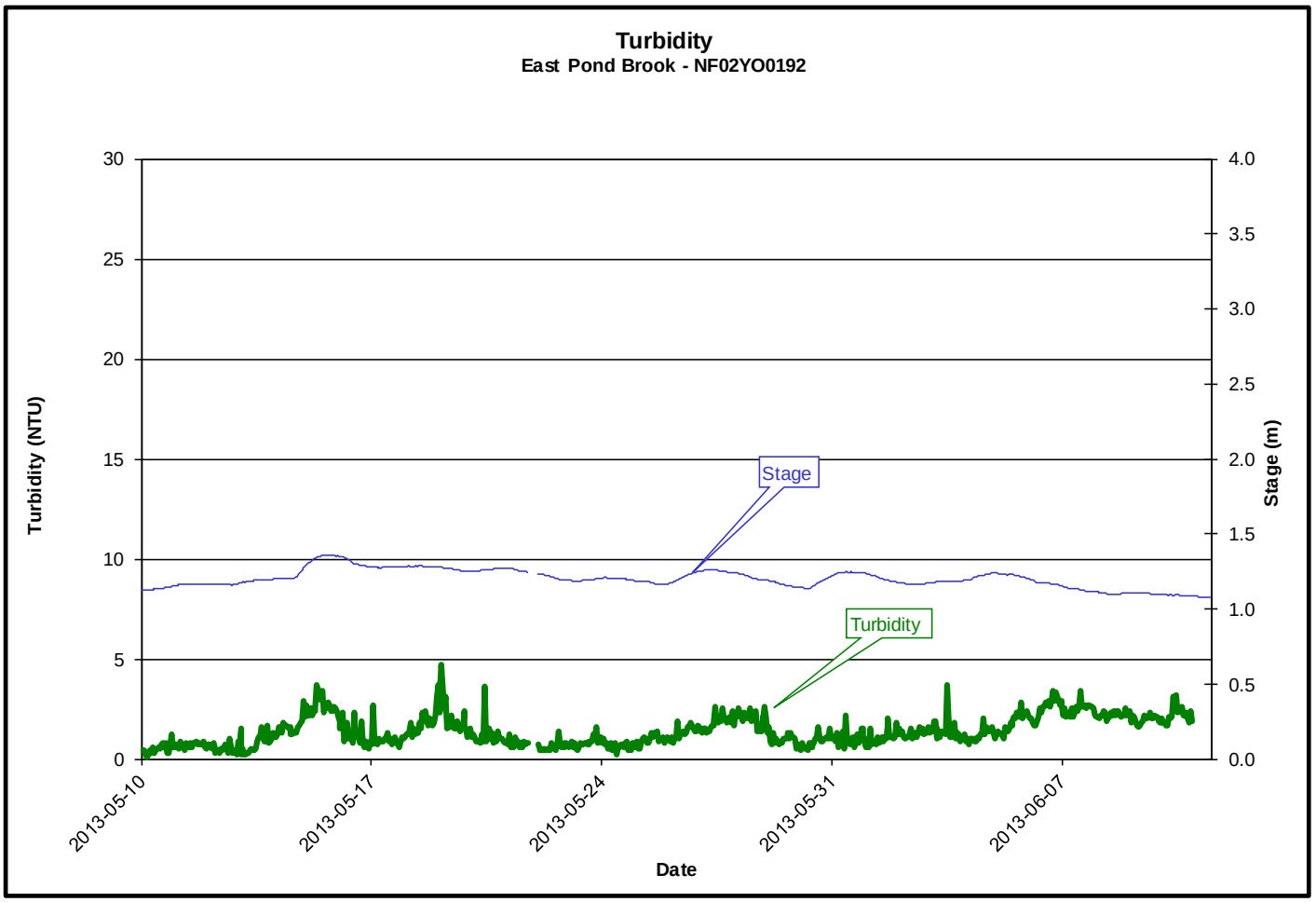


**Figure 11**

- The stage or water level ranged from a minimum of 1.08 m to a maximum of 1.36 m. The flow or discharge ranged from a minimum of 0.79 $m^3/s$ to a maximum of 3.66 $m^3/s$ **(Figure 12)**.
- Increases in stage and flow are attributed to precipitation/runoff events.
- All values for stage and flow are within the normal range.

