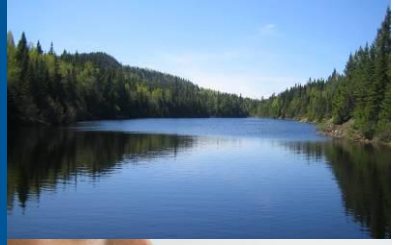




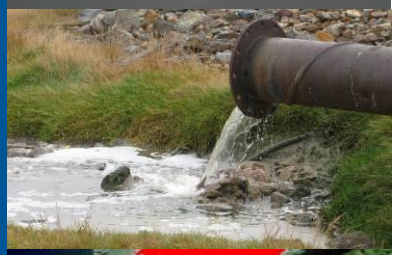


Real Time Water Quality Report
Teck Duck Pond Operations

Deployment Period 2013-11-14 to 2013-12-31

2014-01-03

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 most of the deployment period. There was a cessation in discharge from December 18, 2013 to December 31, 2013, the end of the reporting period.

Maintenance and Calibration of Instrumentation

- **DataSonde®**(s/n 43245) was deployed in Tributary to Gills Pond Brook on November 14, 2013 after being cleaned and freshly calibrated, and will remain deployed continuously until ice and water level conditions allow for its removal in the spring of 2014. This report covers the period from November 14, 2013 to December 31, 2013; a 47 day period.
- **DataSonde®**(s/n 43794) was deployed in East Pond Brook on November 14, 2013 after being cleaned and freshly calibrated, and will remain deployed continuously until ice and water level conditions allow for its removal in the spring of 2014. This report covers the period from November 14, 2013 to December 31, 2013; a 47 day period.
- The regular **MiniSonde®** (s/n 47591) was used for QA/QC purposes during the installation of the instruments. It too, was cleaned and freshly calibrated prior to each use.
- **Quanta G®** (s/n 00653) was deployed on November 13, 2013 and will remain deployed continuously in Monitoring Well After Tailings Dam Station (MW1), until the well thaws in the spring of 2014. This report covers the period from November 14, 2013 to December 31, 2013; a 47 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 installation at the beginning of the deployment period is shown in **Table 2** for Tributary to Gill's Pond Brook and **Table 3** for East Pond Brook. As the instruments remain deployed, no ranking can yet be determined for the removal.
- Because the deployment set-up for Well After Tailings Dam (MW1) is different, comparison with another instrument is not possible. In this case, a grab sample is usually collected at the beginning and end of the deployment period, and the ranking is calculated for pH and Specific Conductivity based upon live data and laboratory data. Ranking data for the beginning of the deployment period is documented in a previous report. As the instrument remains deployed, no ranking can yet be determined for the removal.
- 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**
2013-11-14 Installation	Temp (^{o}C)	Good
	pH (units)	Good
	Sp. Conductivity (µS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent

Table 2

East Pond Brook Station (NF02YO0192)		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2013-11-14 Installation	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (µS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent

Table 3

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of -0.45˚C to a maximum of 5.10˚C.
- The temperature generally decreased over the deployment period to remain constant near freezing for the last several days.

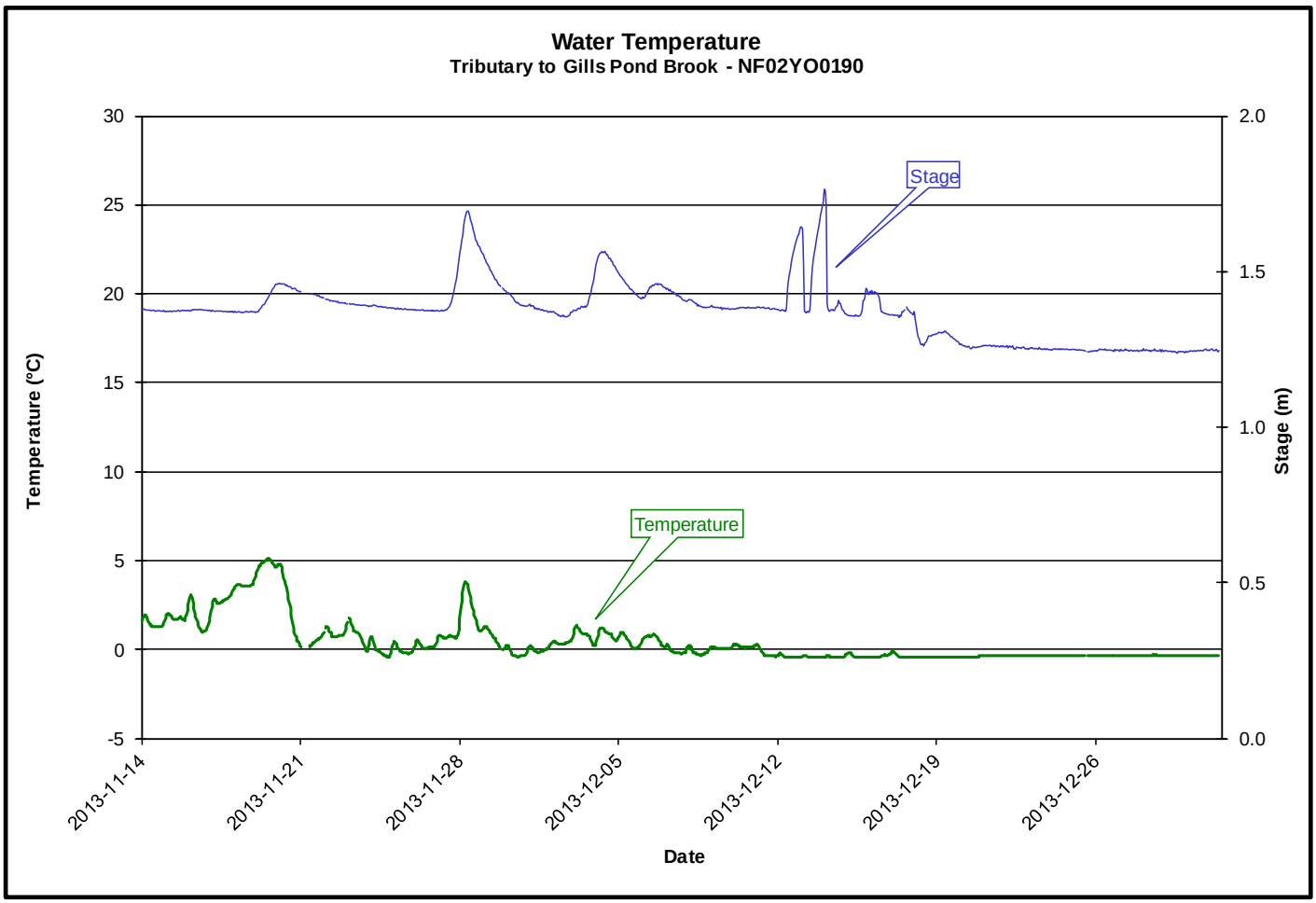

Figure 1

- Throughout the deployment period, pH values (**Figure 2**) ranged from a minimum of 6.14 to a maximum of 7.34 with most values within the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- pH decreased slightly following cessation of discharge from Polishing Pond on December 18, 2013.
- An inverse relationship with stage is obvious over several events during the deployment period.
- The background pH of this stream is normally around the lower limit of the recommended range, and is generally higher during periods of discharge from Polishing Pond.

