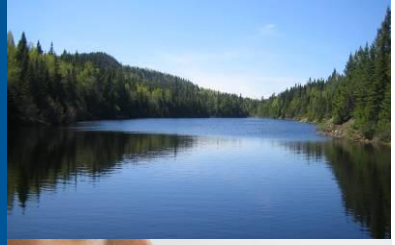




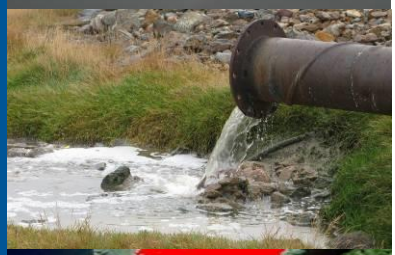


Real Time Water Quality Report
Teck Duck Pond Operations

Deployment Period 2014-07-23 to 2014-08-27

2014-09-22

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) from July 29, 2014 until the end of the deployment period.
- Unfortunately, throughout this deployment period, there were episodic losses of Satellite transmission from the station at East Pond Brook. As the **DataSonde®** was logging internally, this water quality data was used to supplement the missing satellite data for any periods over a few hours. The Satellite transmission issue was resolved by our Environment Canada partners on August 27, 2014. Values for Stage and Flow were not logged internally, and are therefore not available for some periods.

Maintenance and Calibration of Instrumentation

- **DataSonde®**(s/n 62268) was deployed in Tributary to Gills Pond Brook on July 23, 2014 after being cleaned and freshly calibrated, and remained deployed continuously until August 27, 2014; a 34 day period.
- **DataSonde®**(s/n 62267) was deployed in East Pond Brook on July 23, 2014 after being cleaned and freshly calibrated, and remained deployed continuously until August 27, 2014; a 34 day period.
- **MiniSonde®** (s/n 47591) was used for QA/QC purposes during the installation and removal of the instruments. This unit, having the same technical specifications as the **DataSondes®**, was cleaned and freshly calibrated prior to each use.
- **Quanta G®** (s/n 00353) was deployed on June 3, 2014 and remains deployed continuously in Monitoring Well After Tailings Dam Station (MW1). This report covers the period from July 23, 2014 through August 27, 2014, a 34 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 at the 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, 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.
- As the instrument deployed in well was not installed or removed during this deployment period, no ranking could be calculated.
- 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**
2014-07-23 Installation	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (µS/cm)	Good
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2014-08-27 Removal	Temp (^{o}C)	Excellent
	pH (units)	Good
	Sp. Conductivity (µS/cm)	Good
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent

Table 2

East Pond Brook Station (NF02YO0192)		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2014-07-23 Installation	Temp (^{o}C)	Excellent
	pH (units)	Good
	Sp. Conductivity (µS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2014-08-27 Removal	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 15.00˚C to a maximum of 26.80˚C.
- The temperatures during the first half of the deployment period are higher than typical for this time of year. Following the precipitation/runoff event on August 7, 2014, water temperatures were more typical.
- There appears to be an inverse relationship with stage following a precipitation/runoff event beginning on August 19, 2014. There is certainly less diurnal variation during this event.

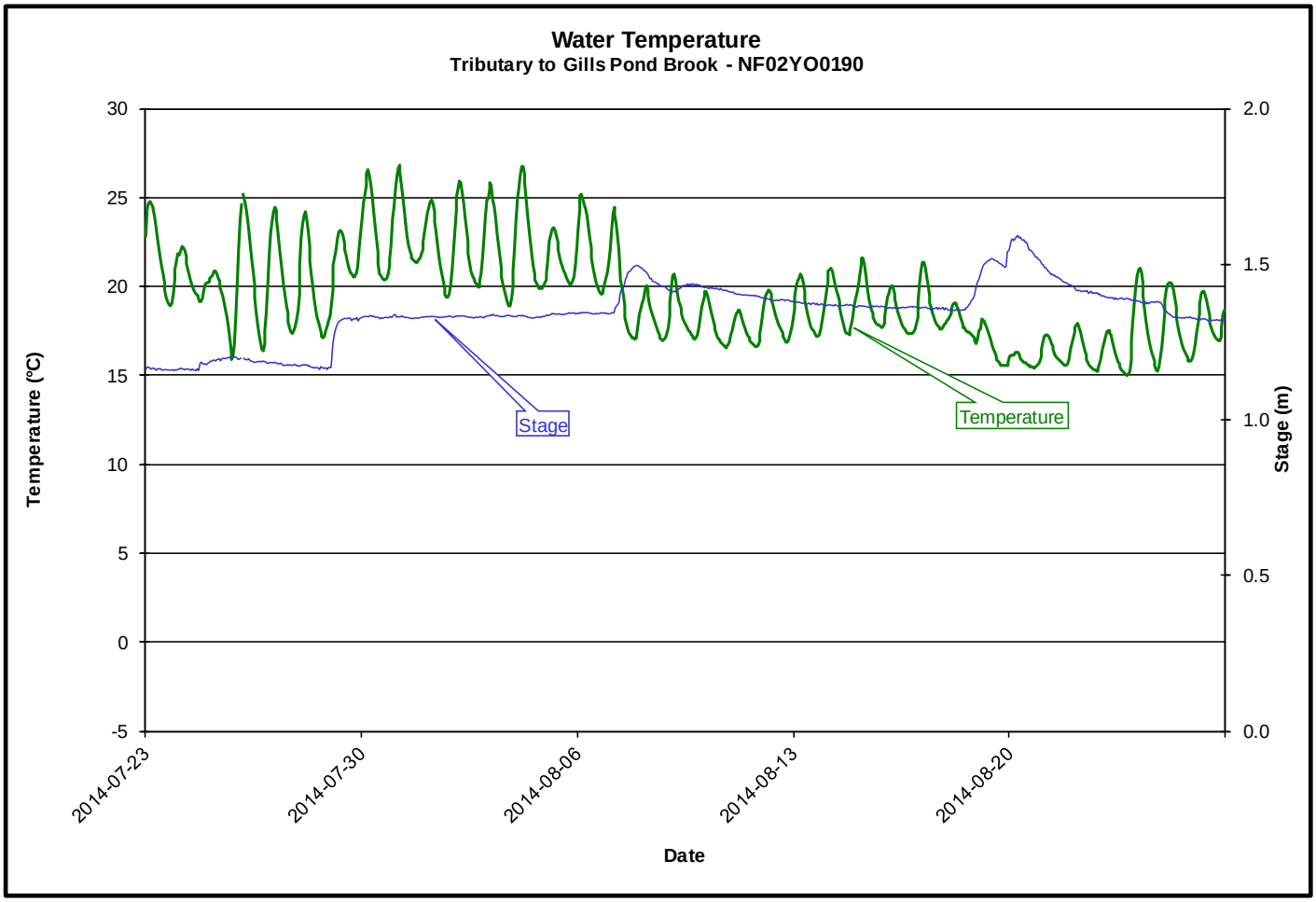

Figure 1

- Throughout the deployment period, pH values (**Figure 2**) ranged from a minimum of 5.86 to a maximum of 7.49 with many values often lower than 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 quite evident during this deployment period.
- The background pH of this stream is normally around the lower limit of the recommended range, and is usually higher during periods of discharge from the Polishing Pond. However, during this deployment, the pH dropped significantly following the release of discharge water from Polishing Pond on July 29, 2014.

