Real Time Water Quality Report
Teck Duck Pond Operations

Deployment Period 2011-09-20 to 2011-11-01

2011-12-16

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 effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) episodically throughout the deployment period.

Maintenance and Calibration of Instrumentation

- After being cleaned and freshly calibrated the regular **DataSondes®**(s/n 43245) for Tributary to Gills Pond Brook and (s/n 43794) for East Pond Brook were installed on September 20, 2011, and remained deployed continuously until November 1, 2011, a 41 day period.

- The regular **Quanta G®** (s/n 00035) has remained deployed continuously in Monitoring Well After Tailings Dam Station (MW1) since September 7, 2011 and will remain deployed throughout the winter as this well is subject to freezing at surface. Data will be discussed only for the 41 day period covered by this report.

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 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 are 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 Conductance based upon live data and laboratory data. However, during this deployment period, no comparisons or rankings are possible.

- There is a brief period of missing data on October 26, 2011 for each of the stations due to data communications issues.

- 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**
2011-09-20 Deployment	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2011-11-01 Removal	Temp (^{o}C)	Good
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent

Table 2

East Pond Brook Station (NF02YO0192)		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2011-08-10 Deployment	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2011-09-16 Removal	Temp (^{o}C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Good
	Turbidity (NTU)	Excellent

Table 3

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of 0.08 ˚C to a maximum of 15.55 ˚C.
- Temperature generally decreased throughout the deployment period.
- There appears to be little correlation with stage.