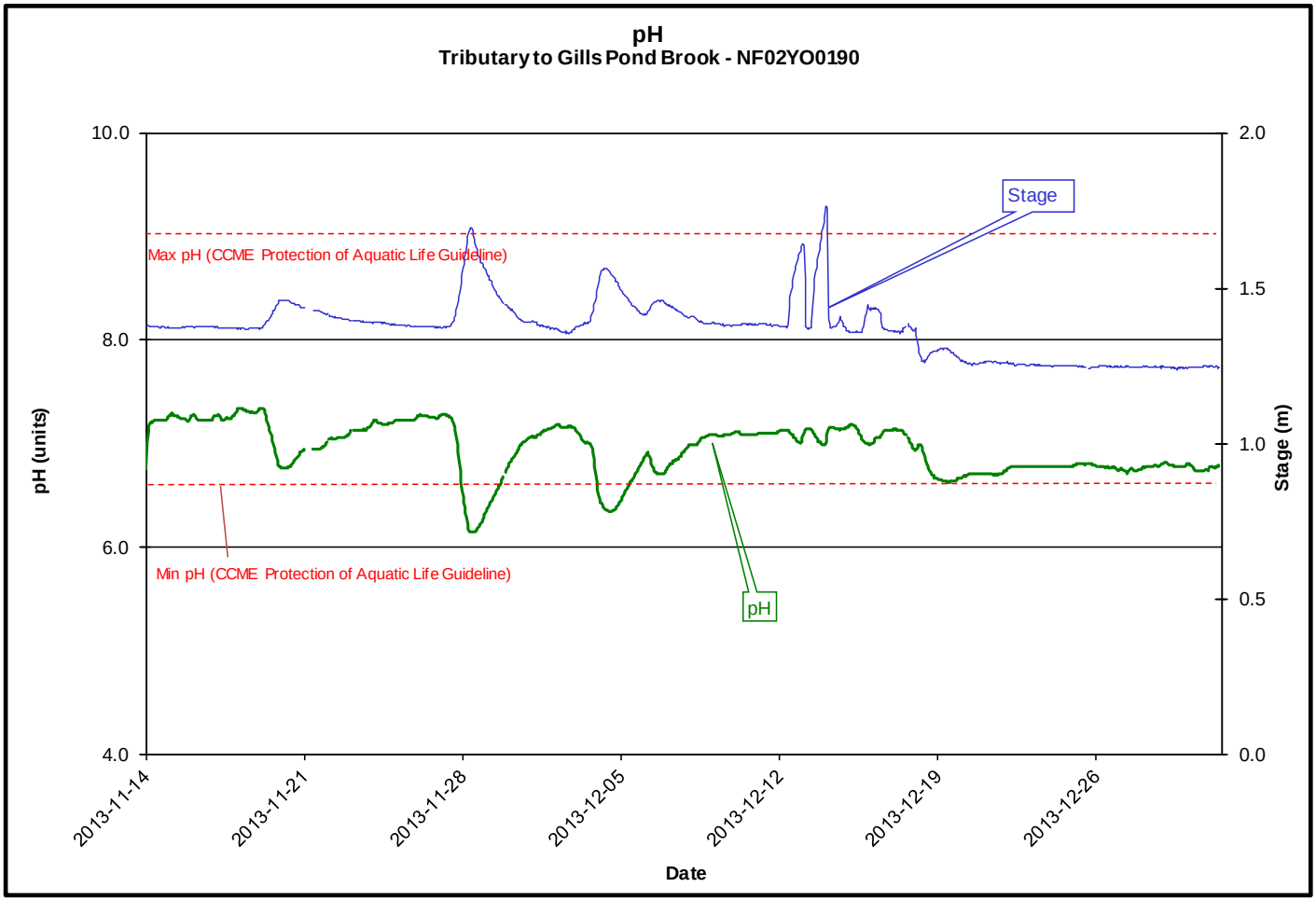

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 73.6µS/cm to a maximum of 1085.0 µS/cm over the deployment period.
- The cessation in discharge from the Polish Pond on December 18, 2013 resulted in the stream's specific conductance returning to near natural background levels.
- An inverse relationship with stage is obvious over several events during the deployment period, when precipitation events effectively caused a dilution effect in the stream's specific conductivity, which was elevated from natural background levels due to discharge from the Polishing Pond.

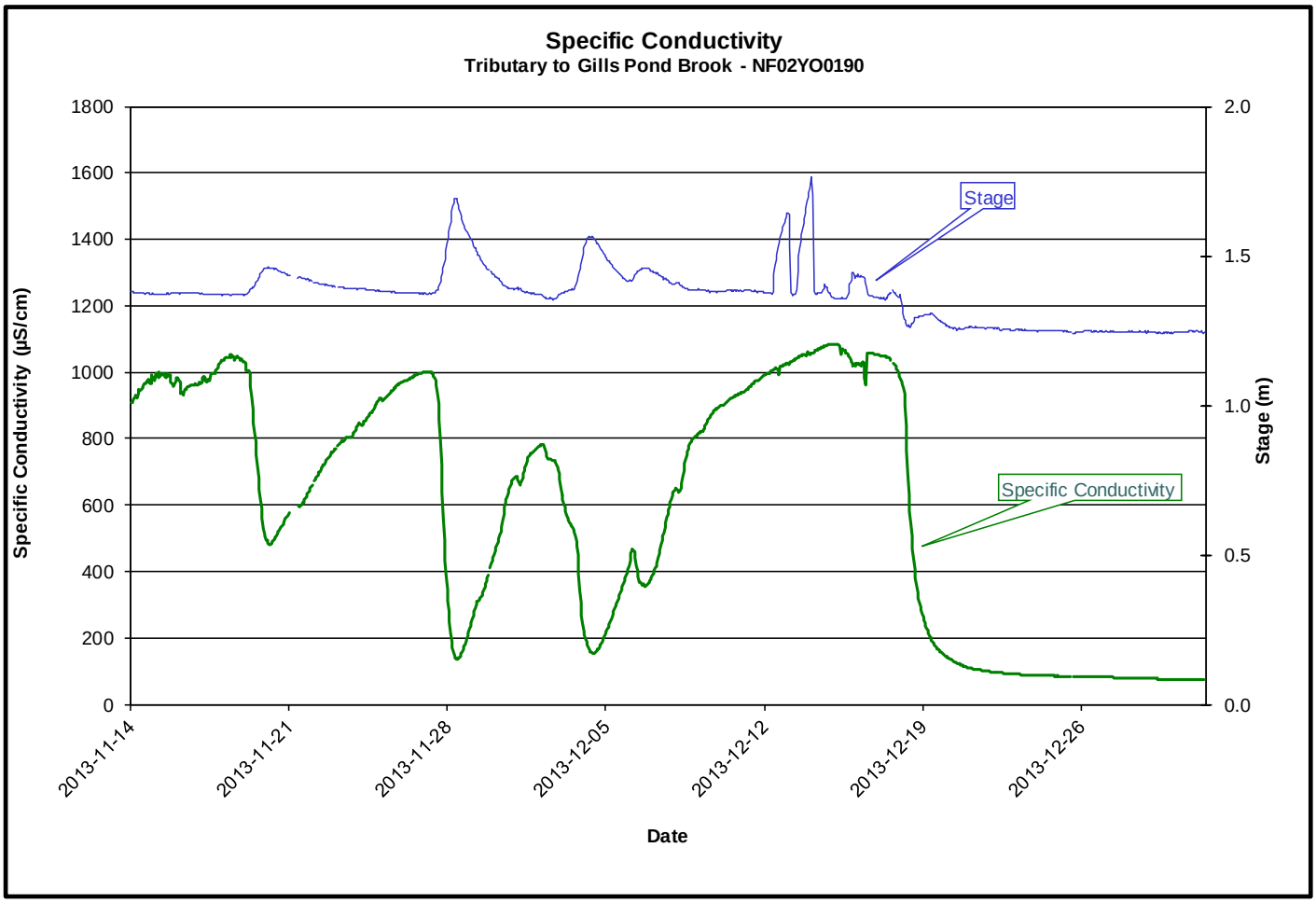

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 11.31 mg/L to a maximum of 13.75 mg/L over the deployment period, with the percent saturation ranging between 82.1 and 96.1.
- Dissolved oxygen (mg/L) rose slightly over the deployment period.
- All of the dissolved oxygen values fell above the minimum for Early Life Stages (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). This range is typical based upon water temperatures.
- 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.