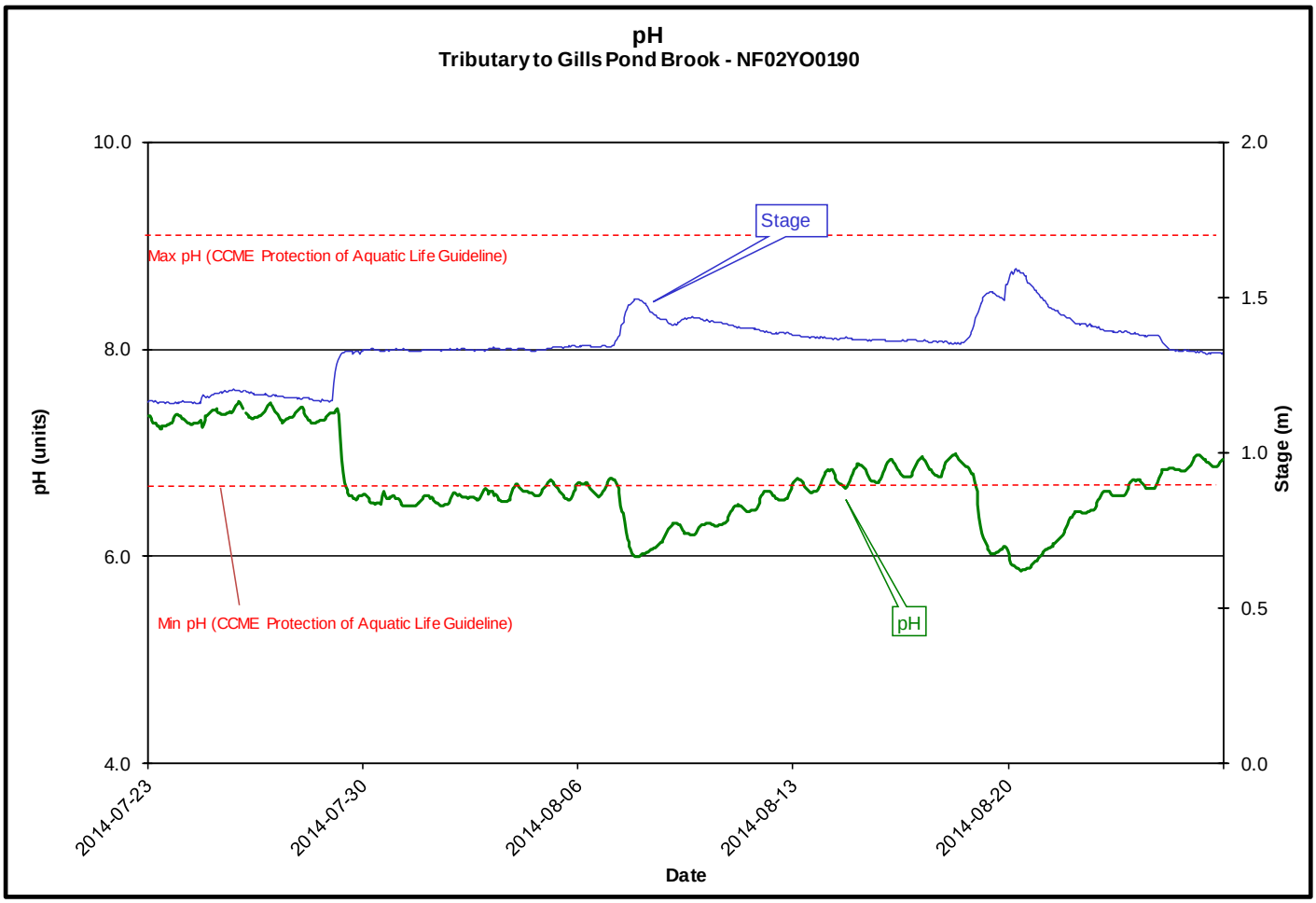

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 114.0 µS/cm to a maximum of 1244.0 µS/cm over the deployment period.
- Specific conductance was significantly higher following the beginning of discharge from Polishing Pond on July 29, 2014.
- Two significant 'V' shaped dips in specific conductivity correspond to increases in stage, wherein precipitation/runoff events effectively cause a temporary 'dilution effect' in the receiving waters.

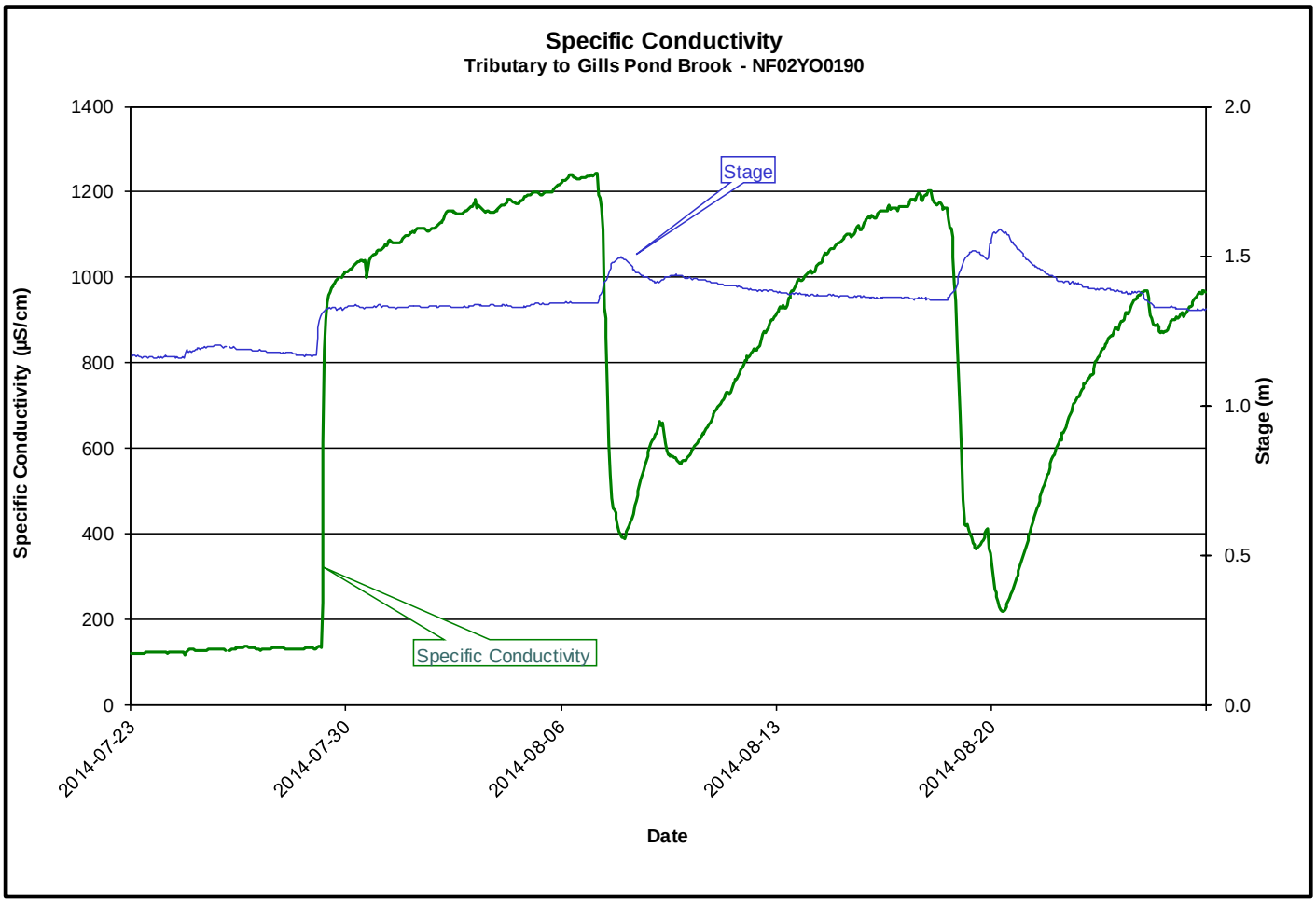

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 7.02 mg/L to a maximum of 9.36 mg/L over the deployment period, with the percent saturation ranging between 79.5 and 99.8.
- Dissolved oxygen (mg/L) increased slightly over the deployment period, which corresponds with the decrease in temperature (**Figure 1**)
- All of the dissolved oxygen values fell above the minimum for Other 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 and predictable change over the deployment period, we can be confident that the dissolved oxygen mg/L values are accurate.