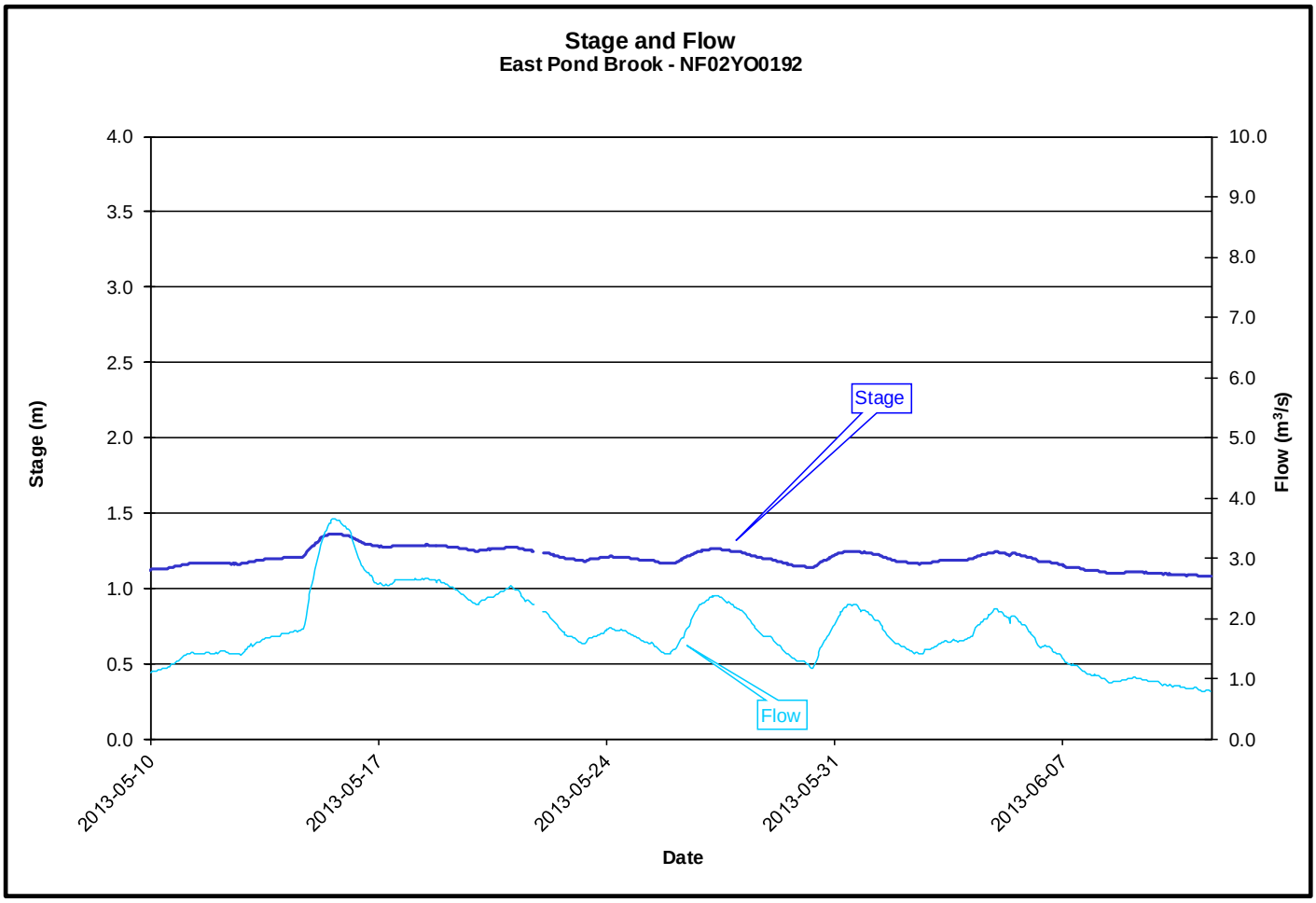


**Figure 12**

## WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 5.26 ˚C to a maximum of 5.47 ˚C with a slight decrease over the deployment period.
- The difference in temperature highlighted by the red ellipse is simply the difference in the accuracies of the two different instruments that were changed out on May 14, 2013. The difference amounts to 0.21 ˚C.
- There appears to be no correlation with water elevation.