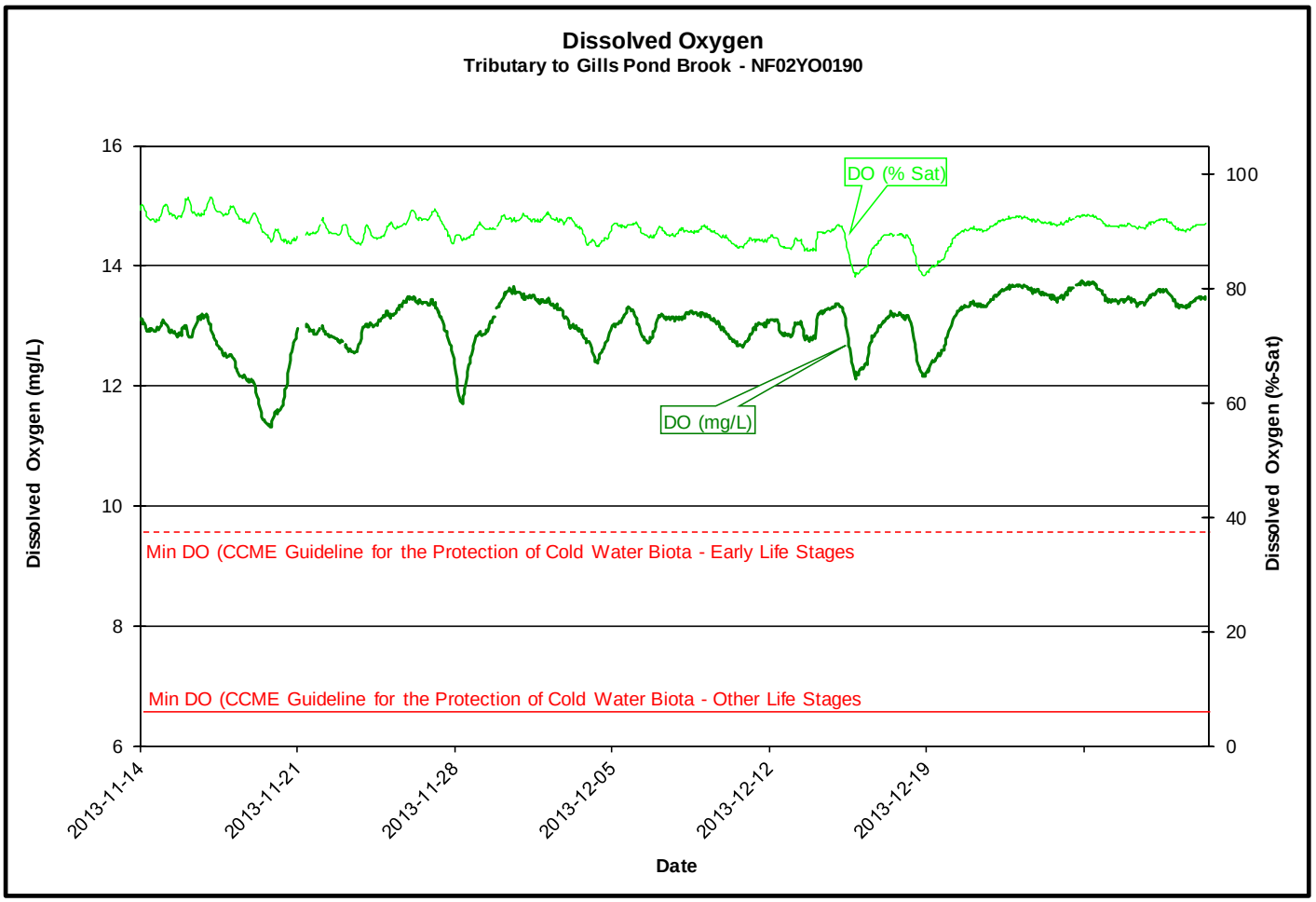

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 411.0 NTU.
- The highest peaks in turbidity were recorded during peaks in stage.

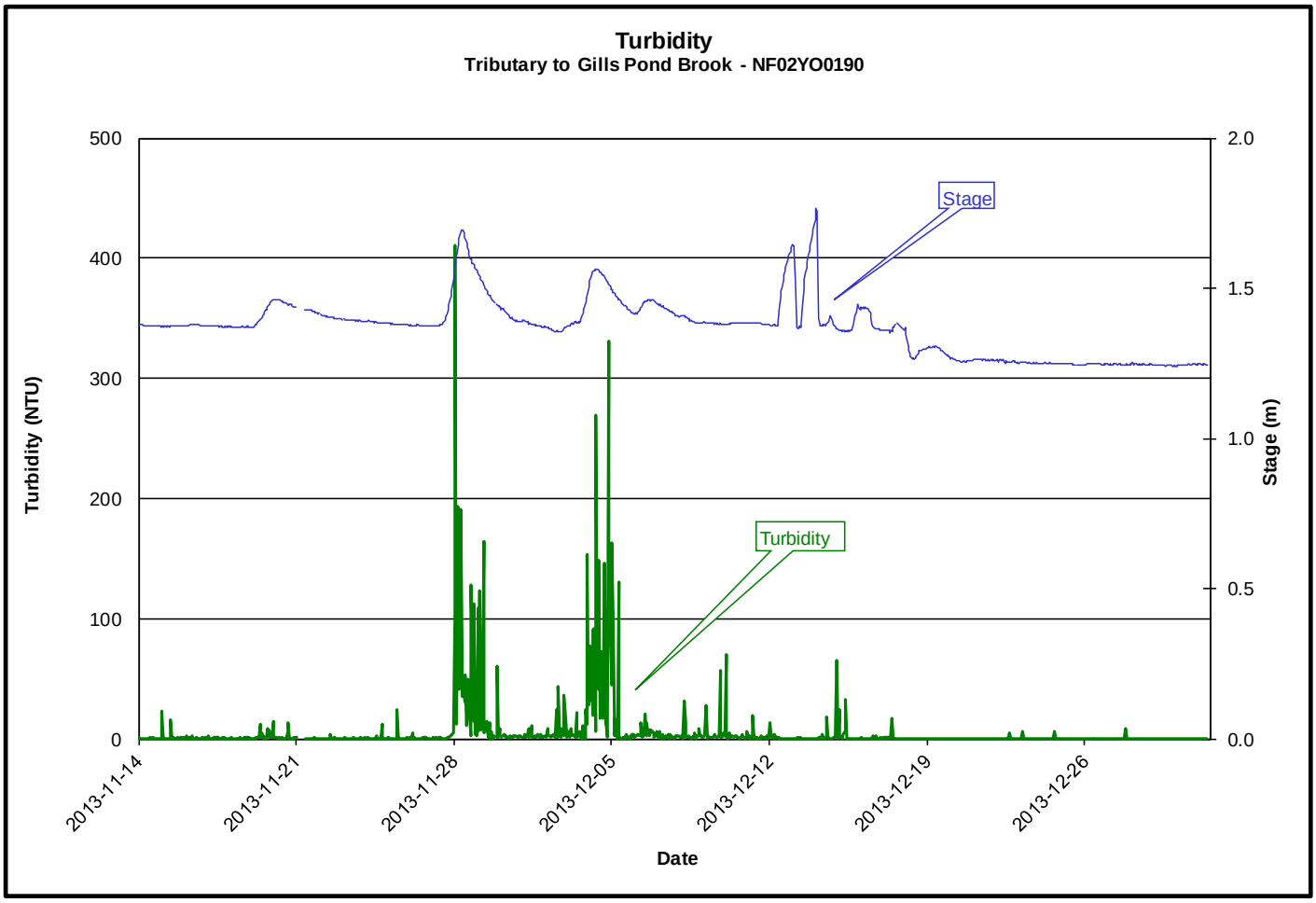

Figure 5

- The stage or water level ranged from a minimum of 1.24 m to a maximum of 1.76 m. The flow or discharge ranged from a minimum of 0.03 m^3/s to a maximum of 2.44 m^3/s (**Figure 6)**.
- The reduction in stage and flow following cessation of discharge from Polishing Pond on December 18, is obvious, as are the changes in stage and flow are resultant from precipitation/runoff events.
- All values are within the normal range.