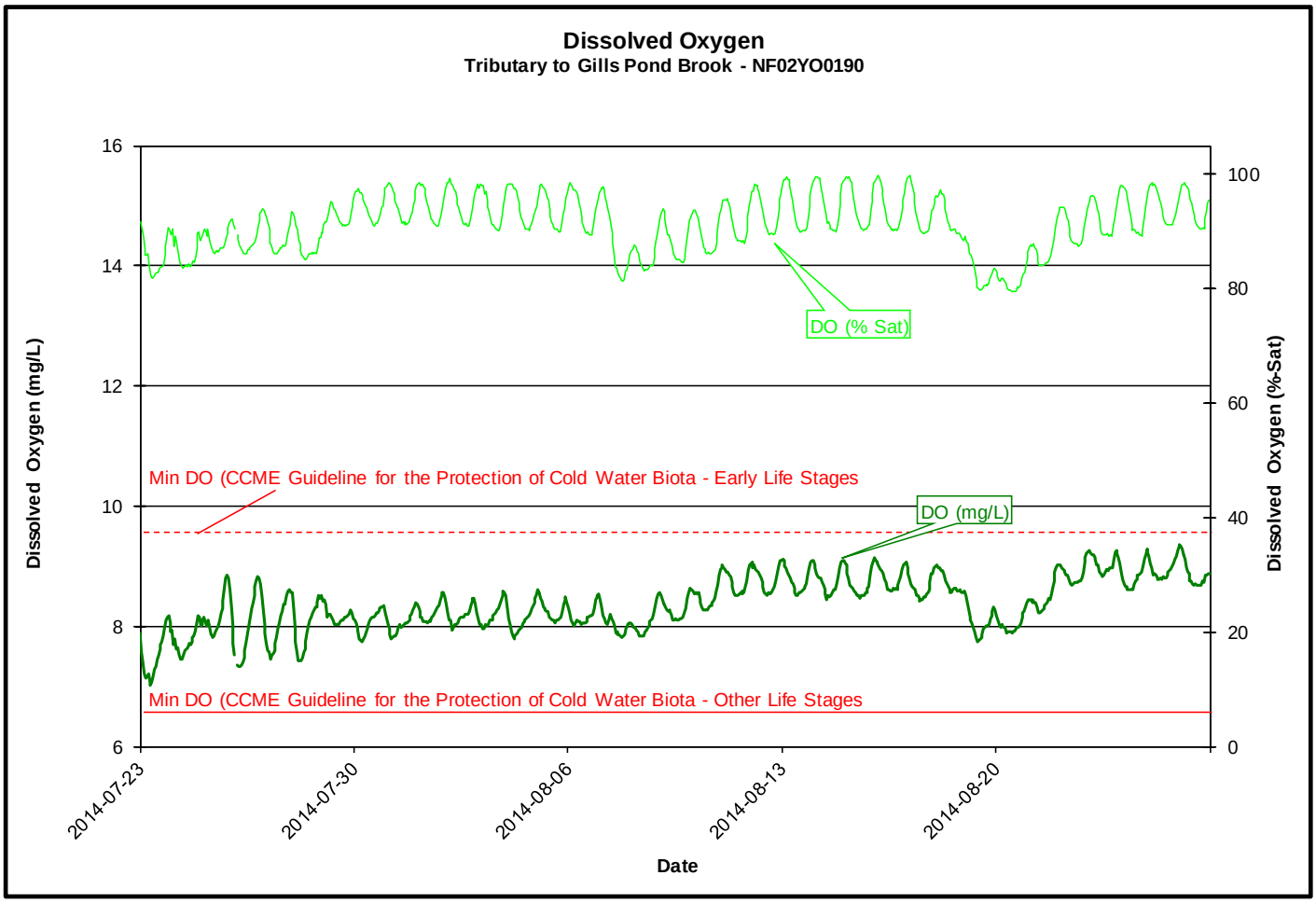

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 15.5 NTU.

- The highest peak in turbidity was recorded during the initial increased stage, when discharge was released from the Polishing Pond on July 29, 2014. Other increases in turbidity correspond with precipitation/runoff events.

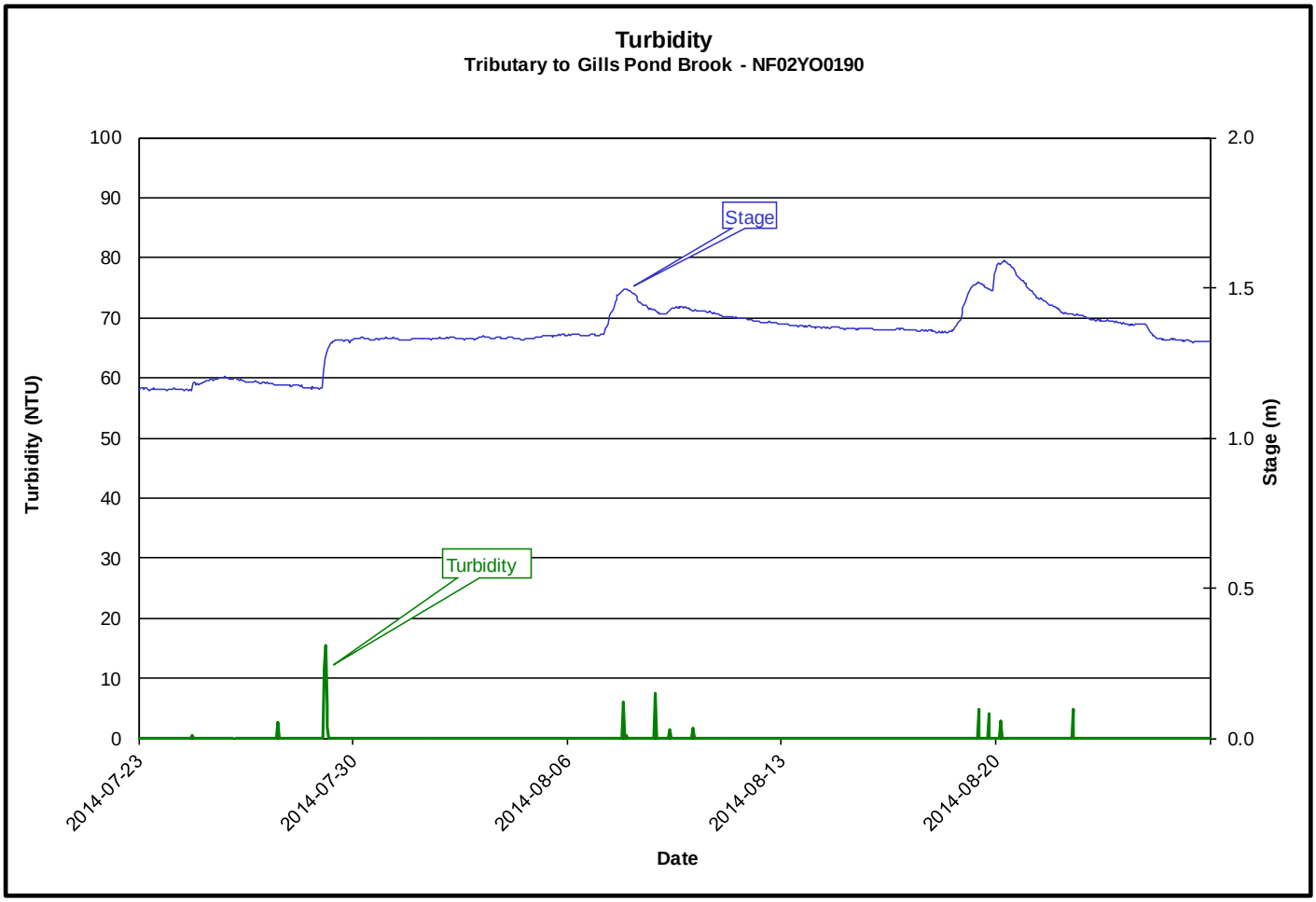

Figure 5

- The stage or water level ranged from a minimum of 1.16 m to a maximum of 1.59 m. The flow or discharge ranged from a minimum of 0.01 m^3/s to a maximum of 1.66 m^3/s (**Figure 6)**.
- The increase in stage and flow following onset of discharge from Polishing Pond on July 29, 2014 is obvious.
- Increases in stage and flow following two subsequent precipitation/runoff events are typical.
- Flow could not be calculated for the initial part of the deployment, as stage was below the minimum level of the existing stage-flow table.

