Real Time Water Quality Report
Teck Duck Pond Operations

Deployment Period 2014-08-27 to 2014-09-24

2014-09-29

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) throughout the entire deployment period.

Maintenance and Calibration of Instrumentation

- **DataSonde®**(s/n 60394) was deployed in Tributary to Gills Pond Brook on August 27, 2014 after being cleaned and freshly calibrated, and remained deployed continuously until September 24, 2014; a 27 day period.
- **DataSonde®**(s/n 43794) was deployed in East Pond Brook on August 27, 2014 after being cleaned and freshly calibrated, and remained deployed continuously until September 24, 2014; a 27 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 August 27, 2014 through September 24, 2014, a 27 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**
2014-08-27 Installation	Temp (^{o}C)	Excellent
	pH (units)	Good
	Sp. Conductivity (µS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2014-09-24 Removal	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	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**
2014-08-27 Installation	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (µS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2014-09-24 Removal	Temp (^{o}C)	Excellent
	pH (units)	Good
	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 10.23˚C to a maximum of 22.09˚C.
- There was a slight decrease in water temperatures over the deployment period.
- There does not appear to be any correlation with stage during this reporting period.

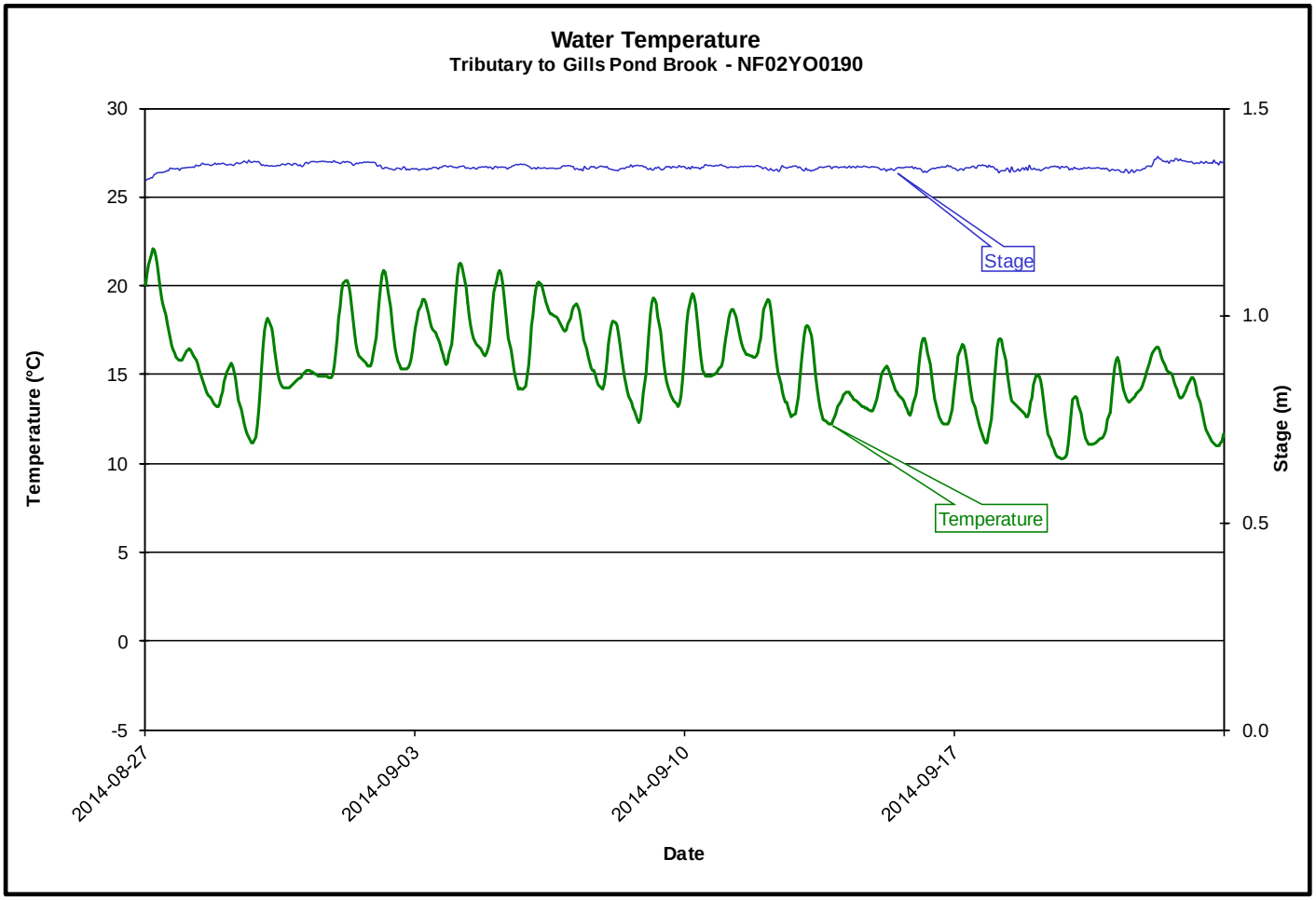

Figure 1

- Throughout the deployment period, pH values (**Figure 2**) ranged from a minimum of 6.77 to a maximum of 7.20.
- All pH values within the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.

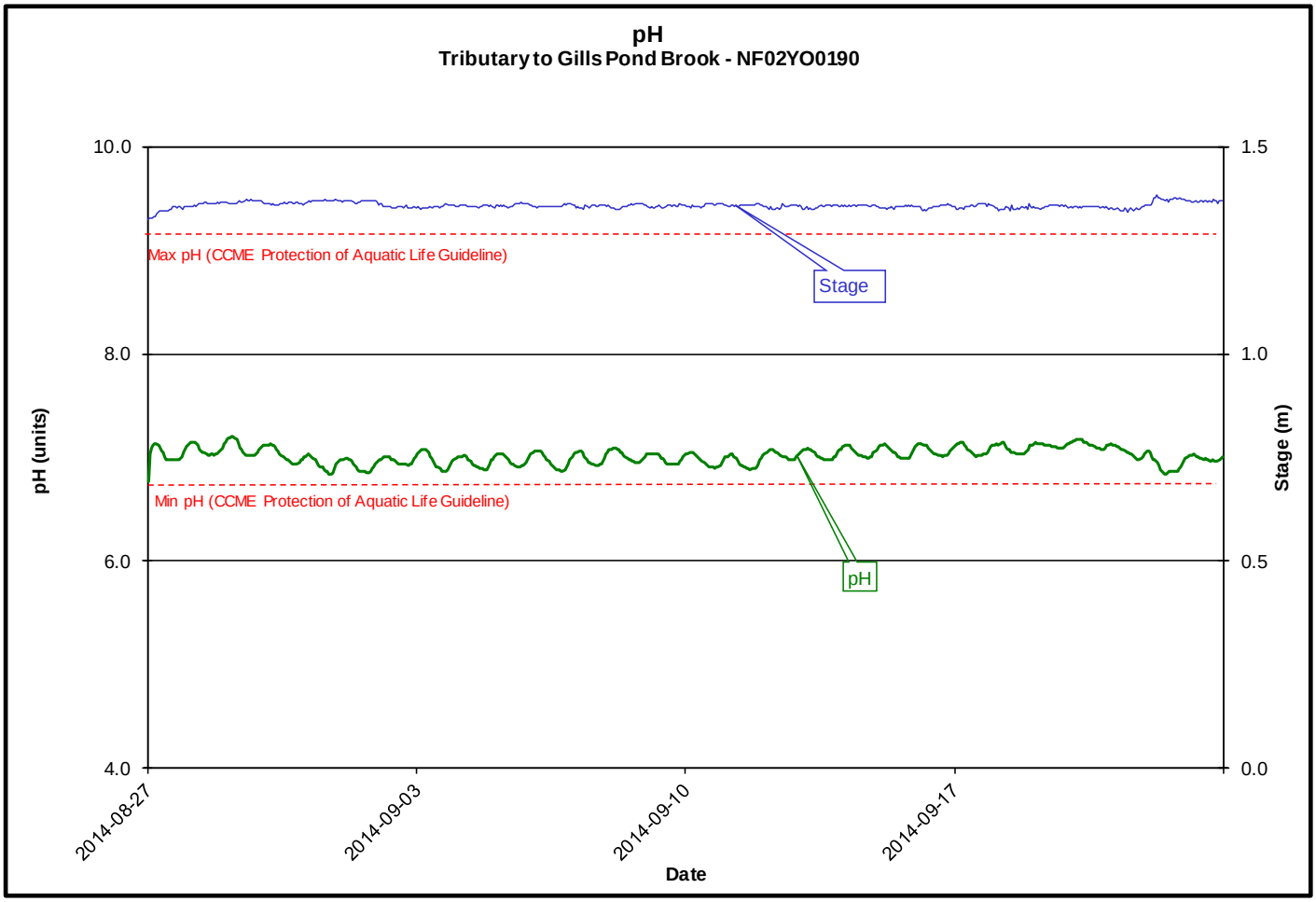

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 1025.0 µS/cm to a maximum of 1584.0 µS/cm over the deployment period.
- Specific conductance generally increased over the deployment period.
- The significant 'V' shaped dip in specific conductivity near the end of the deployment period corresponds to an increase in stage, wherein a precipitation/runoff event effectively caused a temporary 'dilution effect' in the receiving waters.