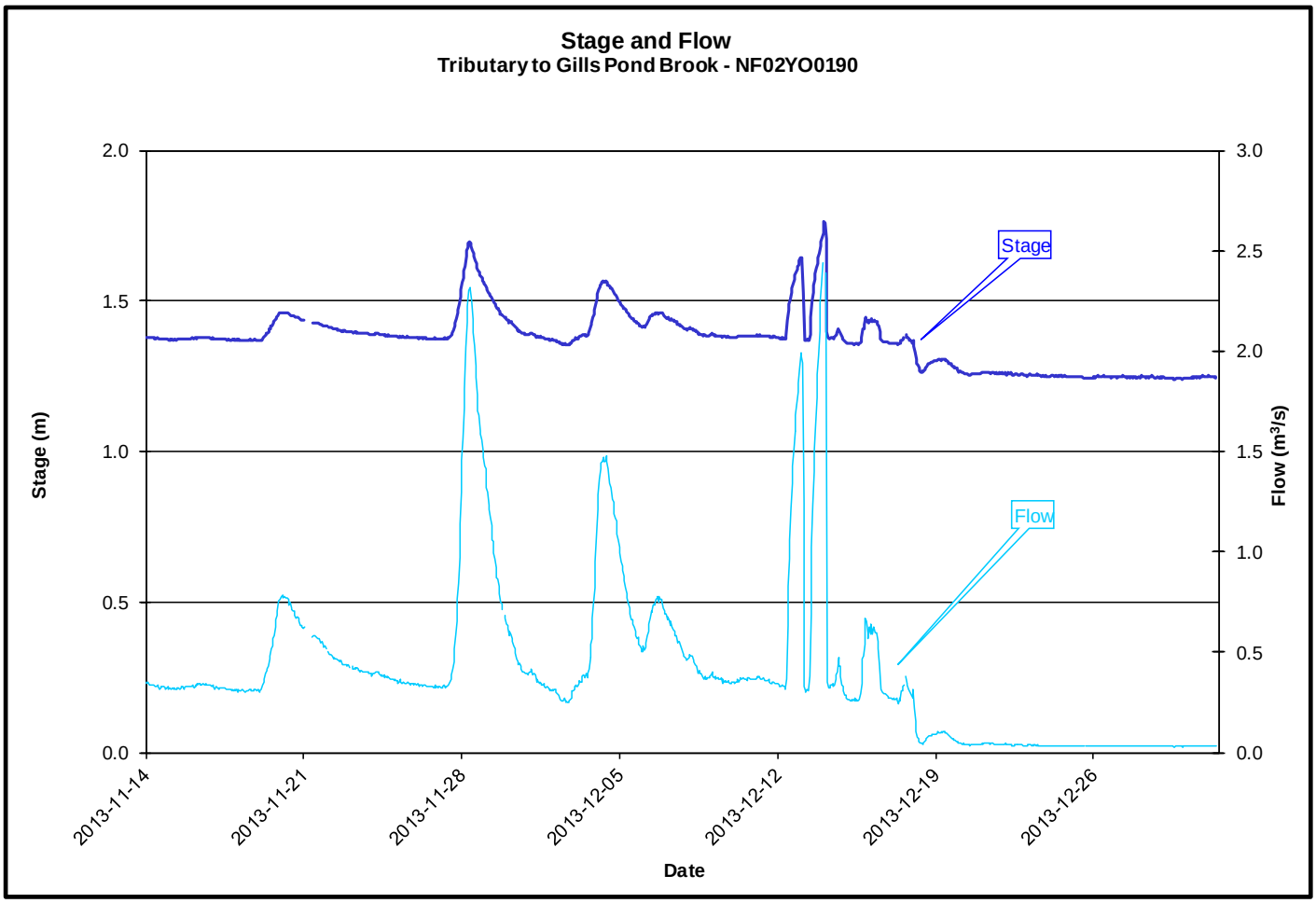

Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 0.03 ˚C to a maximum of 5.74 ˚C.
- The temperature generally decreased over the deployment period, to remain constant near zero from the first week of December onward.
- In three instances near the beginning of the deployment period water temperature increased during peaks in runoff. This is likely due to the nature of the weather system passing through.

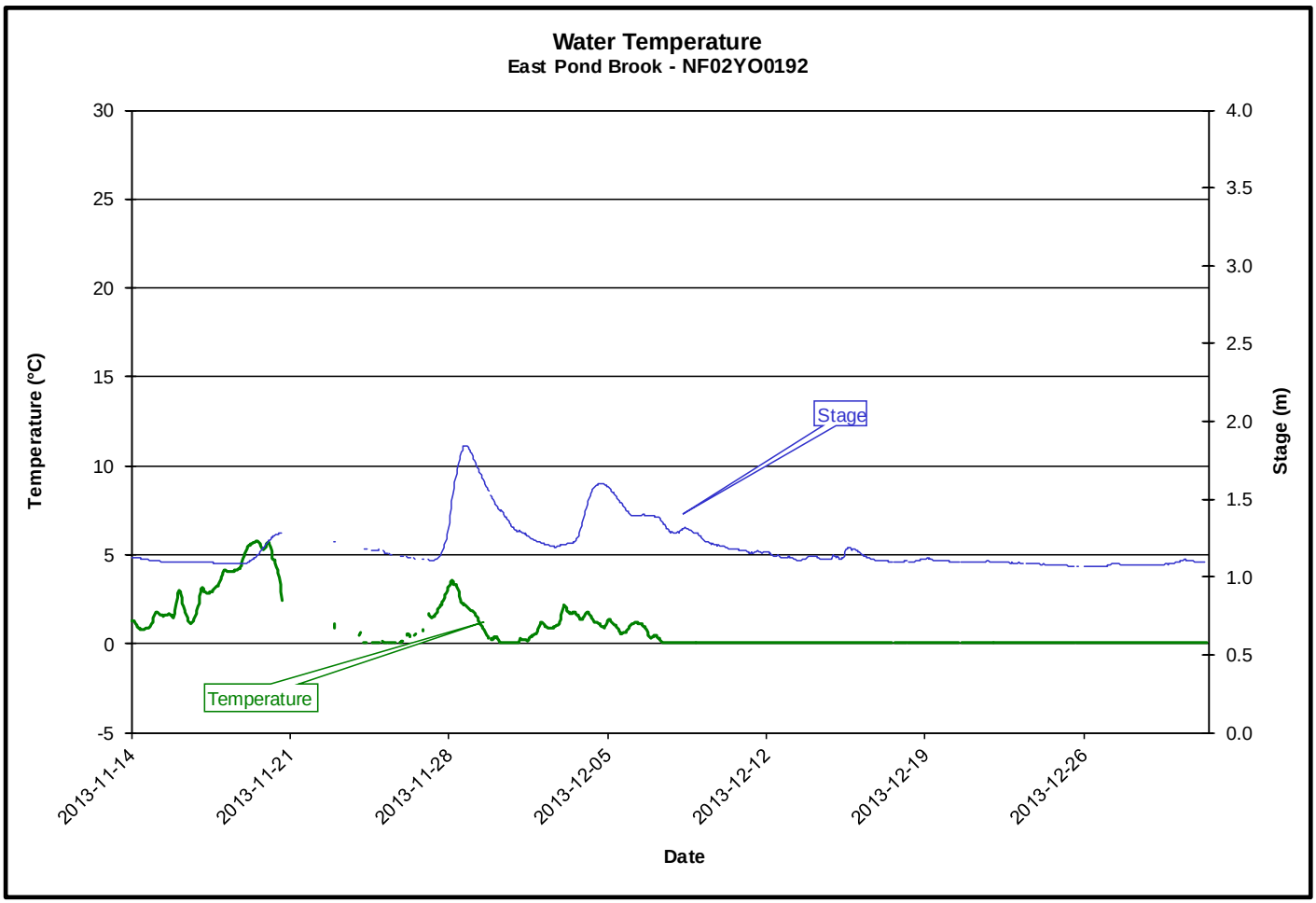

Figure 7

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 5.87 to a maximum of 6.86, with a slight decrease over the deployment period.
- An inverse relationship with stage is obvious over much of the deployment period.
- For most of the deployment period, pH values were 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*.
- The background pH of this stream is normally quite low, and values near and below the lower limit are not unusual.