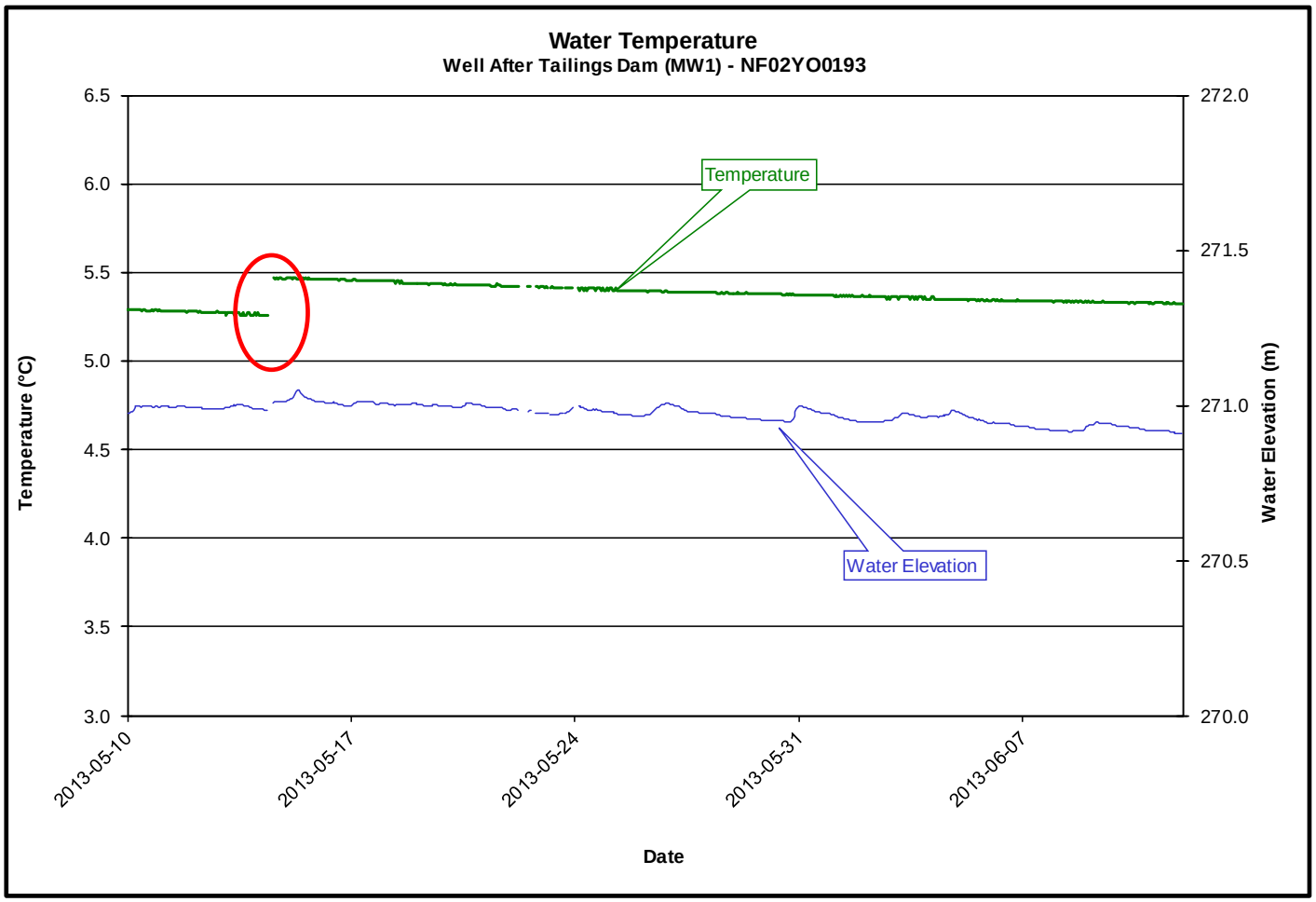


**Figure 13**

- The pH (**Figure 14**) ranged from a minimum of 7.60 to a maximum of 8.33 over the deployment period.
- The difference in pH on May 14, 2013 highlighted by the red ellipse is typical each time a Quanta G instrument is deployed in this well. It is assumed that this is due to the displacement of water in the well as the Sonde is deployed in the small diameter casing.
- The subsequent rapid increase in pH, followed by gradual increase is also typical. By the end of the deployment period, levels were very similar to those at the beginning.
- There does not appear to be any correlation with water elevation.