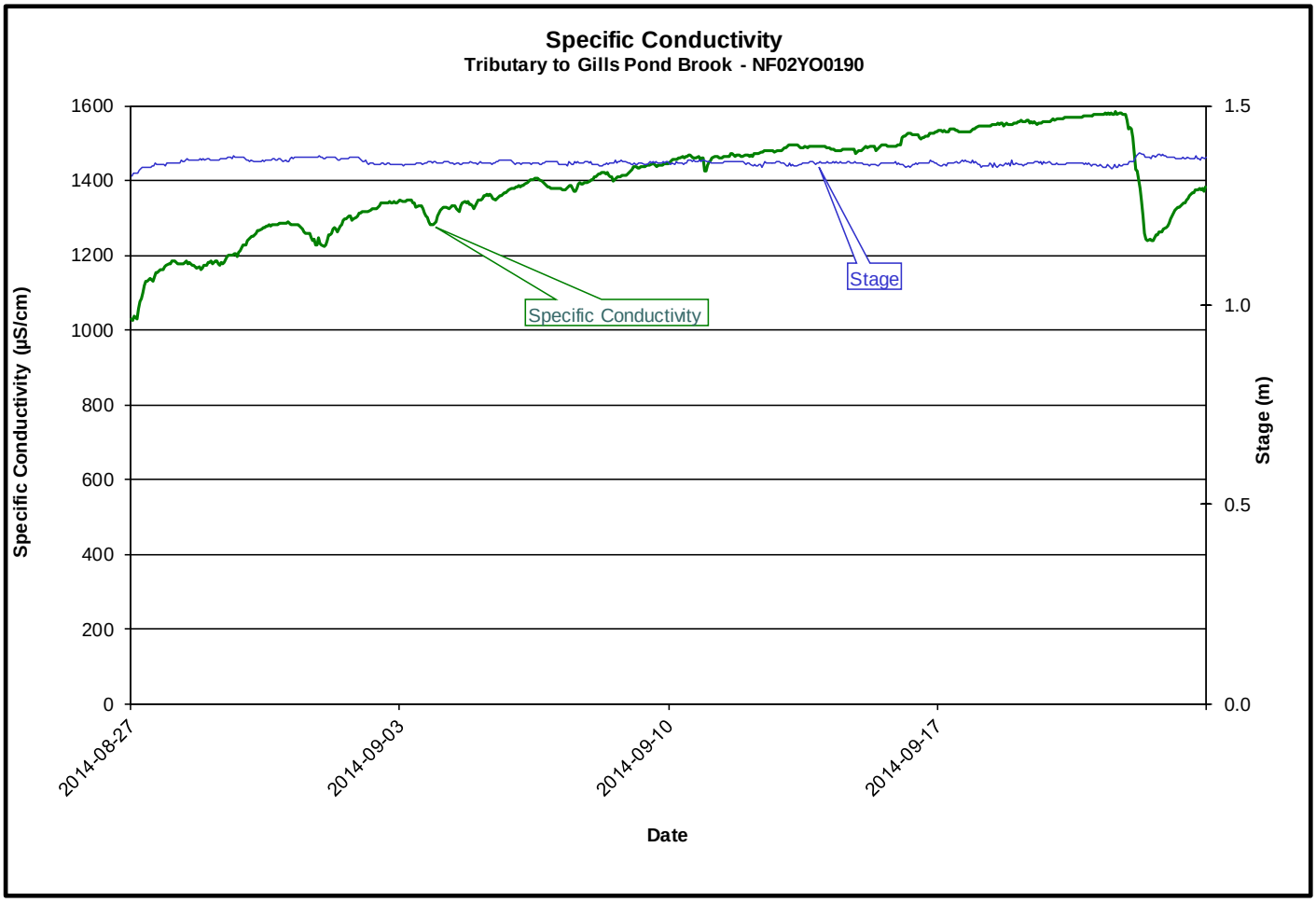

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 8.38 mg/L to a maximum of 10.42 mg/L over the deployment period, with the percent saturation ranging between 88.7 and 99.3.
- 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.

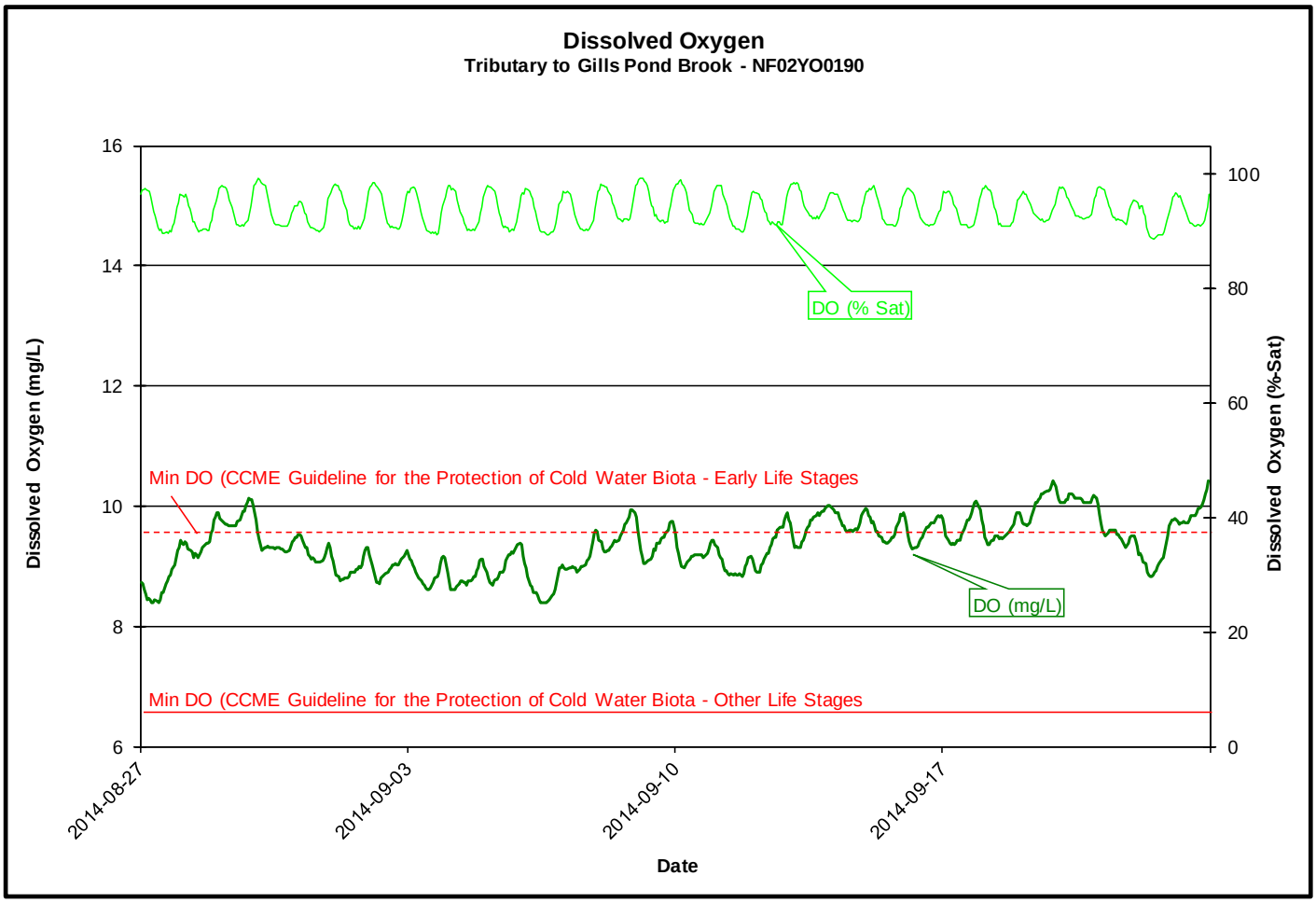

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 7.0 NTU.
- Only two short term and insignificant peaks were observed in turbidity over the deployment period.