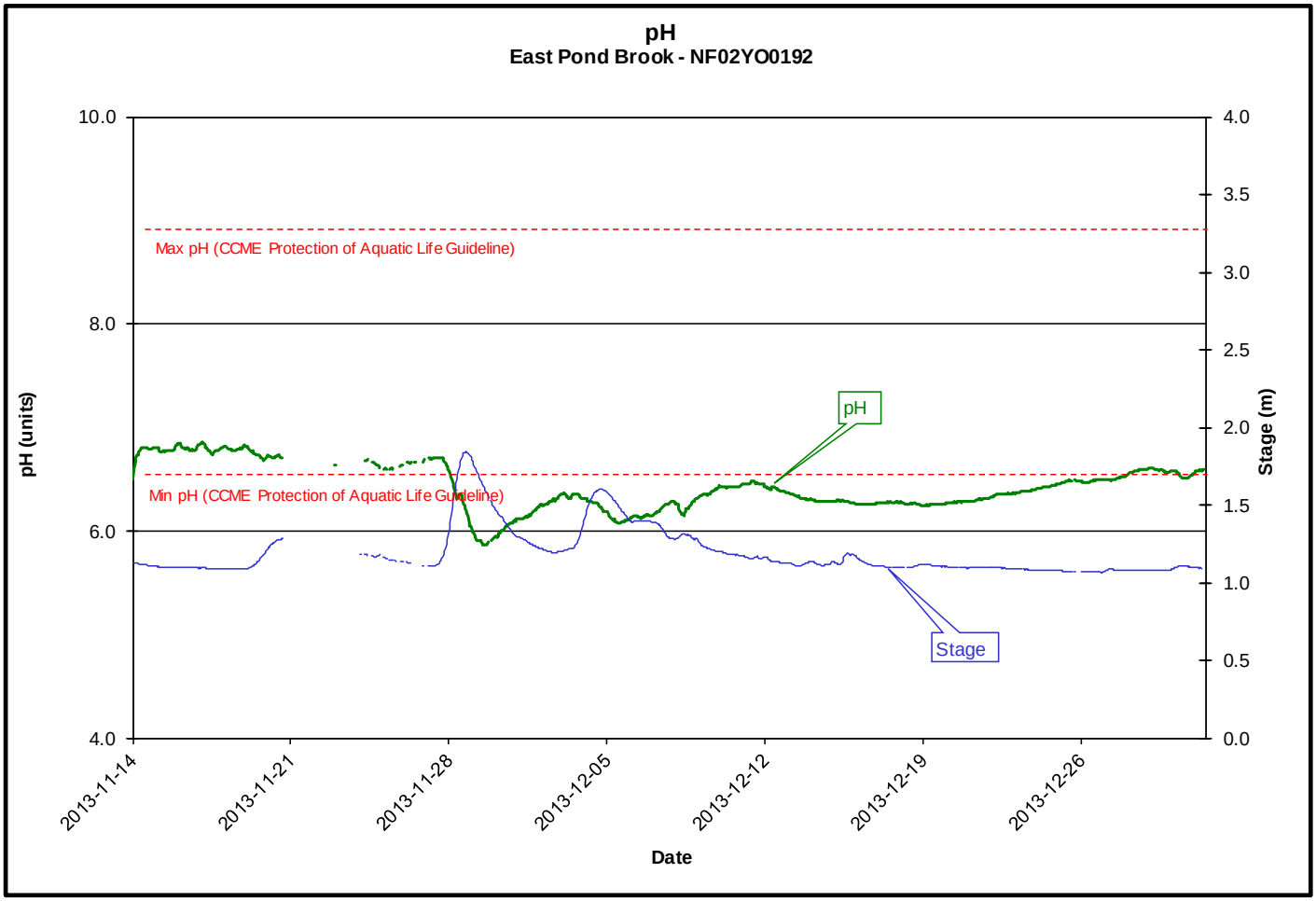

Figure 8

- The specific conductivity **(Figure 9)** ranged from a minimum of 12.8 µS/cm to a maximum of 29.4 µS/cm.
- There was a slight increase over the deployment period.
- All values are within the normal range.

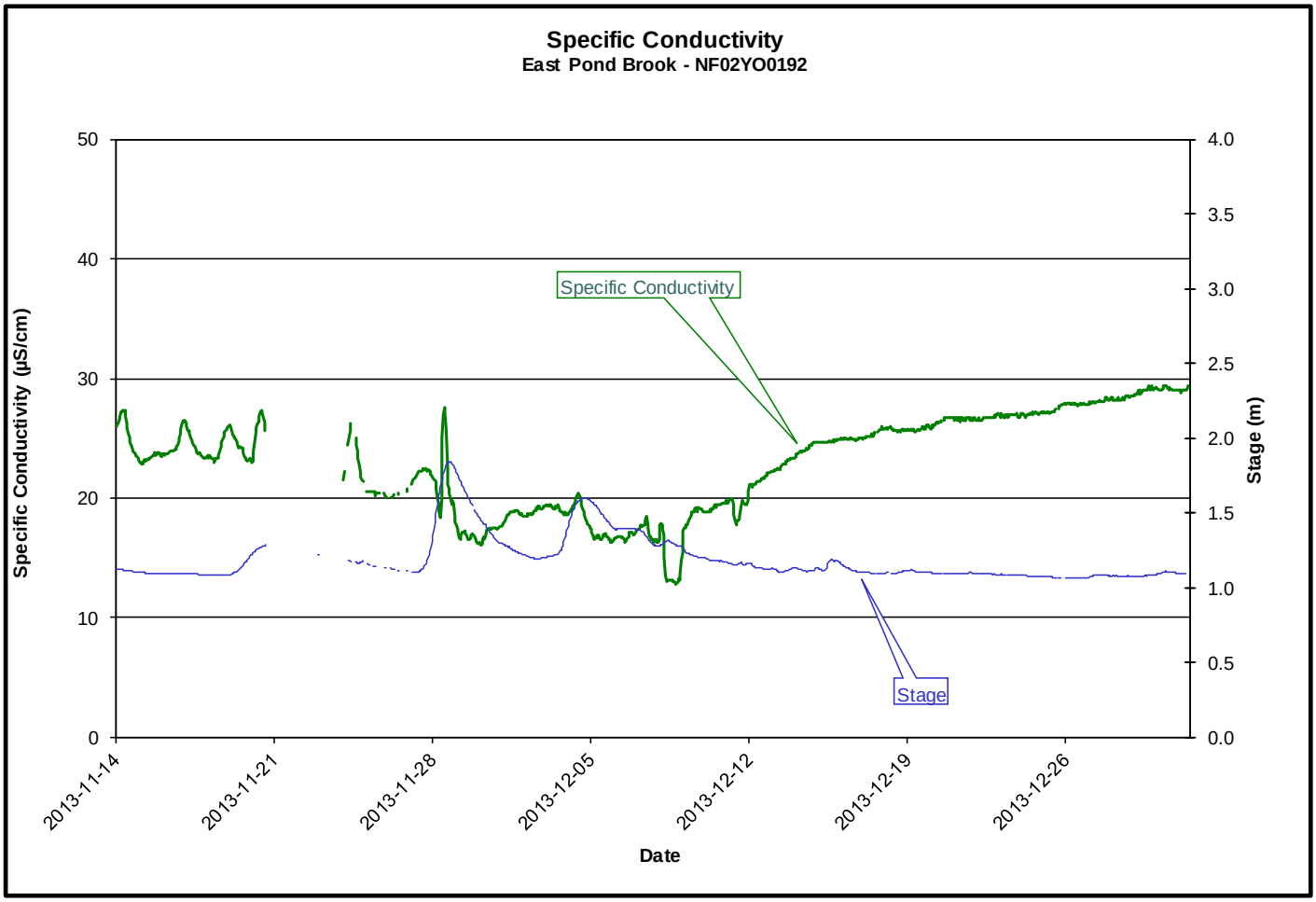

Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 11.71 mg/L to a maximum of 14.03 mg/L over the deployment period, with the percent saturation ranging between 81.6 and 97.8.
- There was little change in dissolved oxygen (mg/L) over the deployment period.
- All of the dissolved oxygen values fell above the minimum for Early Life Stages (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). This range is typical based upon water temperatures.
- Based upon the fact that Dissolved Oxygen % Saturation had limited drift, we can be confident that the Dissolved Oxygen mg/L values are accurate.