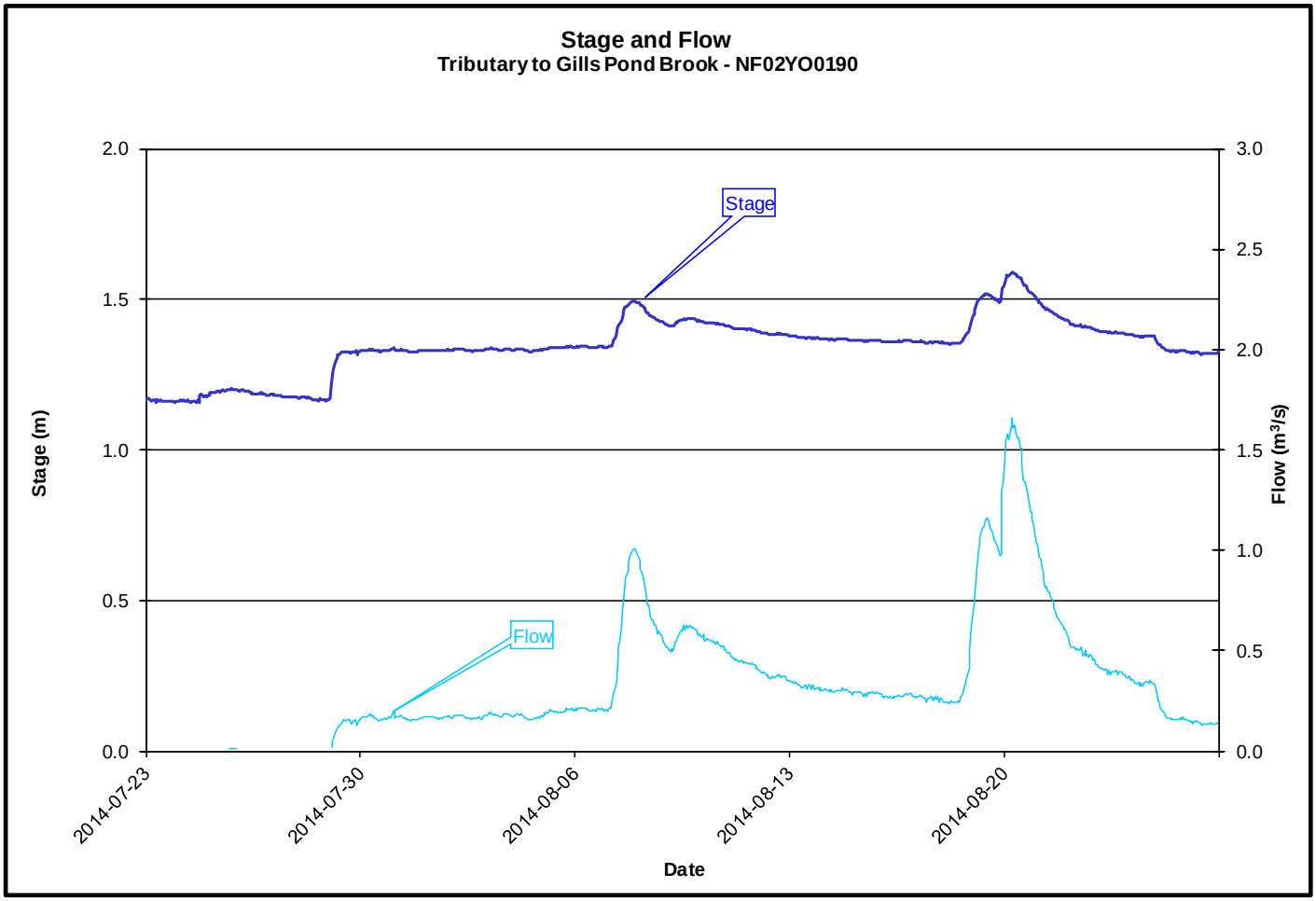

Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 15.42 ˚C to a maximum of 28.39 ˚C.
- The temperatures throughout the first half of the deployment period are higher than typical for this time of year. Following the precipitation/runoff event on August 7, 2014, water temperatures were more typical.
- There does not appear to be any correlation with stage during this reporting period.

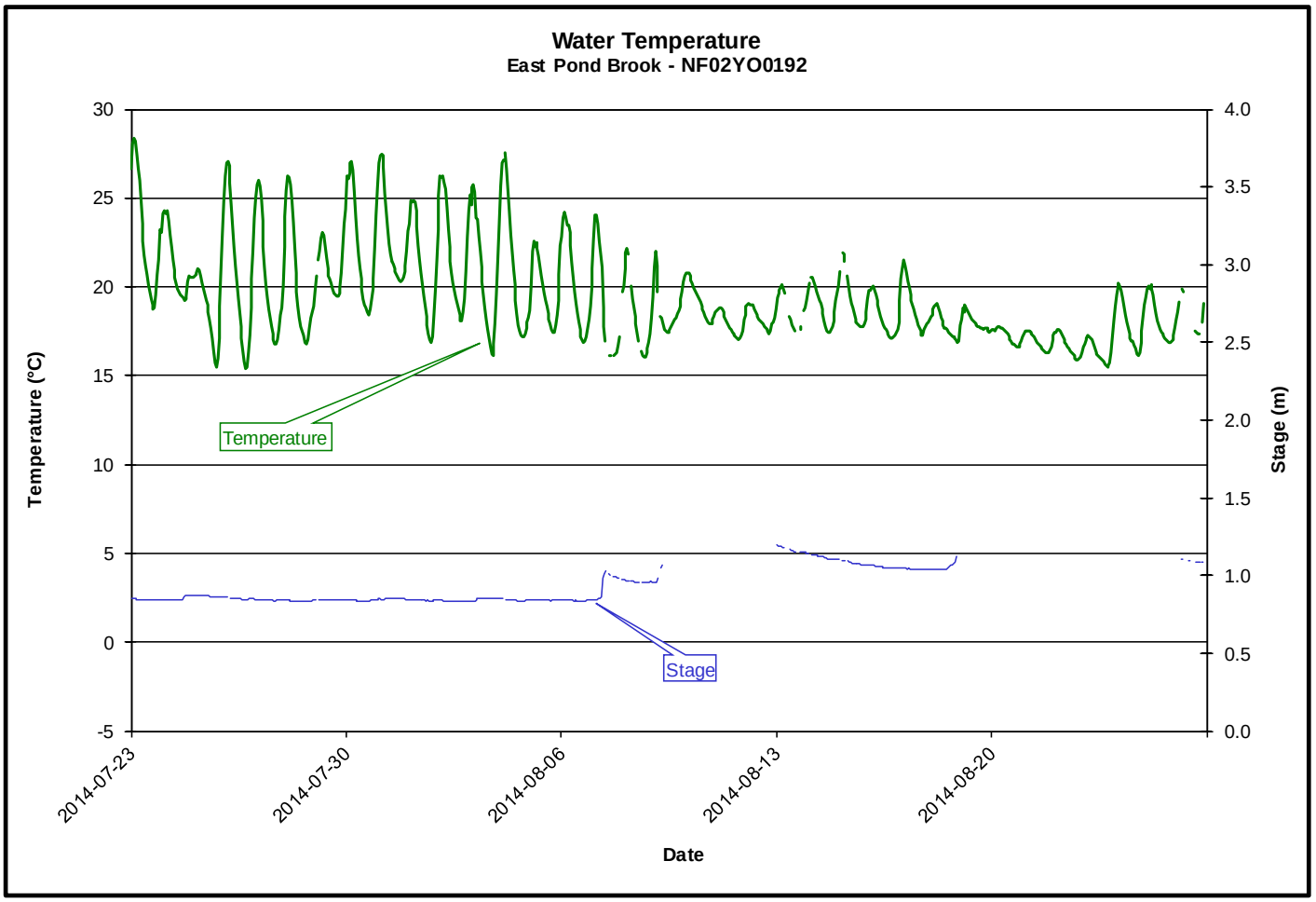

Figure 7

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 5.76 to a maximum of 7.11, with pH decreasing during the second half of the deployment period.
- For most of the deployment period, pH values were 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.