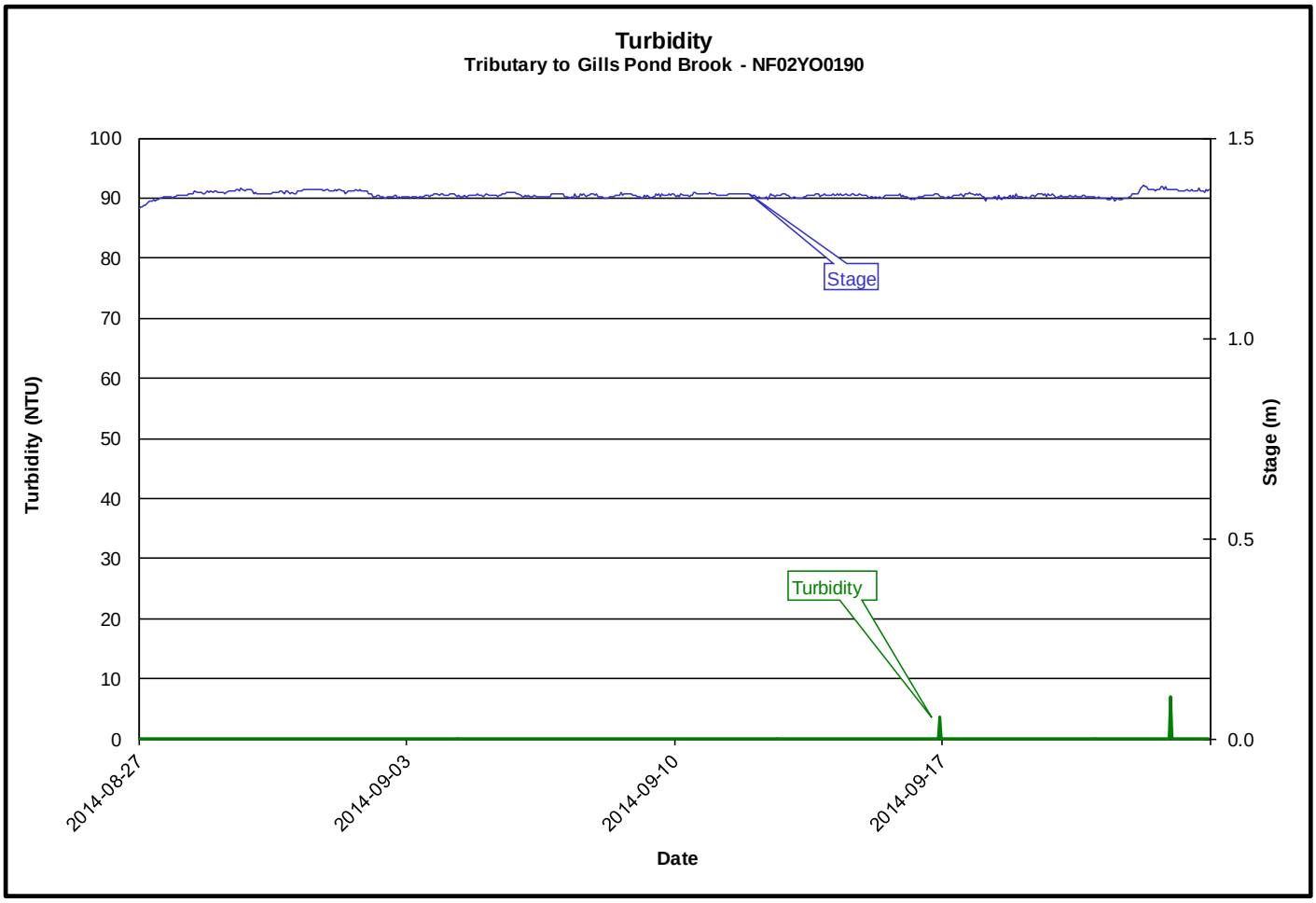

Figure 5

- The stage or water level ranged from a minimum of 1.33 m to a maximum of 1.38 m. The flow or discharge ranged from a minimum of 0.15 m^3/s to a maximum of 0.33 m^3/s (**Figure 6)**.
- There was little change in stage or flow over the deployment period.
- Flow data was not calculated for several days in the deployment period.

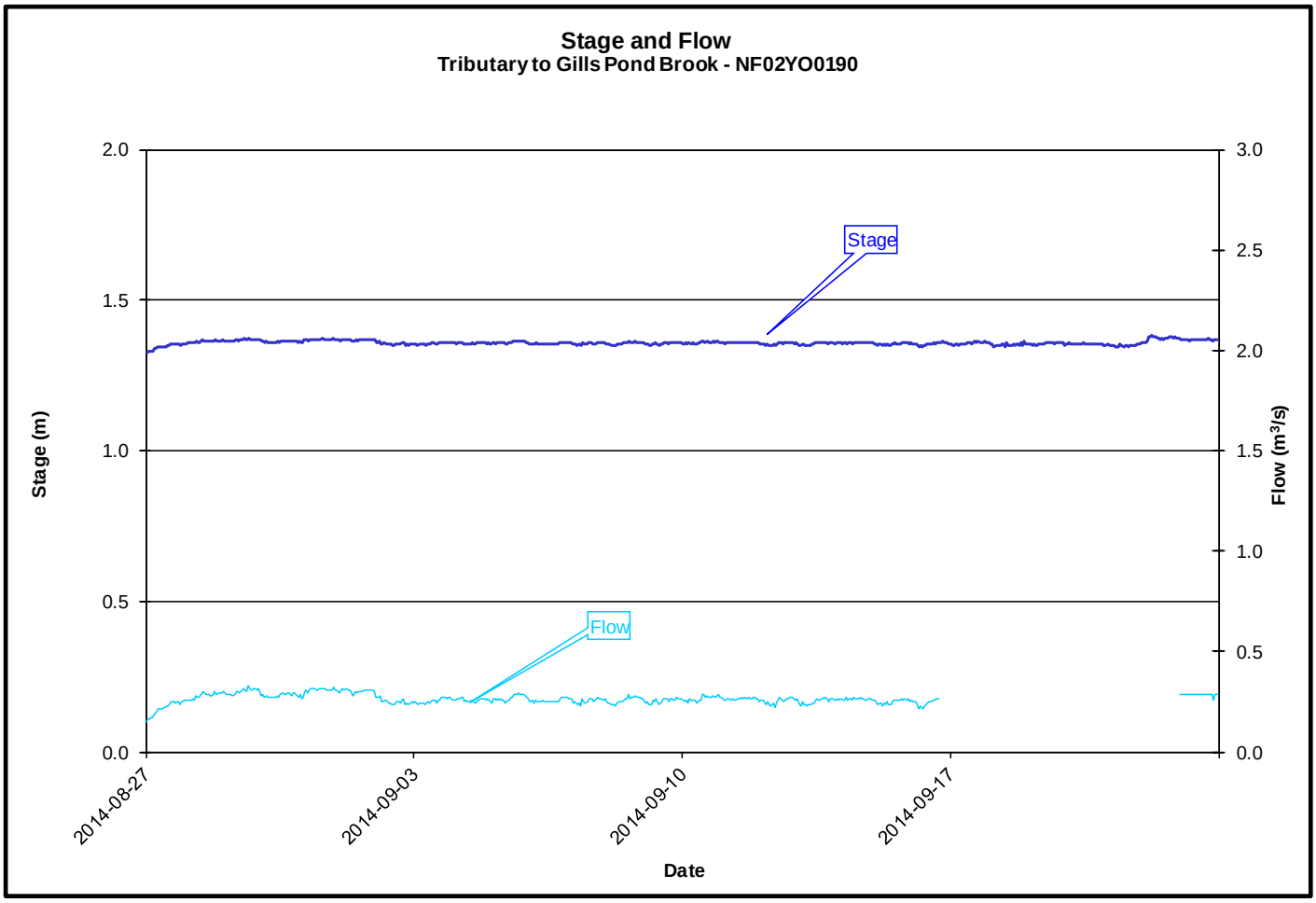

Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 7.71 ˚C to a maximum of 22.43 ˚C.
- There was a slight decrease in water temperatures over the deployment period.
- There does not appear to be any correlation with stage during this reporting period.