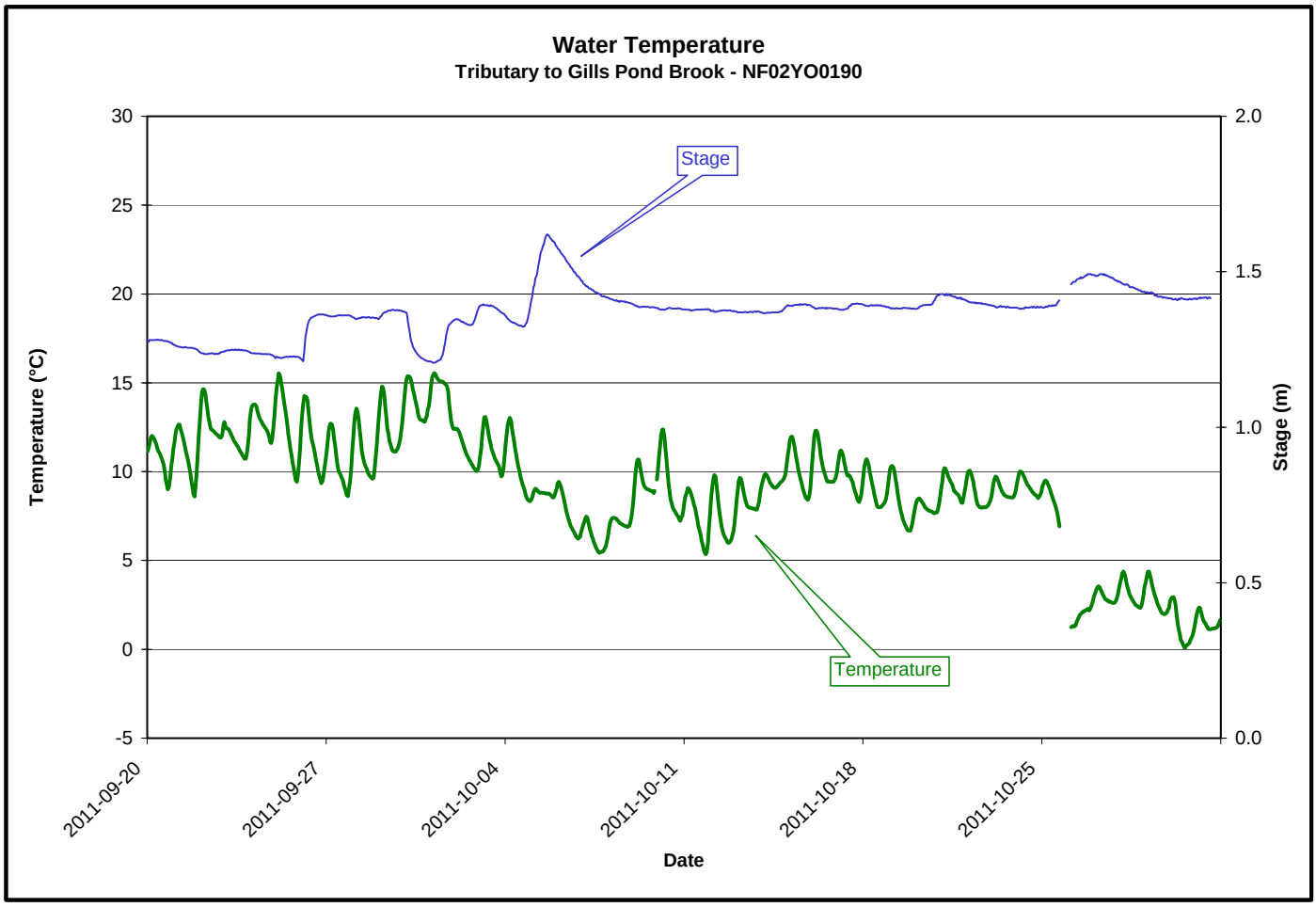

Figure 1

- Throughout the deployment period pH values (**Figure 2**) ranged from a minimum of 6.06 to a maximum of 7.49 with few of the values falling outside 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 this deployment period.
- The background pH of this stream is normally around the lower limit of the recommended range.

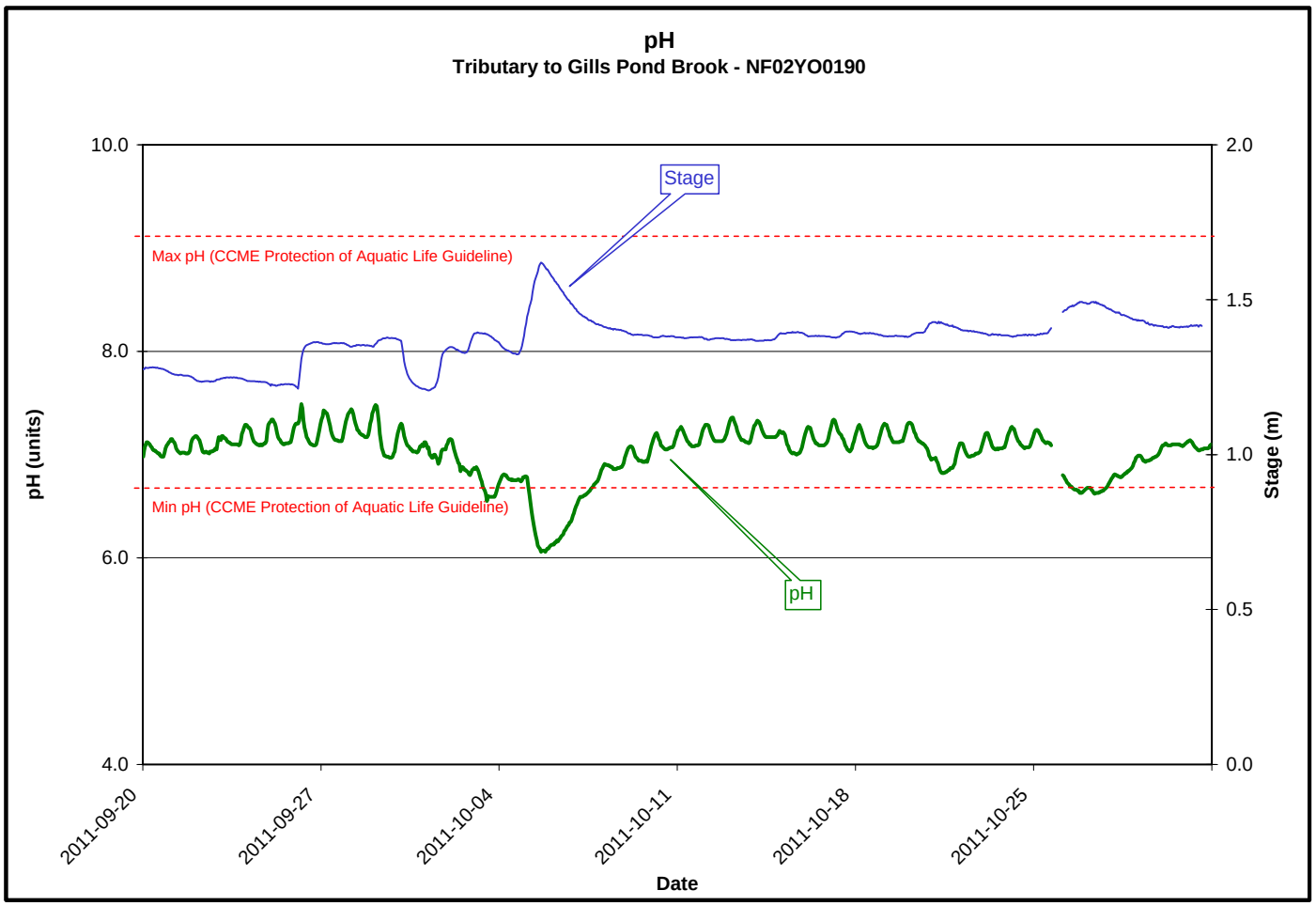

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 59.1 µS/cm to a maximum of 1193.0 µS/cm over the deployment period.
- The highest specific conductance readings correspond with periods of discharge from the Polishing Pond.
- The 'V' shaped dips are the result of dilution caused by precipitation events, indicated by increases in the stage.