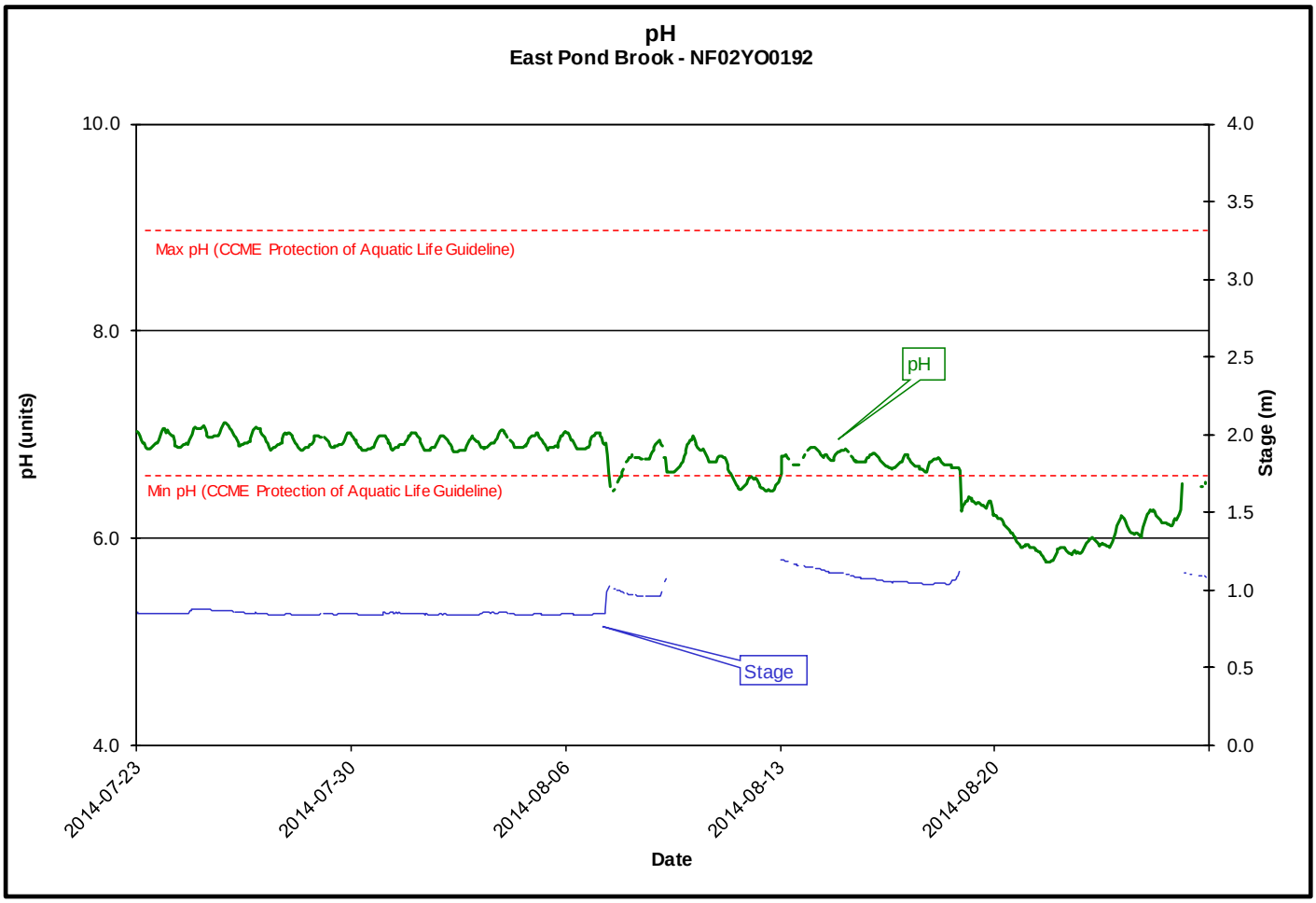

Figure 8

- The specific conductivity **(Figure 9)** ranged from a minimum of 22.0 µS/cm to a maximum of 61.0 µS/cm.
- There was a rapid decrease in specific conductance corresponding with an increase in stage on August 7, 2014. Following this event, the typical diurnal variation is no longer evident.
- The spike in specific conductance on August 11, 2014 is atypical and is difficult to explain in light of the missing (satellite transmission issues) stage data.
- All values are within the normal range.

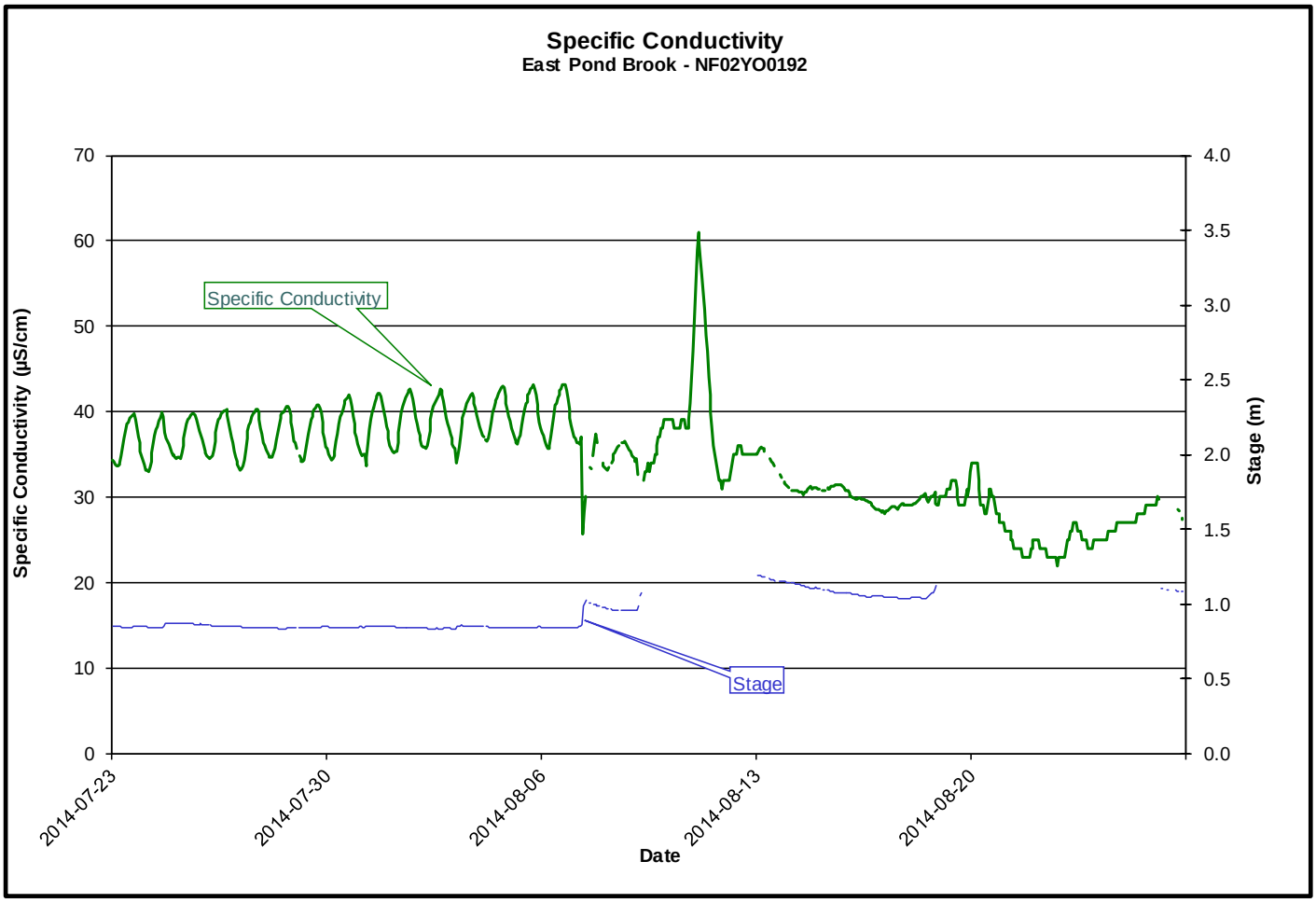

Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 6.97 mg/L to a maximum of 9.63 mg/L over the deployment period, with the percent saturation ranging between 80.6 and 101.1.
- Dissolved oxygen (mg/L) tended to increase toward the end of the deployment period, which corresponds with the decrease in temperature (**Figure 7**)
- There was less diurnal variation in dissolved oxygen mg/L and % Saturation following the precipitation/runoff event on August 7, 2104.
- All of the dissolved oxygen values fell above the minimum for Other 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 and predictable change over the deployment period, we can be confident that the dissolved oxygen mg/L values are accurate.