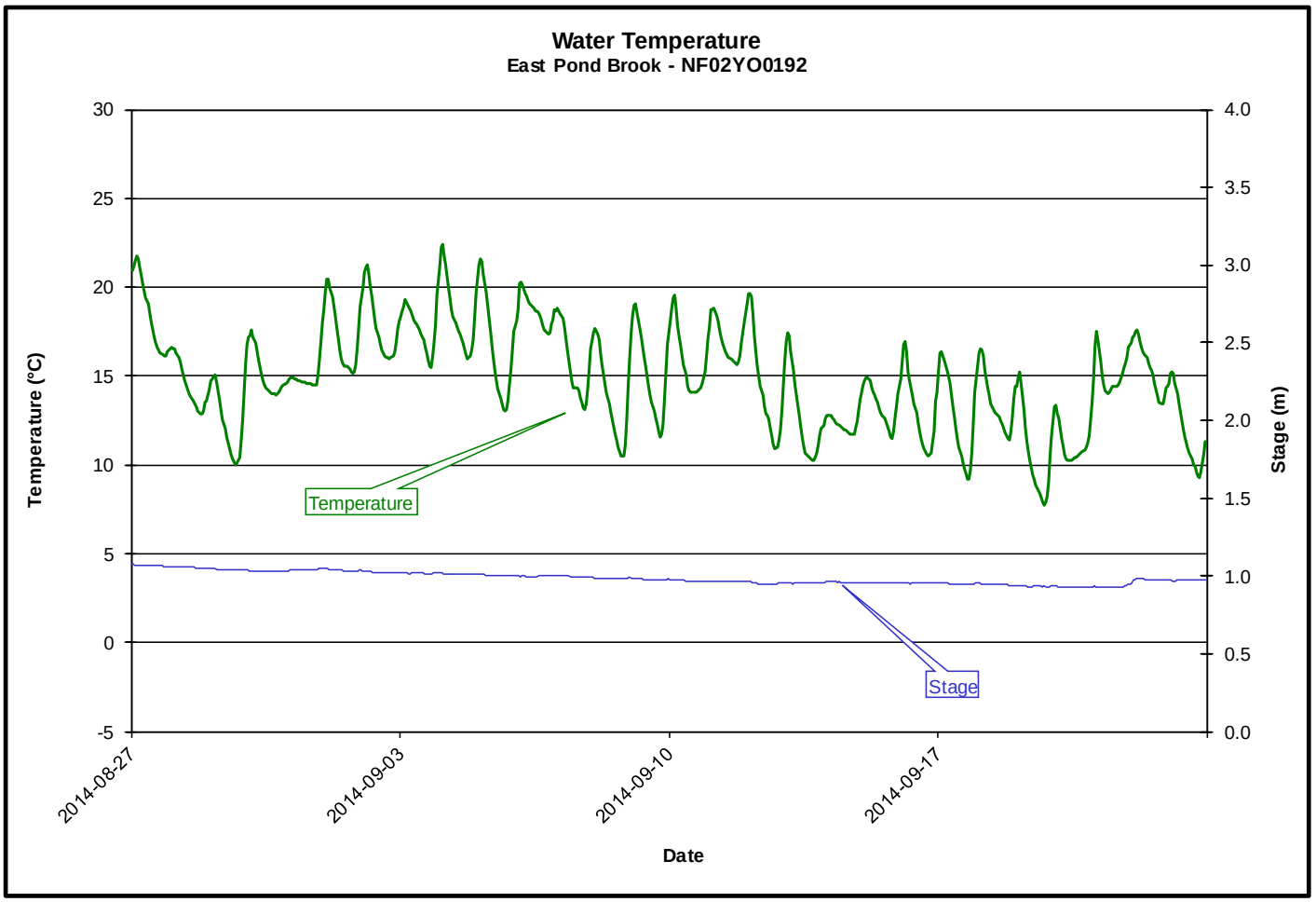

Figure 7

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 6.23 to a maximum of 6.89, with pH decreasing slightly over the deployment period.
- Throughout 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.

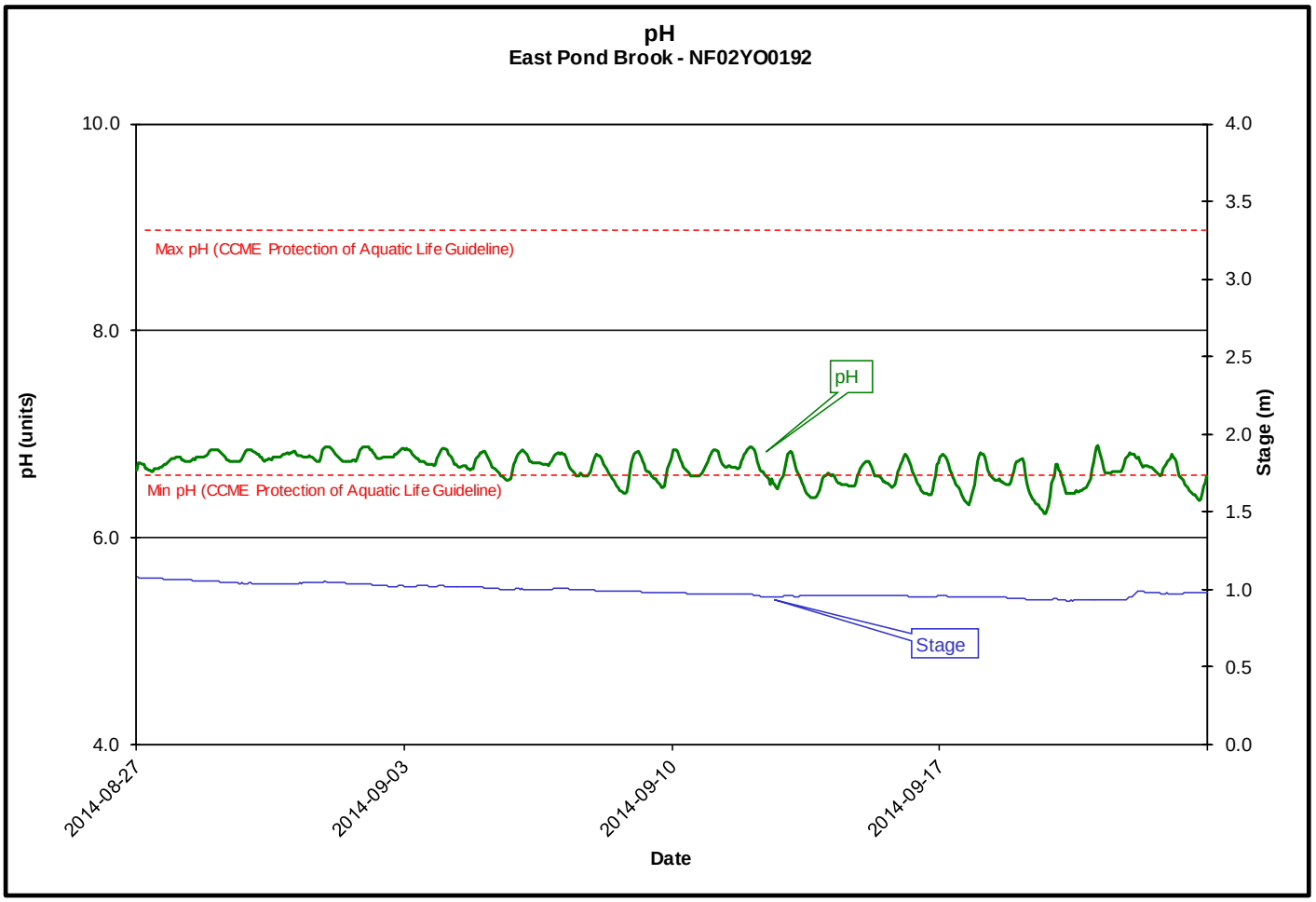

Figure 8

- The specific conductivity **(Figure 9)** ranged from a minimum of 25.9 µS/cm to a maximum of 39.8 µS/cm.
- There was a slight increase in specific conductance over the deployment period.
- All values are within the normal range.