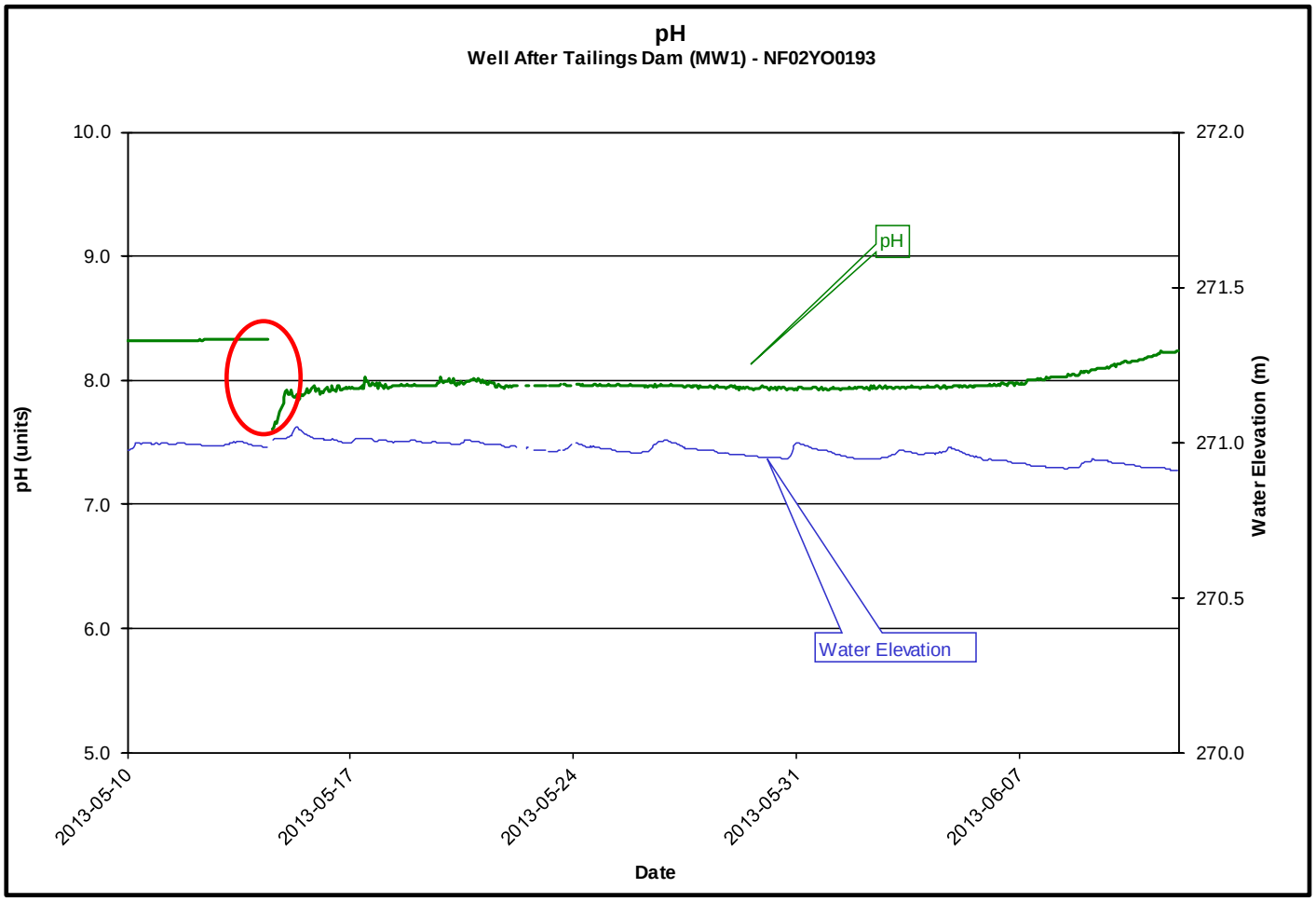


**Figure 14**

- The specific conductivity **(Figure 15)** ranged from a minimum of 0.706 mS/cm to a maximum of 0.727 mS/cm.
- There was a slight increase over the deployment period.
- There does not seem to be any correlation with water elevation.