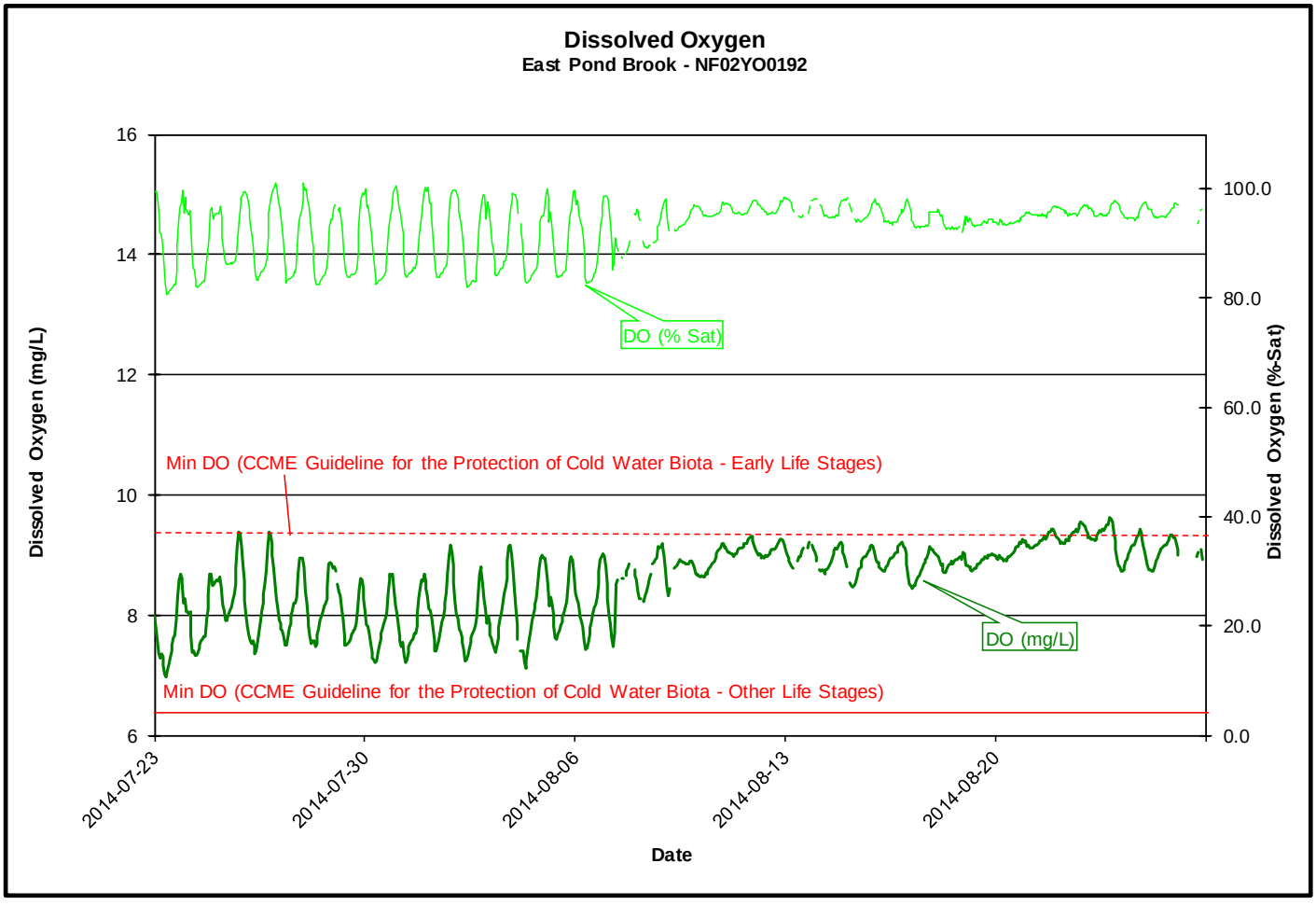

Figure 10

- The turbidity values (**Figure 11**) ranged from a minimum of 0.0 NTU to a maximum of 1.1 NTU.
- The one minor spike in turbidity corresponded with the precipitation/runoff event on August 7, 2014.

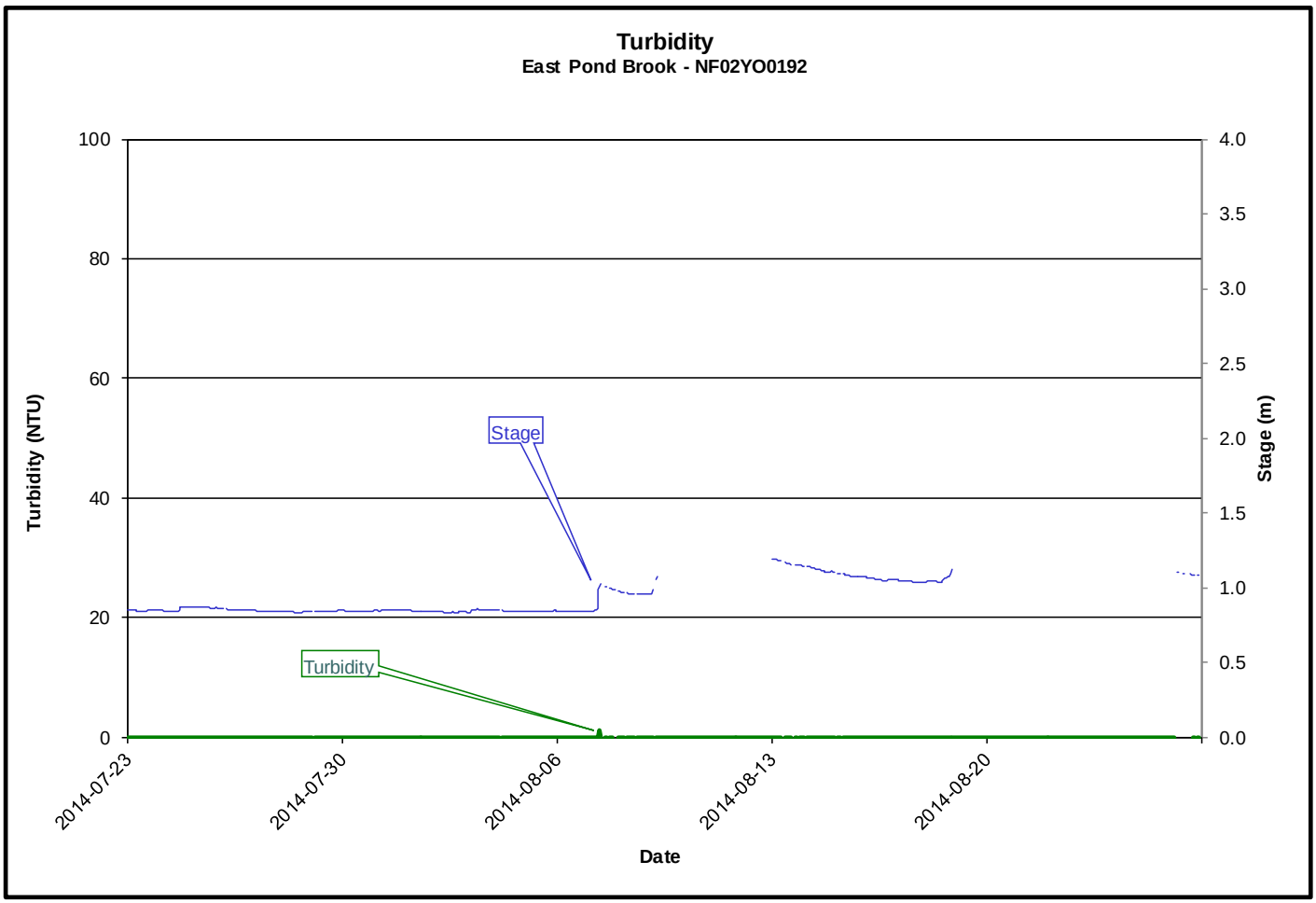

Figure 11

- The stage or water level ranged from a minimum of 0.83 m to a maximum of 1.38 m. The flow or discharge ranged from a minimum of 0.26 m^3/s to a maximum of 3.87 m^3/s **(Figure 12)**.
- Due to satellite transmission issues, stage and flow values are missing for portions of the deployment period.
- Flow could not be calculated for the earlier part of the deployment, as stage was below the minimum level of the existing stage-flow table.