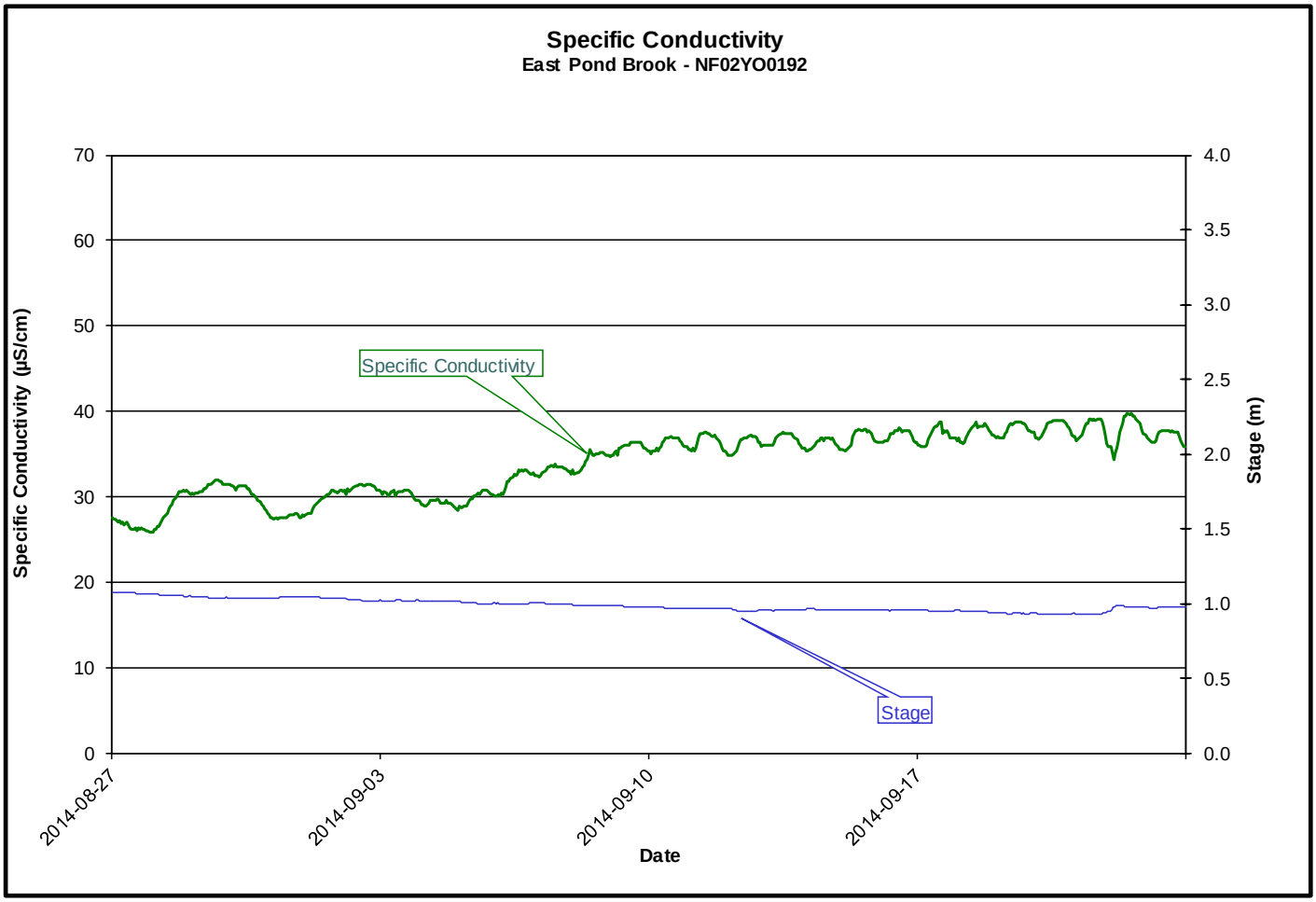

Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 8.28 mg/L to a maximum of 11.25 mg/L over the deployment period, with the percent saturation ranging between 89.9 and 99.1.
- Dissolved oxygen (mg/L) tended to increase over the deployment period, which corresponds with the decrease in temperature (**Figure 7**)
- 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.

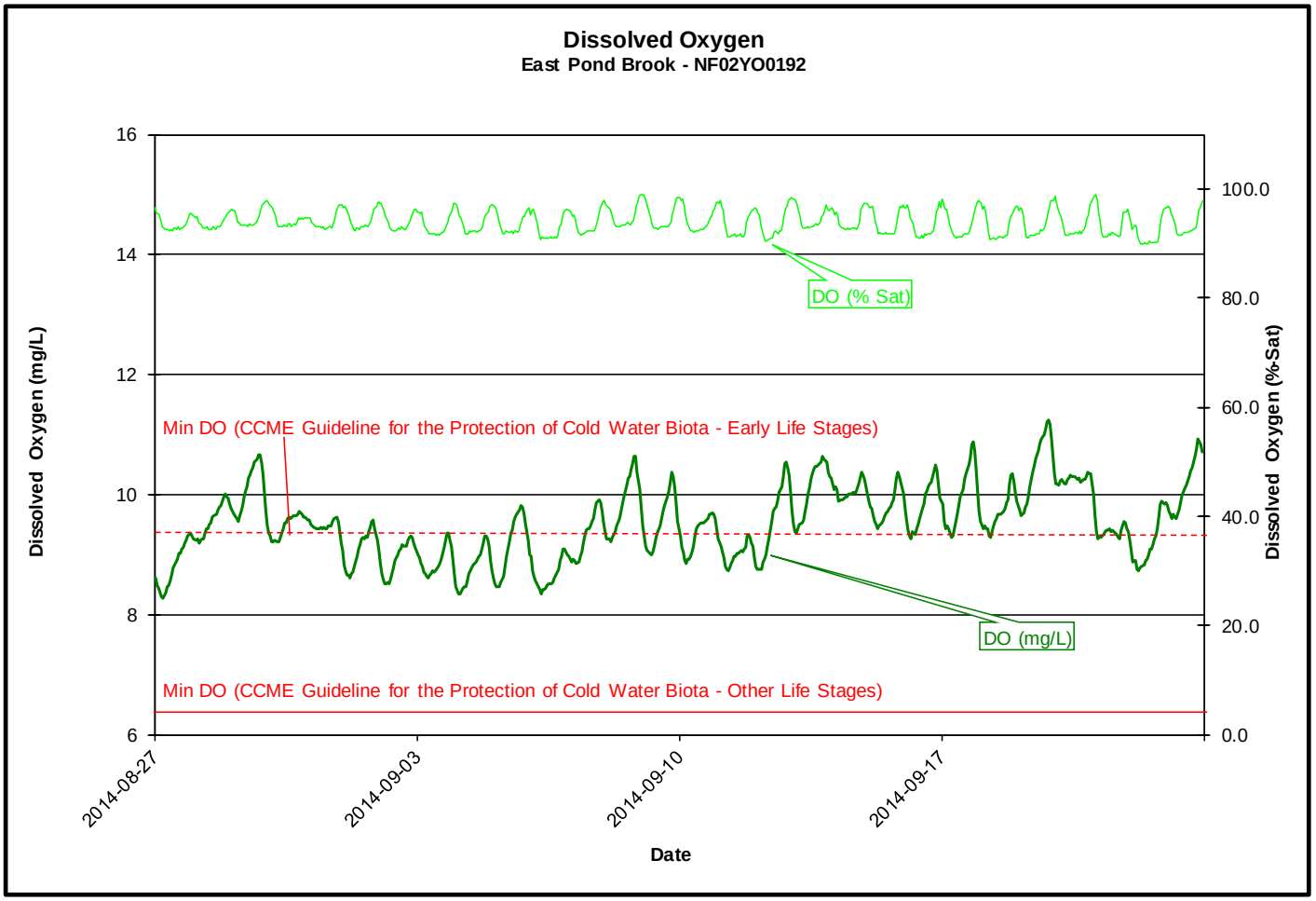

Figure 10

- The turbidity values (**Figure 11**) ranged from a minimum of 0.0 NTU to a maximum of 12.5 NTU.
- There were a couple of short term and insignificant spikes in turbidity.