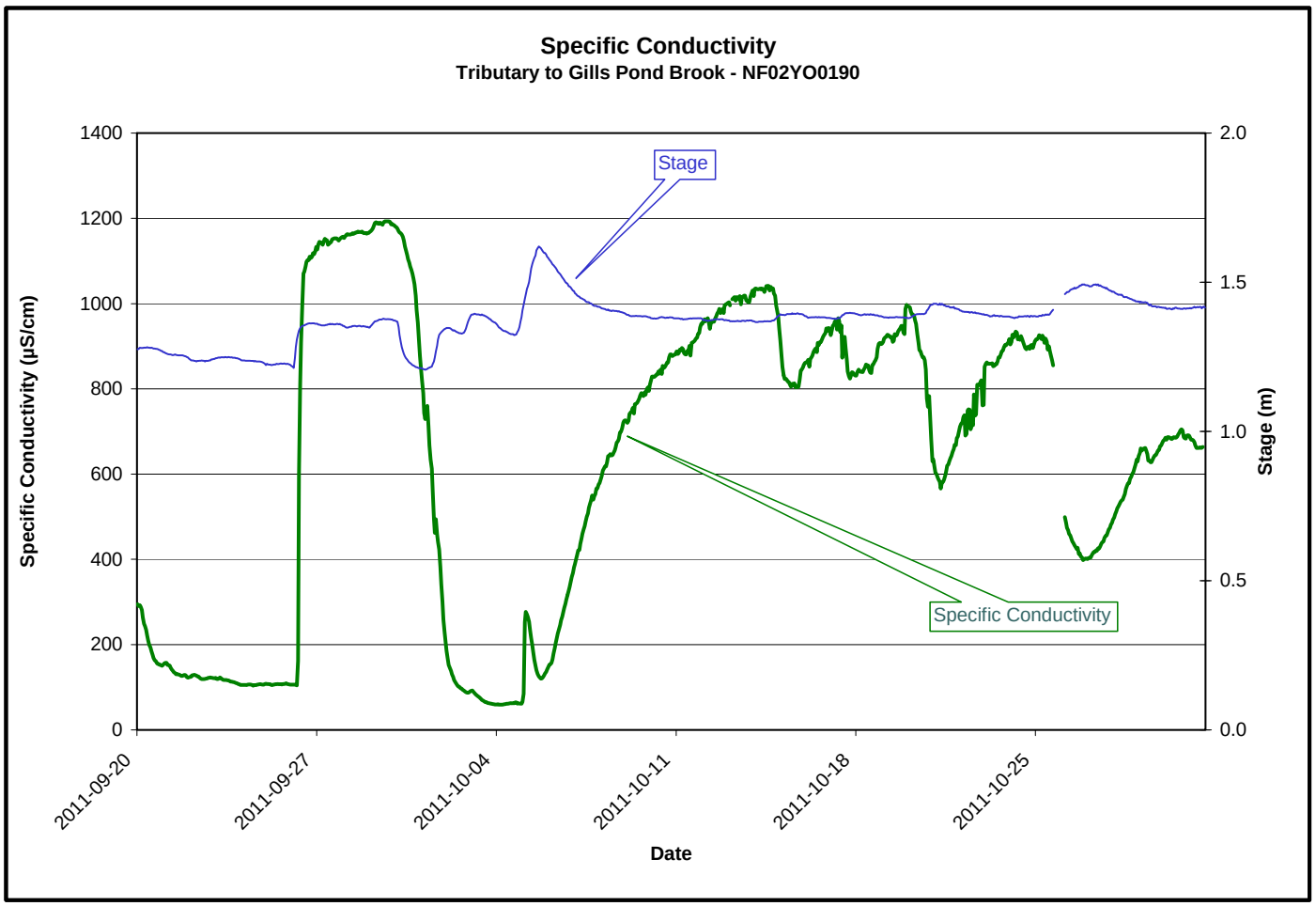

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 8.91 mg/L to a maximum of 13.00 mg/L over the deployment period, with the percent saturation ranging between 81.6 and 98.9.
- Dissolved oxygen is generally inversely proportional to water temperature.
- Nearly all of the 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 minimal change over the deployment period, we can be confident that the Dissolved Oxygen mg/L values are accurate.