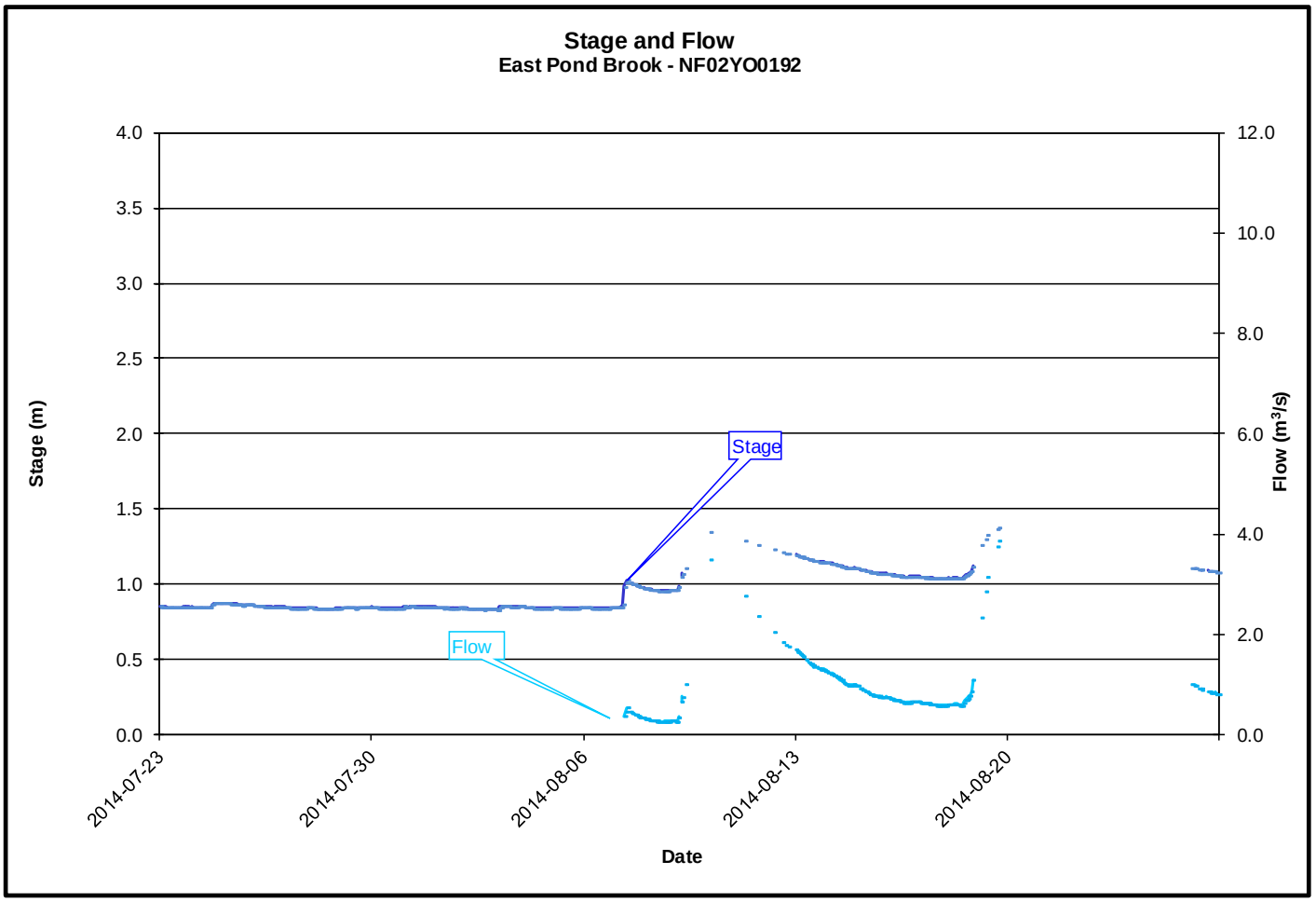

Figure 12

WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 5.03 ˚C to a maximum of 5.25 ˚C with a slight increase over the deployment period.
- There appears to be no correlation with water elevation.

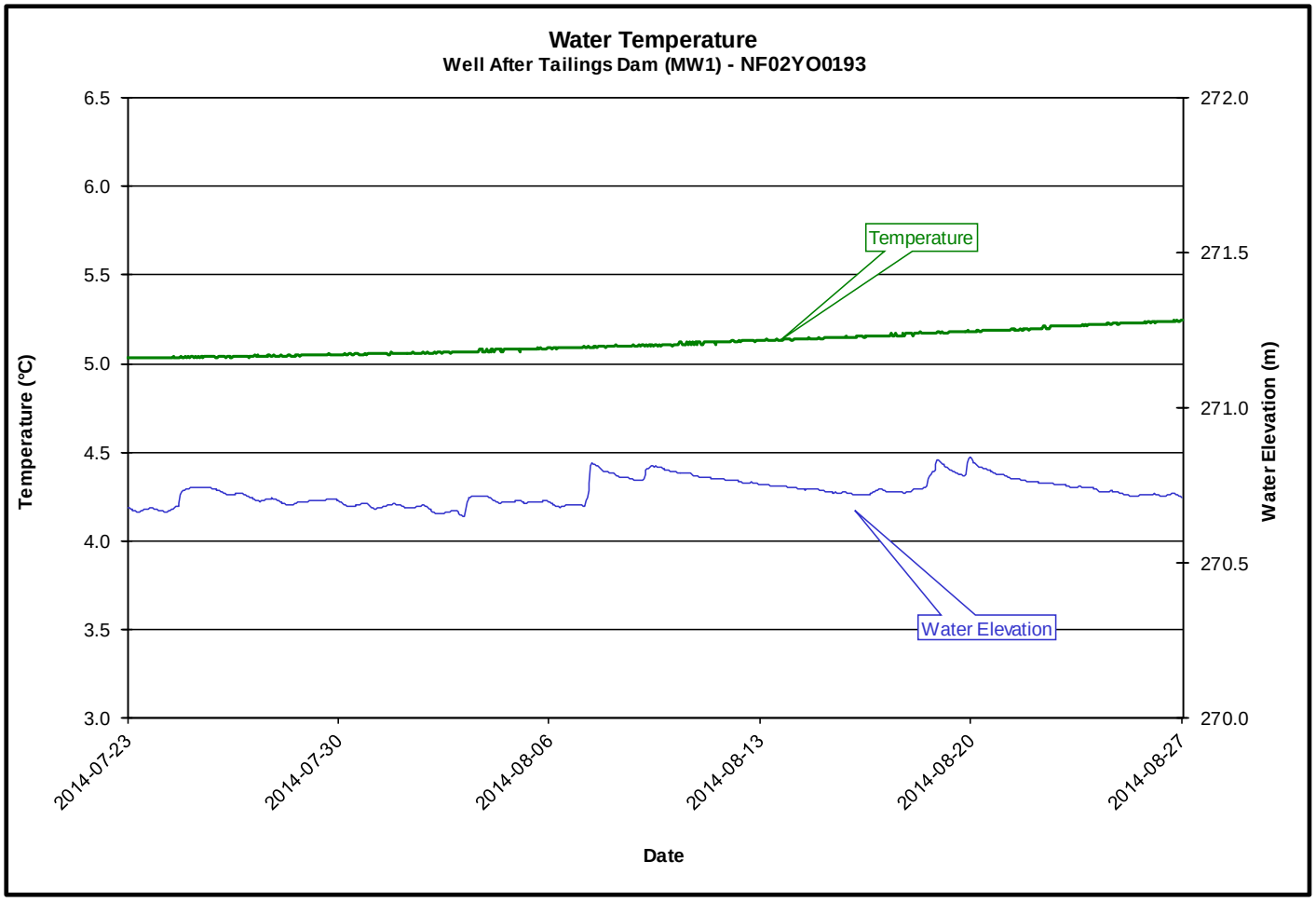

Figure 13

- The pH (**Figure 14**) ranged from a minimum of 8.52 to a maximum of 8.57, with little change over the deployment period.
- There does not appear to be any correlation with water elevation.

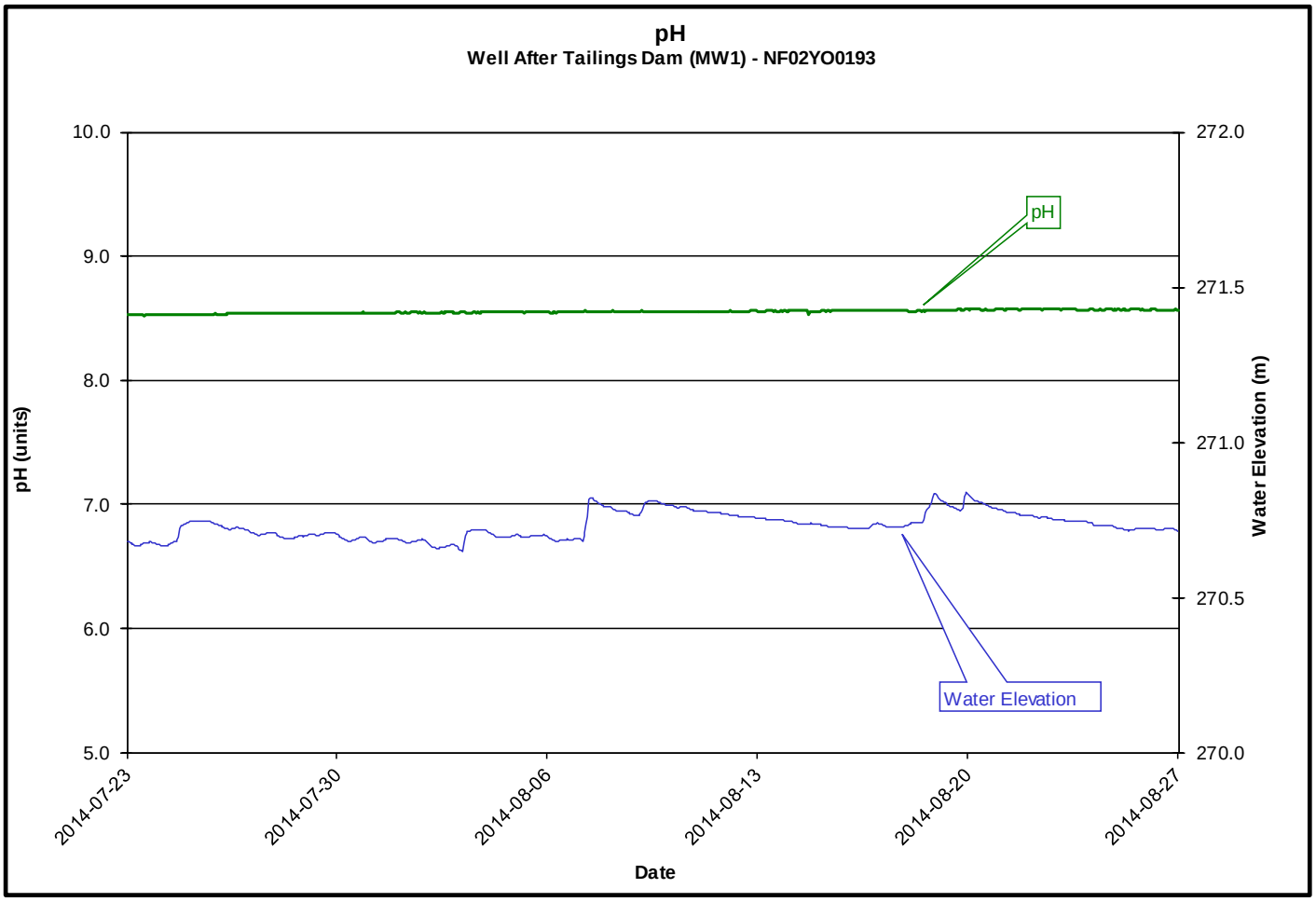

Figure 14

- The specific conductivity **(Figure 15)** ranged from a minimum of 0.776 mS/cm to a maximum of 0.781 mS/cm.
- There was little change evident over the deployment period.