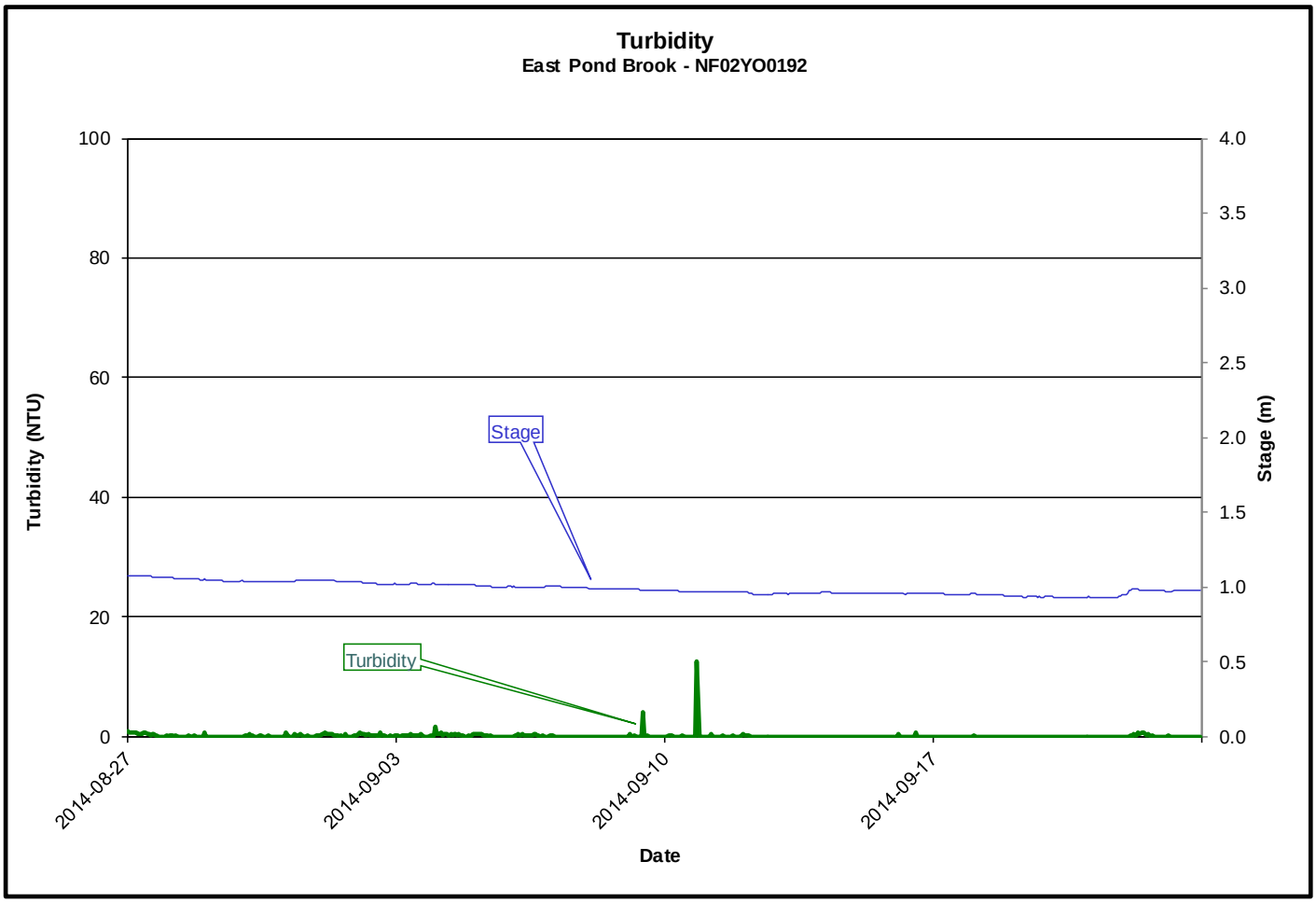

Figure 11

- The stage or water level ranged from a minimum of 0.92 m to a maximum of 1.08 m. The flow or discharge ranged from a minimum of 0.23 m^3/s to a maximum of 0.78 m^3/s **(Figure 12)**.
- There was a slight decrease in stage and flow over the deployment period.
- Flow data was not calculated for several days in the deployment period.

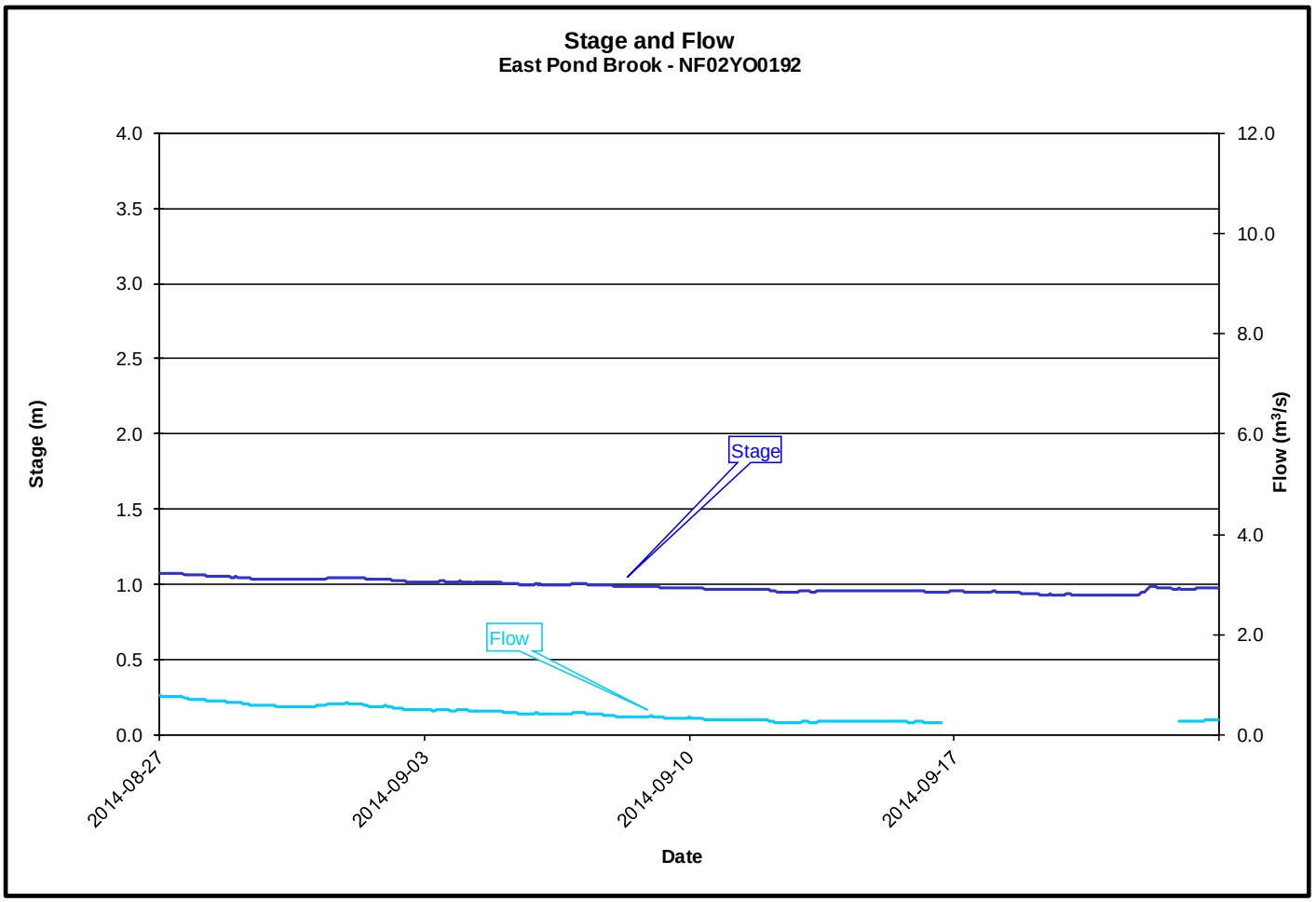

Figure 12

WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 5.25 ˚C to a maximum of 5.54 ˚C with a slight increase over the deployment period.
- There appears to be no correlation with water elevation.