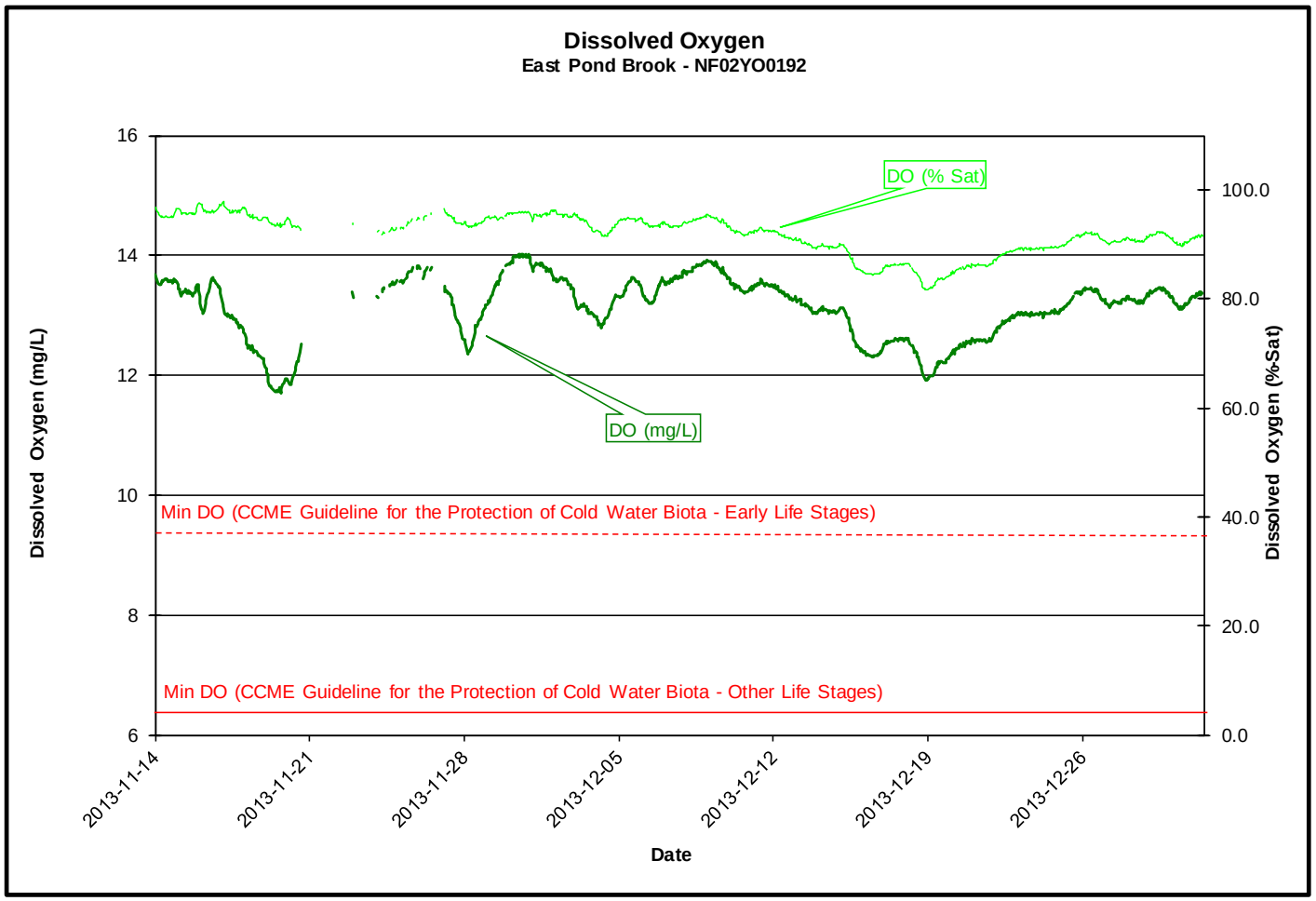

Figure 10

- The turbidity values (**Figure 11**) ranged from a minimum of 0.0 NTU to a maximum of 40.0 NTU.
- Most of the peaks in turbidity corresponded to increased stage.

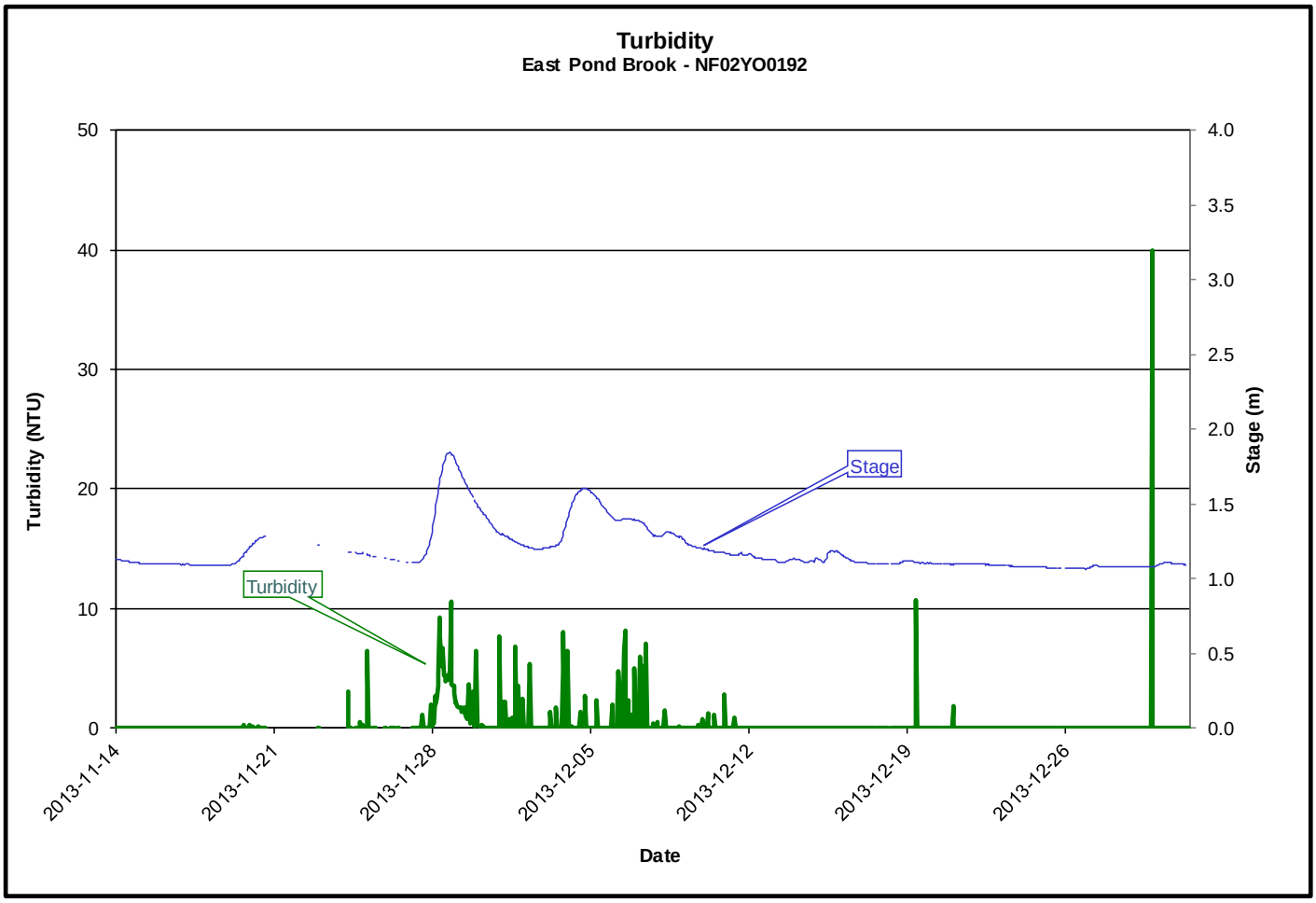

Figure 11

- The stage or water level ranged from a minimum of 1.06 m to a maximum of 1.84 m. The flow or discharge ranged from a minimum of 0.72 m^3/s to a maximum of 11.6 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.

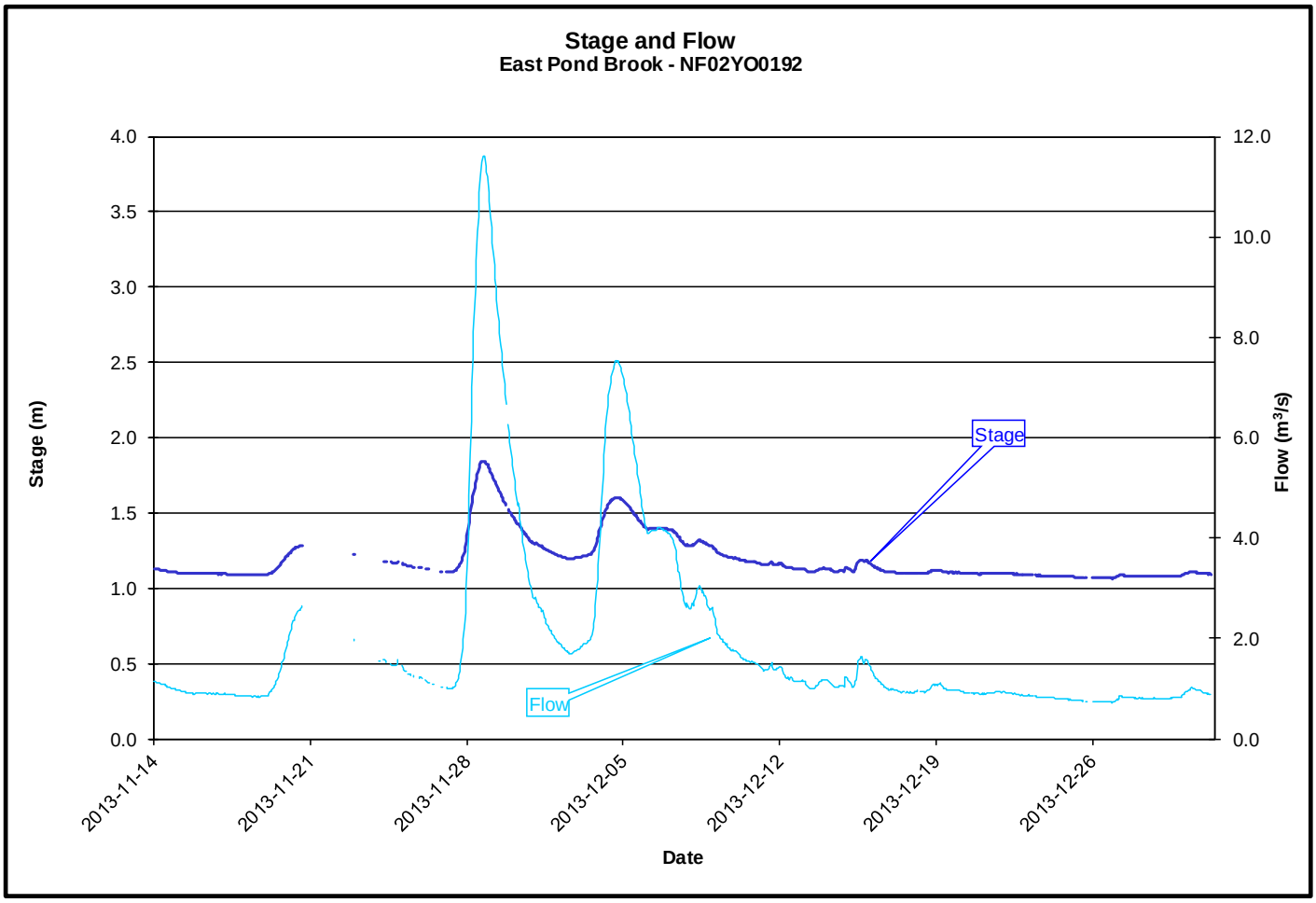

Figure 12

WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 6.23 ˚C to a maximum of 6.35 ˚C with a slight increase over the deployment period.
- There appears to be no correlation with water elevation.