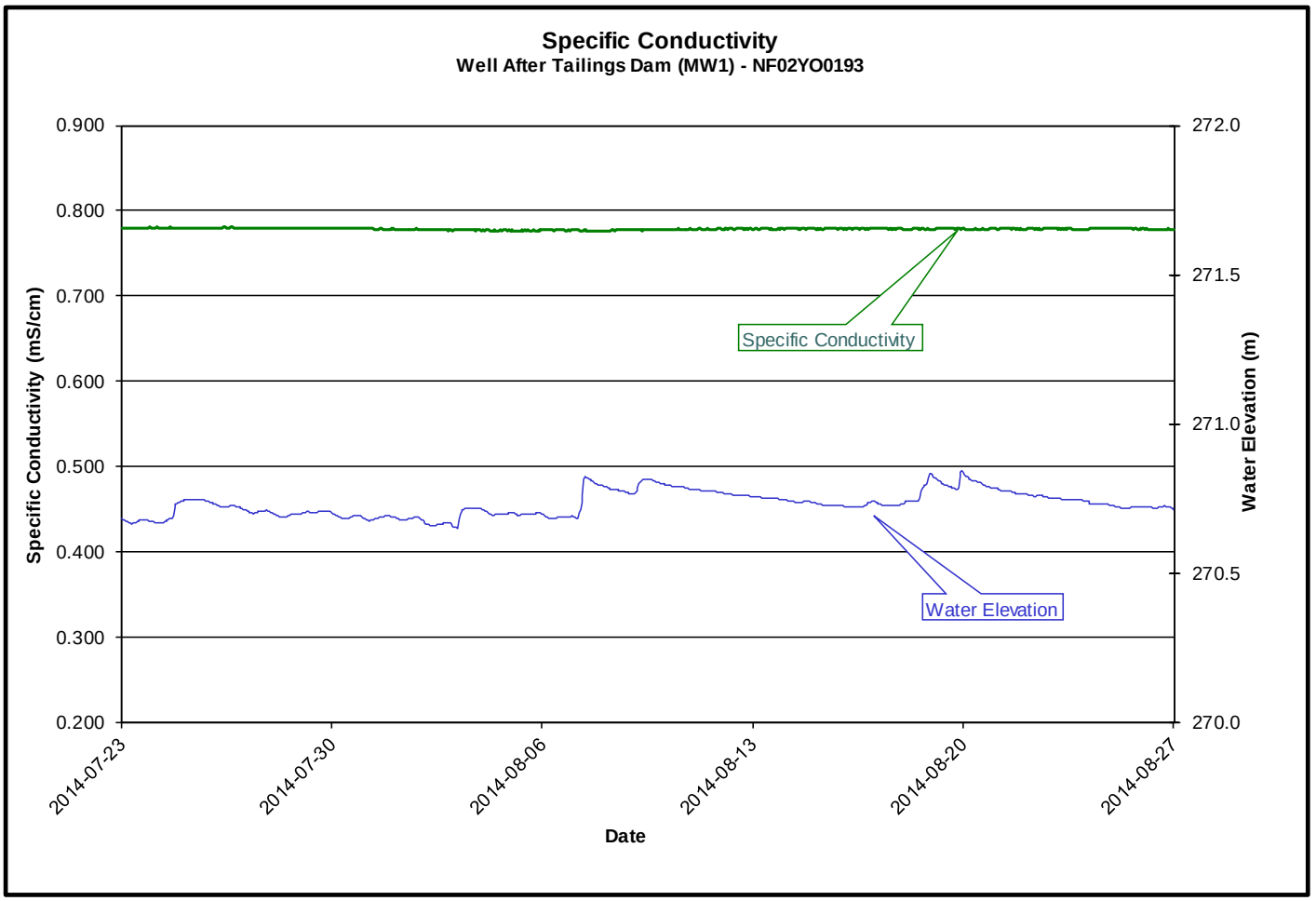

Figure 15

- The Water Elevation **(Figure 16)** ranged from a minimum of 270.65 m to a maximum of 270.84 m.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by runoff from precipitation. This is evidenced by the increase on August 7, 2014 and August 19, 2014, which are similar to nearby streams (**Figures 6 and 12**).

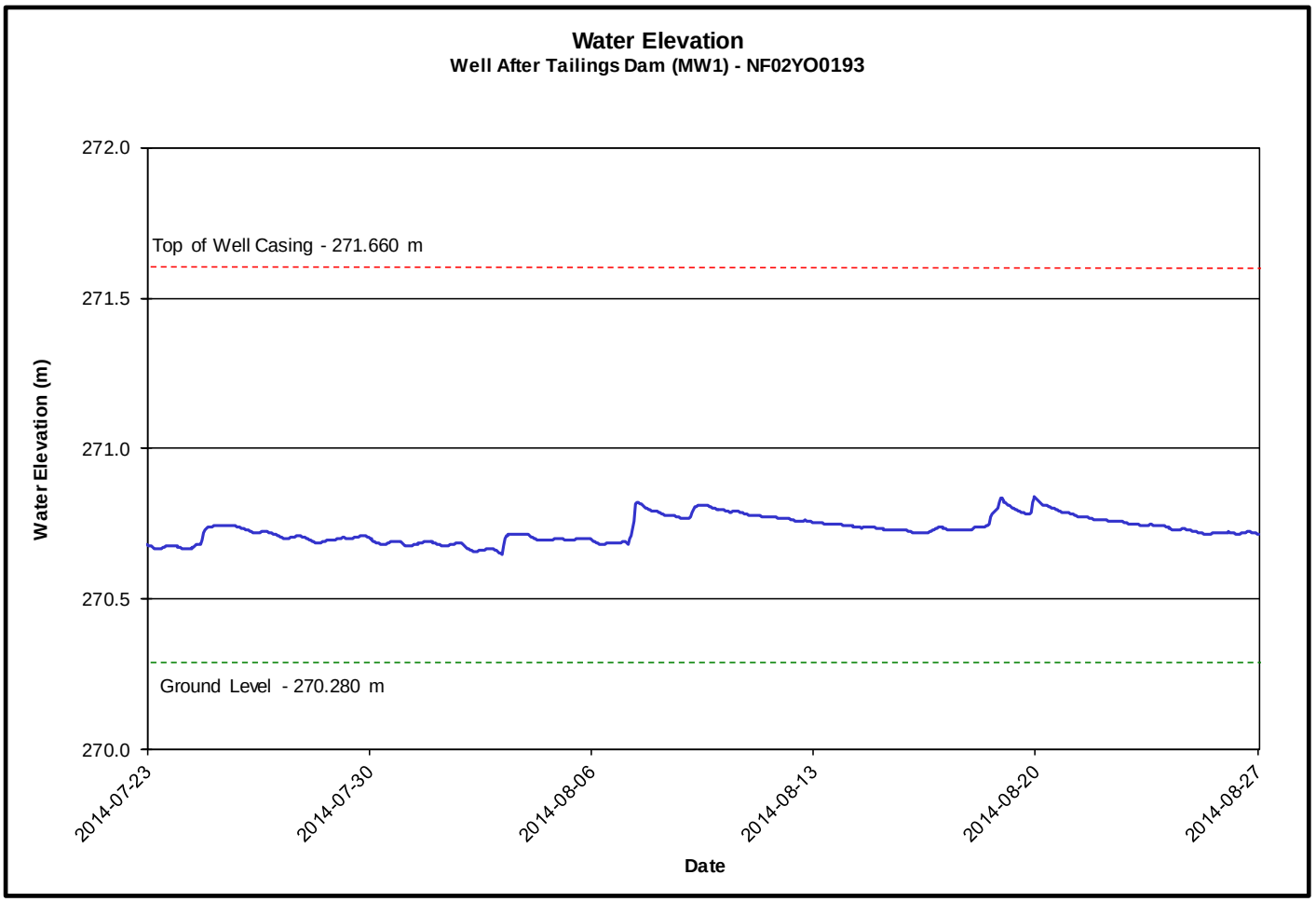

Figure 16

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