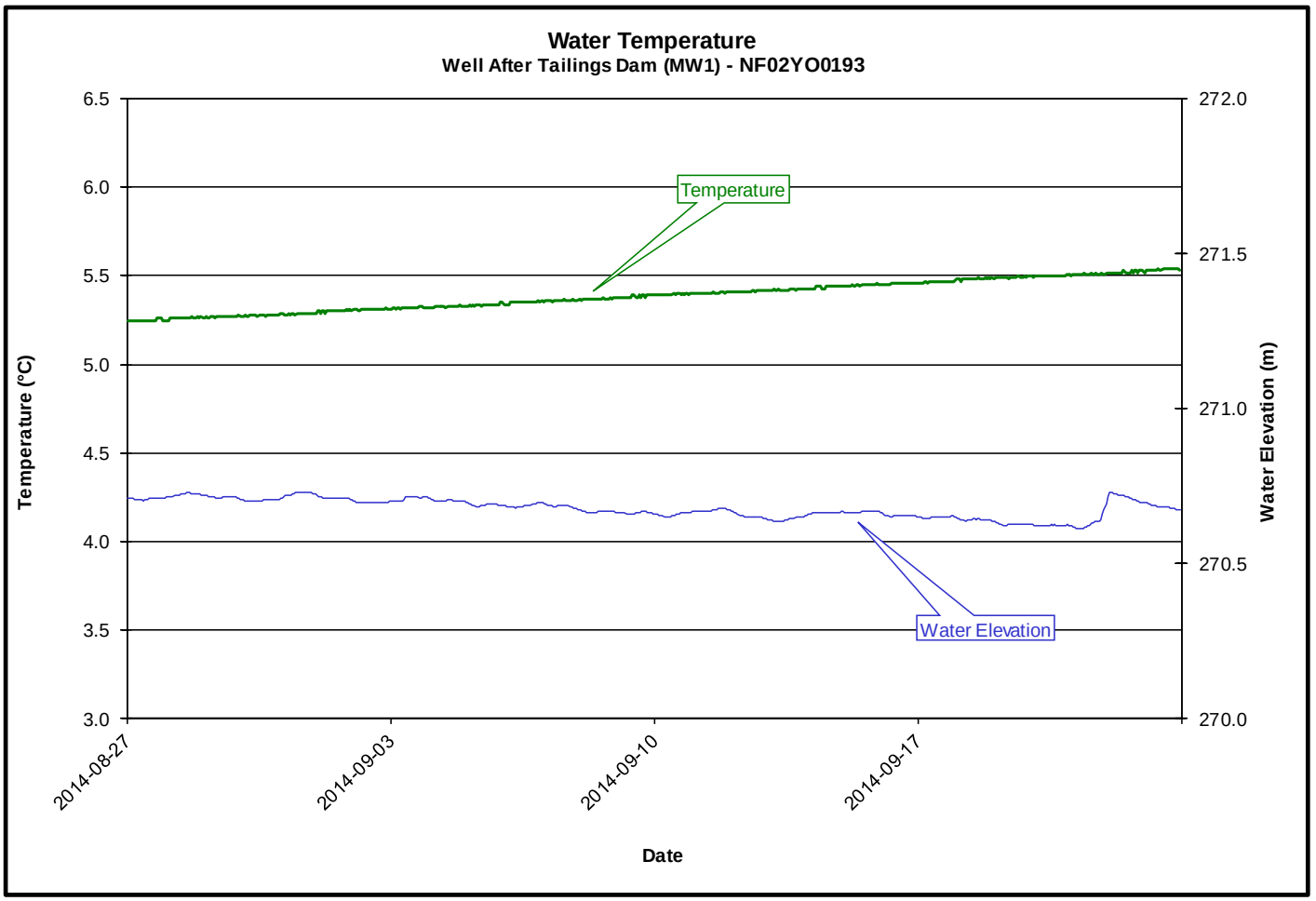

Figure 13

- The pH (**Figure 14**) ranged from a minimum of 8.56 to a maximum of 8.58, with little change over the deployment period.
- There does not appear to be any correlation with water elevation.

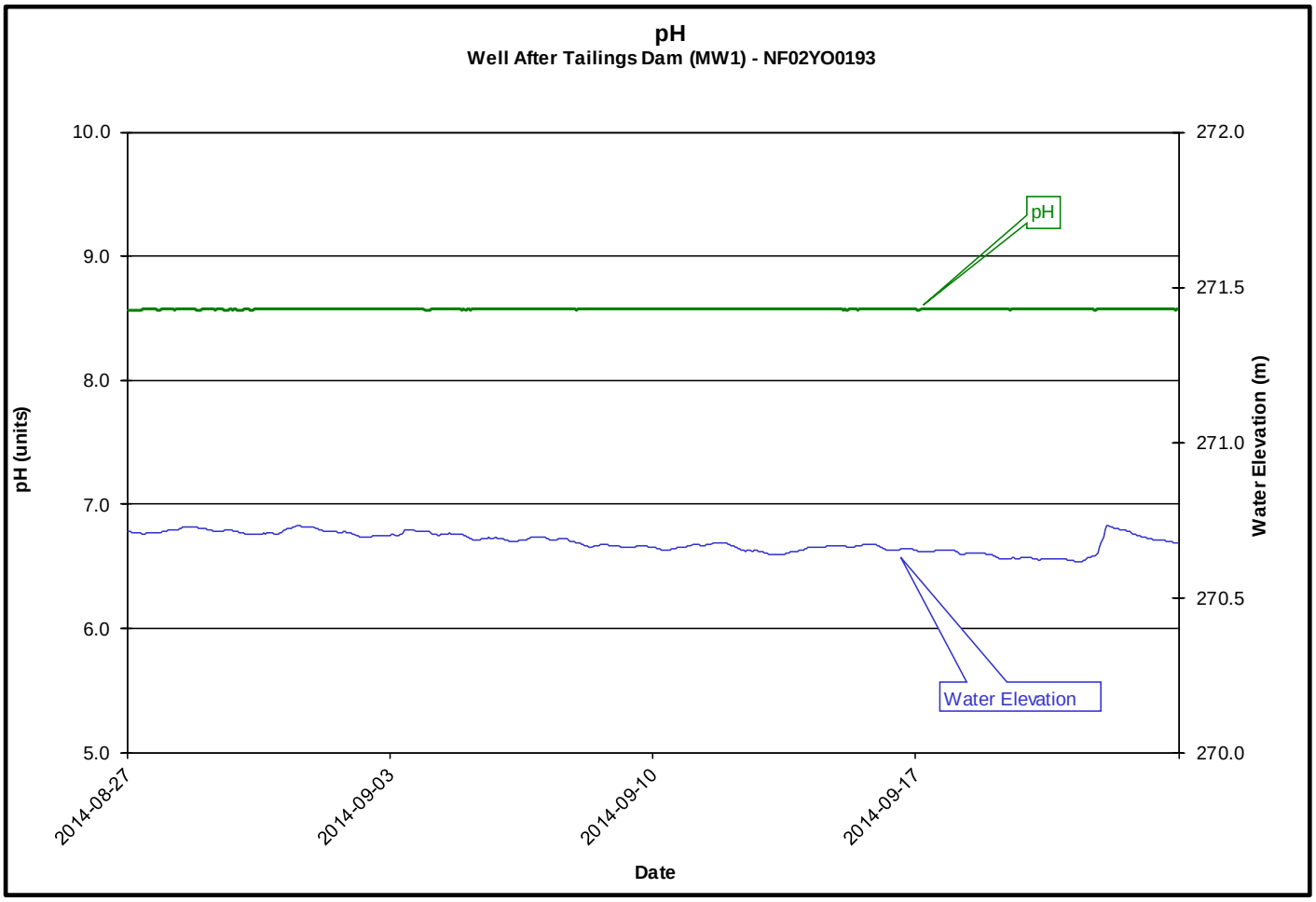

Figure 14

- The specific conductivity **(Figure 15)** ranged from a minimum of 0.776 mS/cm to a maximum of 0.782 mS/cm.
- There was little change evident over the deployment period.