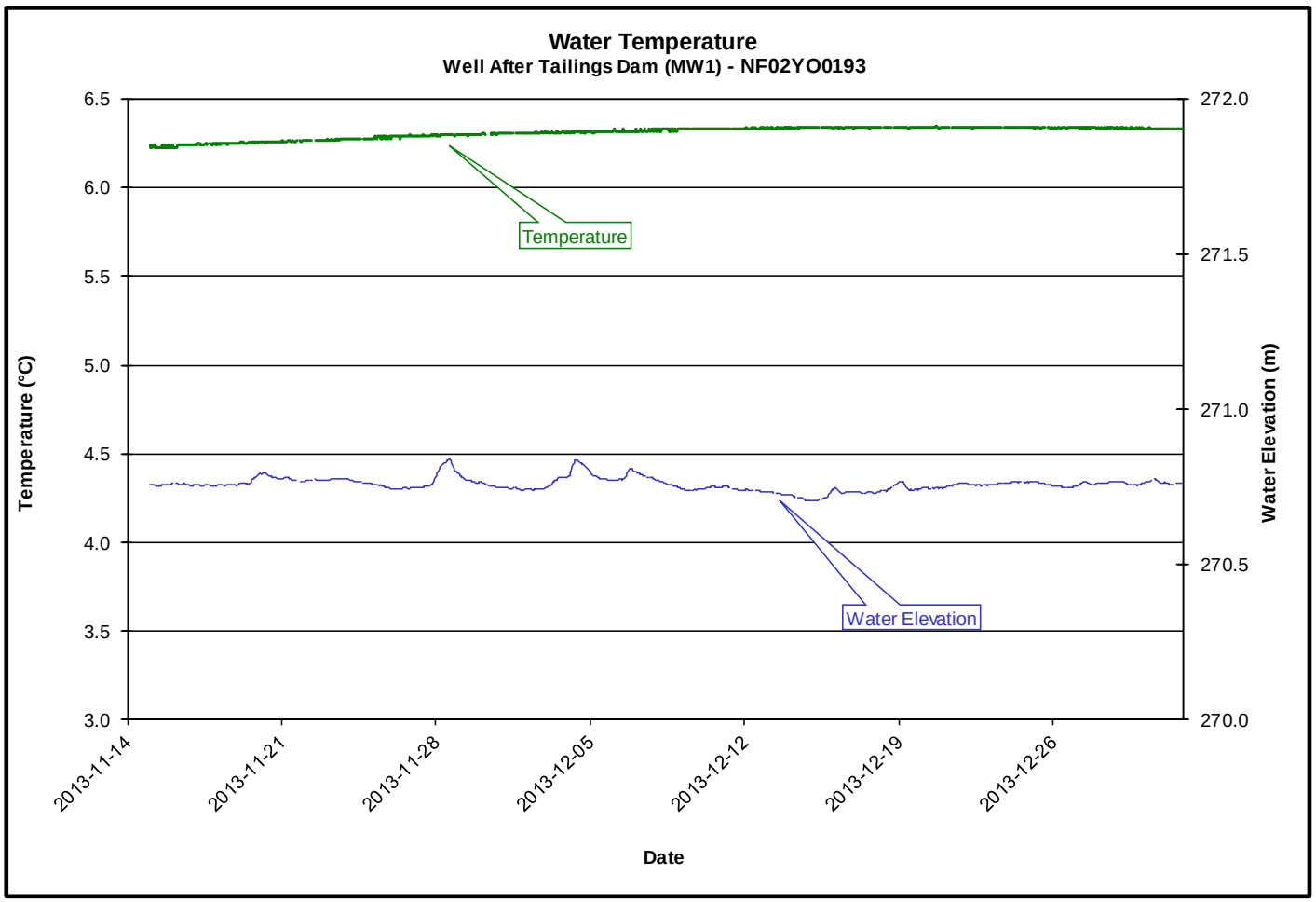

Figure 13

- The pH (**Figure 14**) ranged from a minimum of 7.90 to a maximum of 8.58 over the deployment period.

- The pH continued to rise gradually, following the instrument deployment on December 13, 2013 (the day before the current reporting period). Typical of all deployments in this well, there is an increase in pH during the first few days of deployment, followed by a subsequent levelling off. This change is attributed to the disruption of the water column in the well during the replacement of the instrument.

- There does not appear to be any correlation with water elevation.

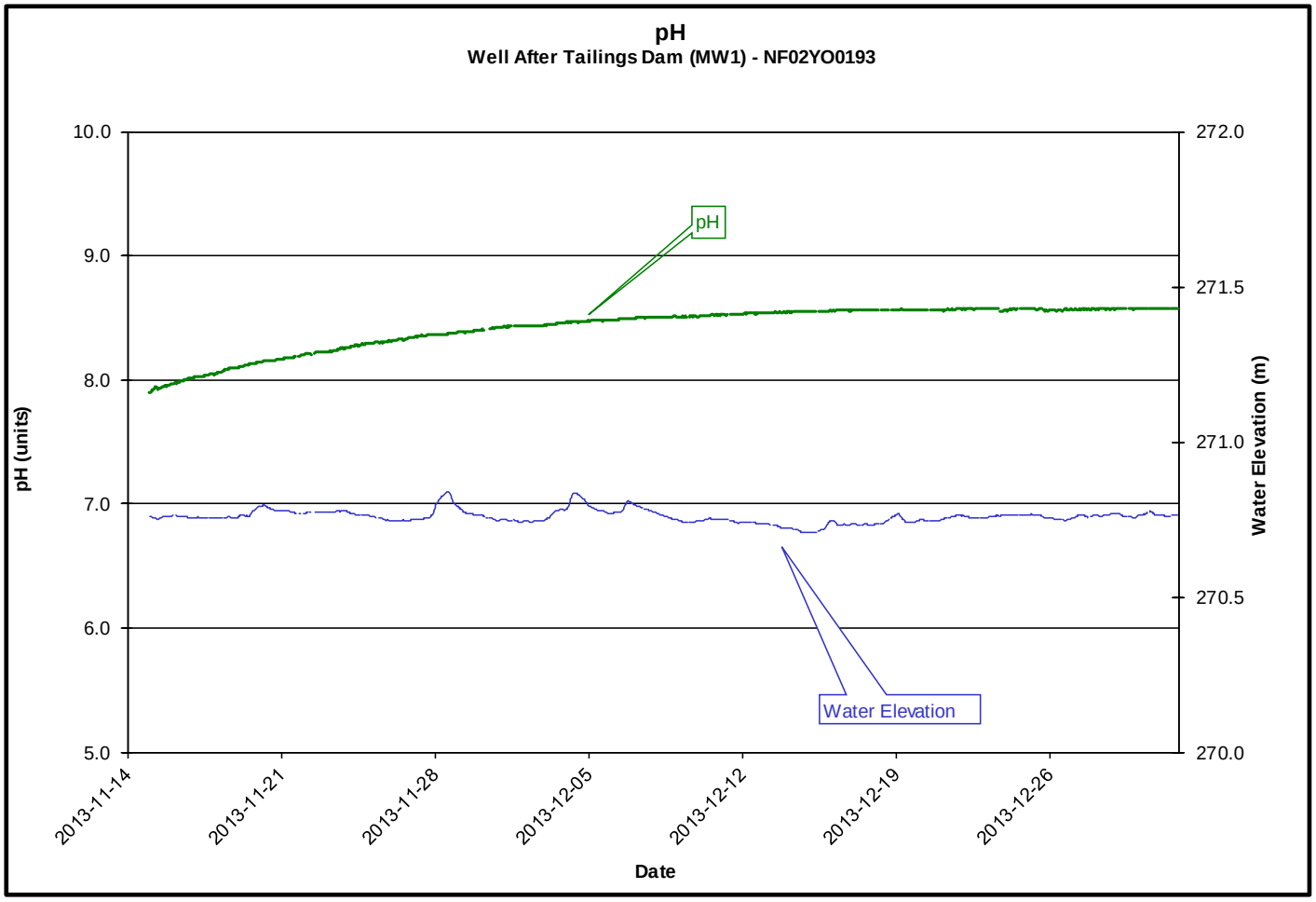

Figure 14

- The specific conductivity **(Figure 15)** ranged from a minimum of 0.792 mS/cm to a maximum of 0.817 mS/cm.
- There was a slight increase over the deployment period.
- There does not seem to be any correlation with water elevation.