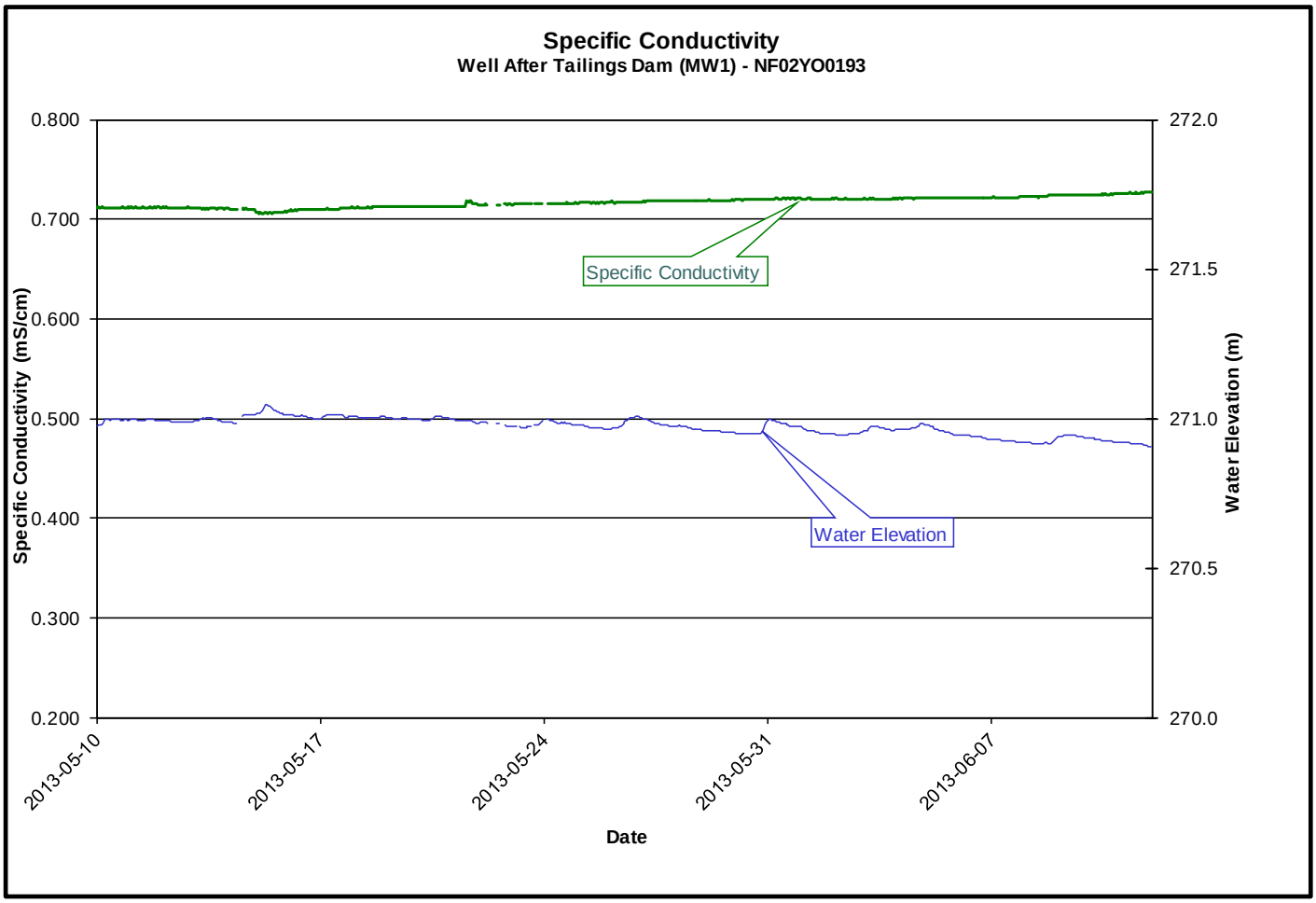


**Figure 15**

- The Water Elevation **(Figure 16)** ranged from a minimum of 270.91 m to a maximum of 271.05 m.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by runoff from precipitation.
- There was a slight difference (0.027 m) in the water elevation observed when the instruments were changed out on May 14, 2013. This may be due in part to water displacement during deployment and modest differences in the instruments' accuracy.