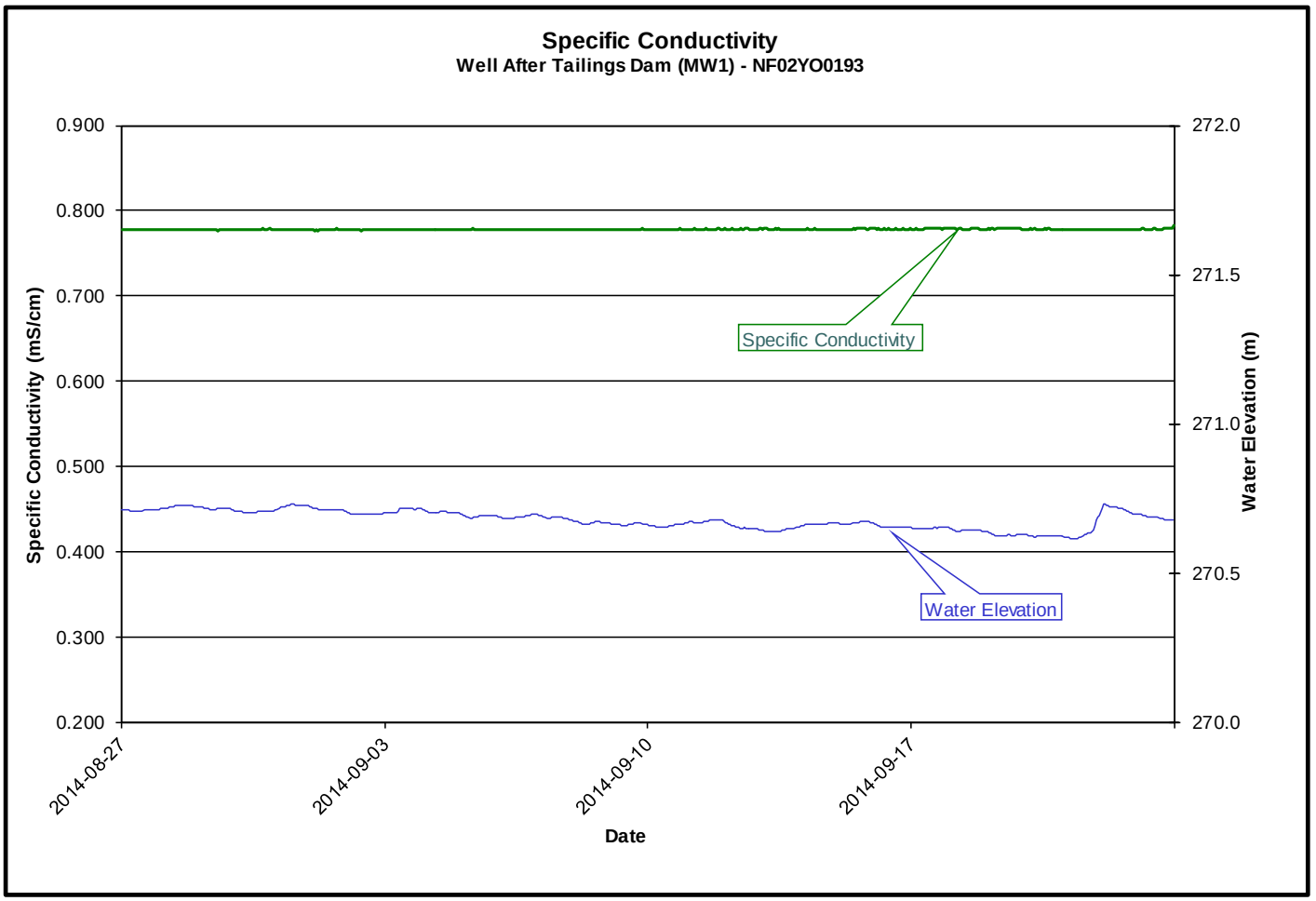

Figure 15

- The Water Elevation **(Figure 16)** ranged from a minimum of 270.61 m to a maximum of 270.73 m.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by precipitation/runoff events. This is evidenced by the increase on September 22, 2014 which is similar to nearby streams (**Figures 6 and 12**).

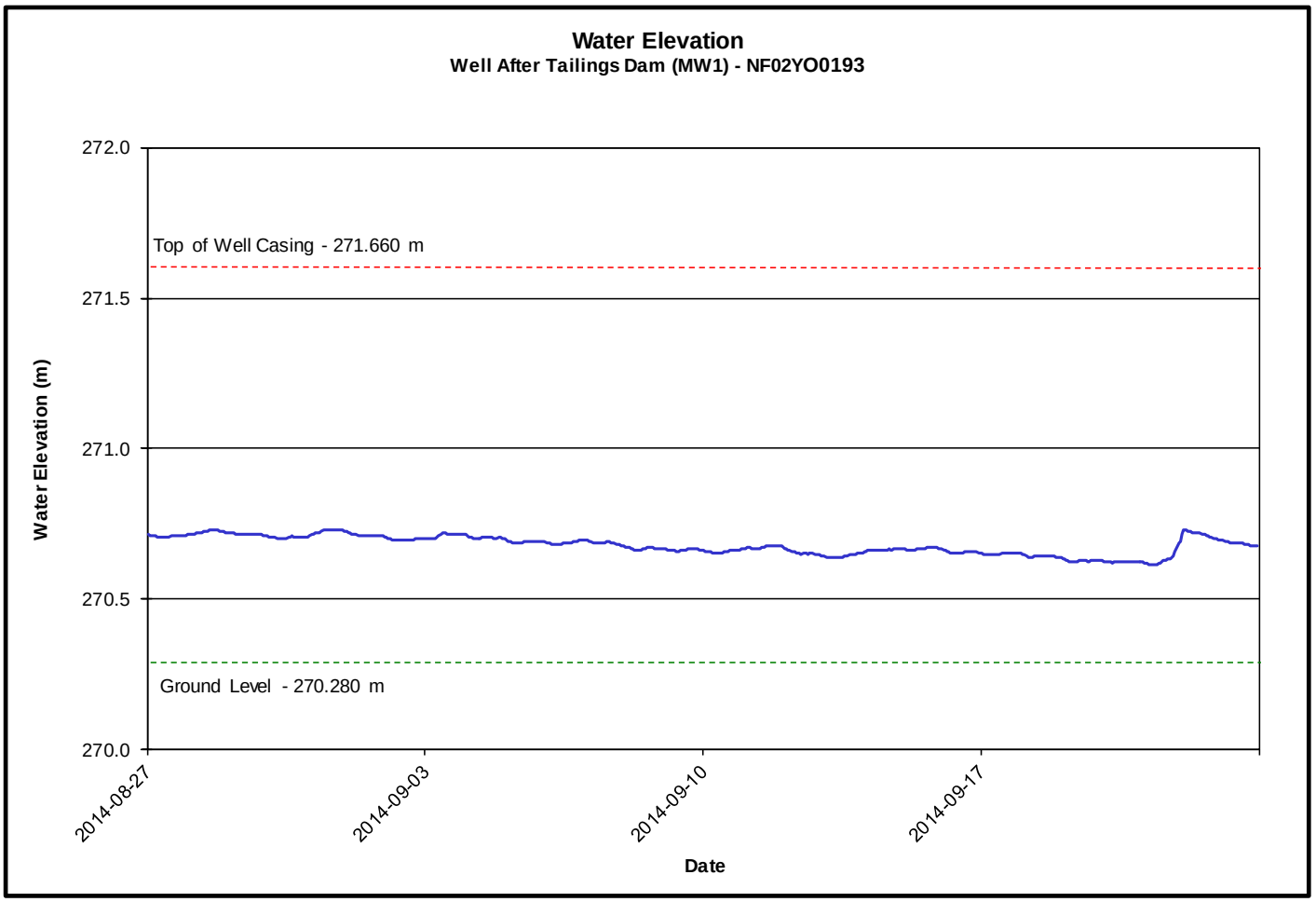

Figure 16

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