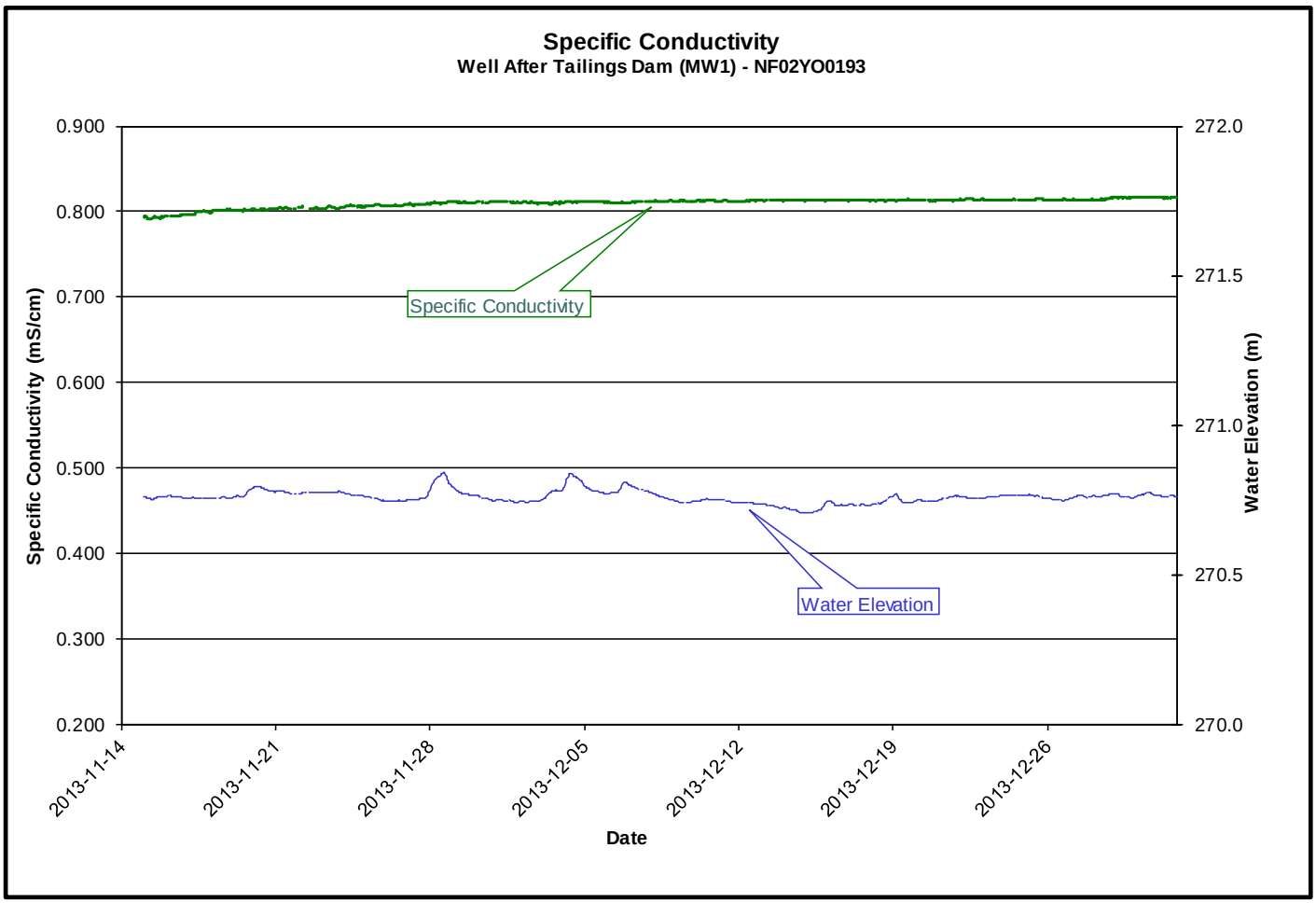

Figure 15

- The Water Elevation **(Figure 16)** ranged from a minimum of 270.71 m to a maximum of 270.84 m, remaining fairly constant over the deployment period.

- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by runoff from precipitation.

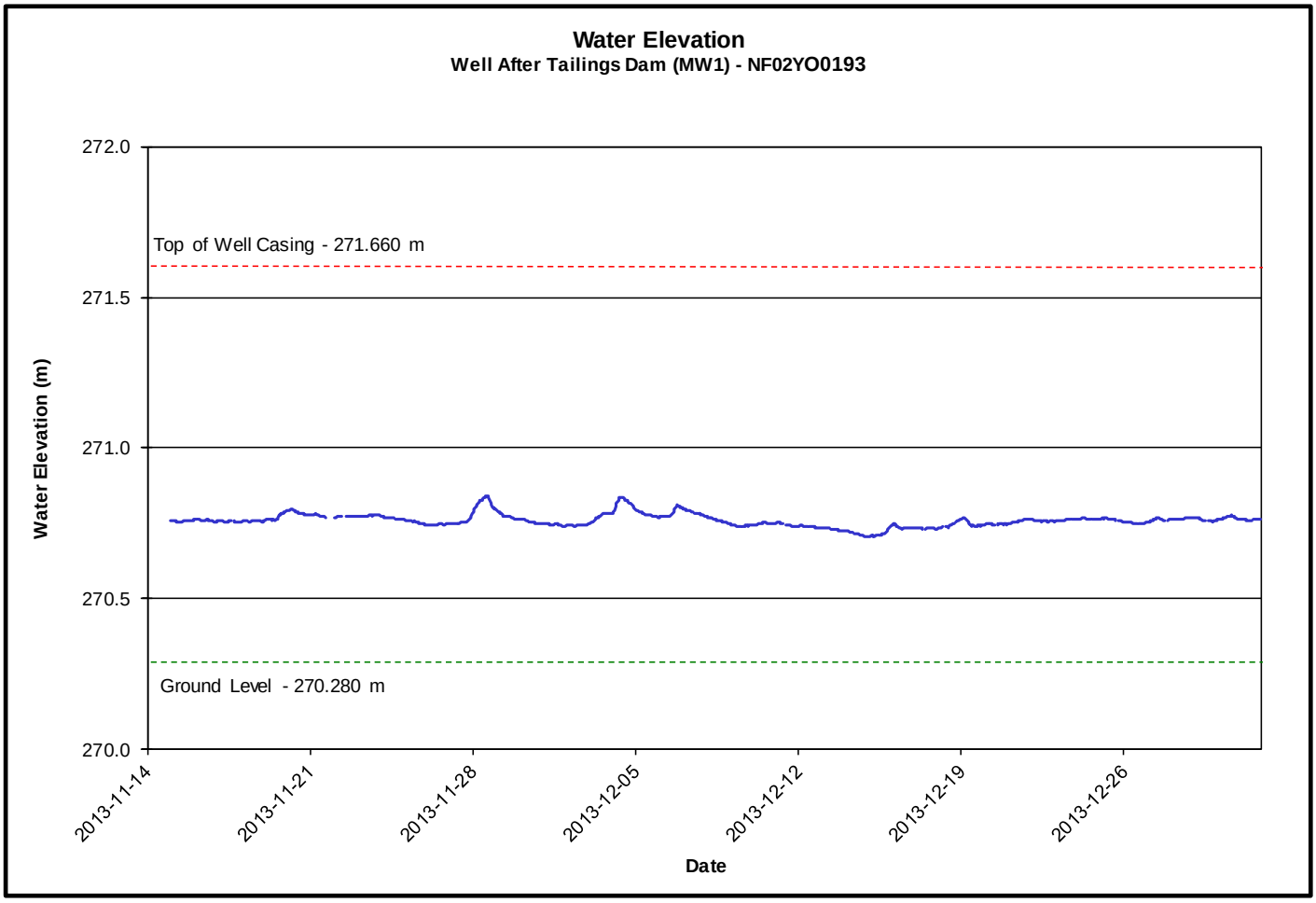

Figure 16

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