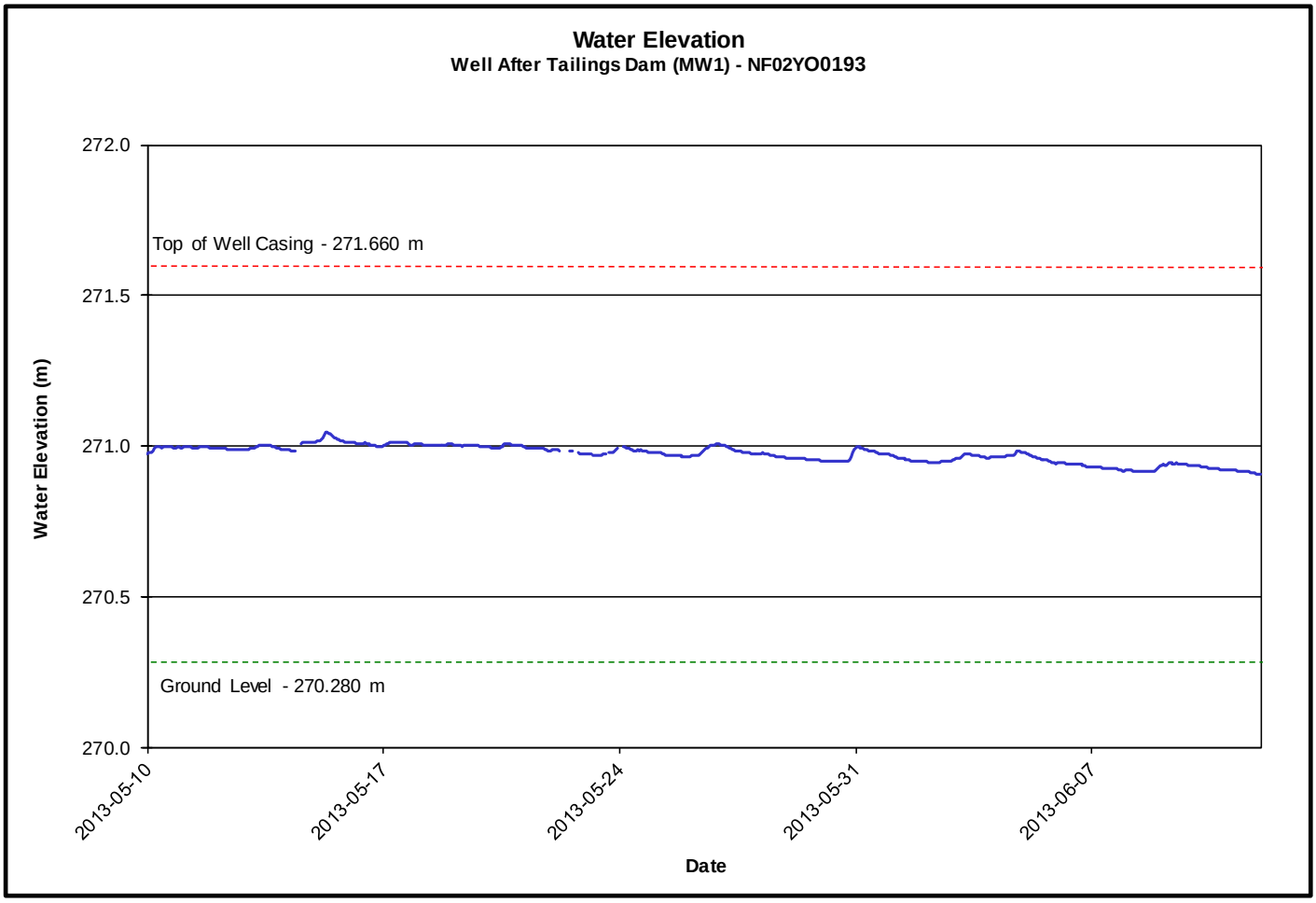


**Figure 16**

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