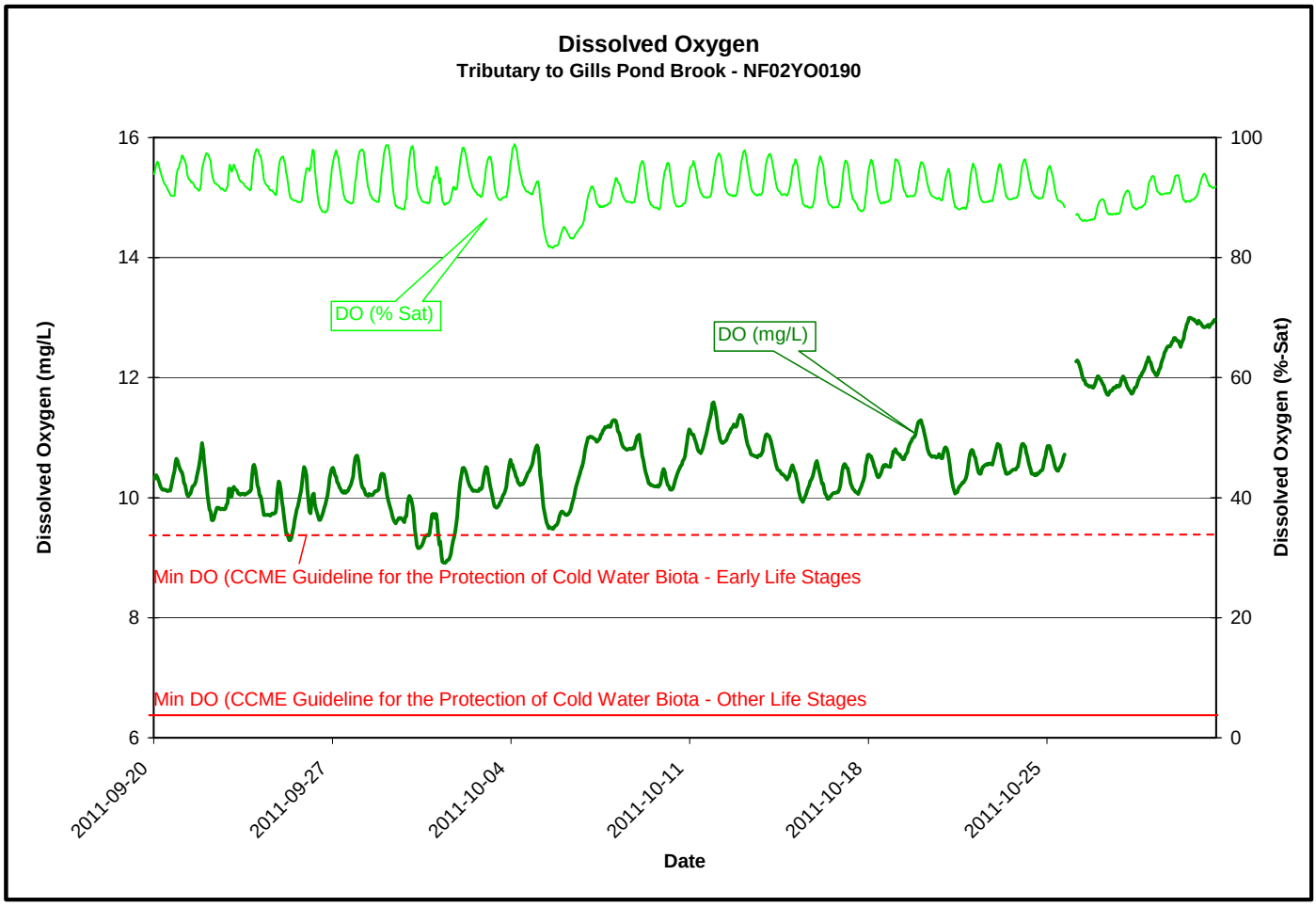

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 186.5 NTU.
- The highest turbidity spikes are correlated with increases in stage which are the result of heavy precipitation.
- Upon removal, the water appeared to be slightly turbid, with instrument values reporting between 2.2 NTU and 3.4 NTU in situ.
- Based upon previous investigation, it has been determined that turbidity values may be artificially increased due to air entrainment during higher flows.
- The higher turbidity spikes likely correspond to natural in-stream debris and/or air bubbles from turbulent flow passing over the sensor.

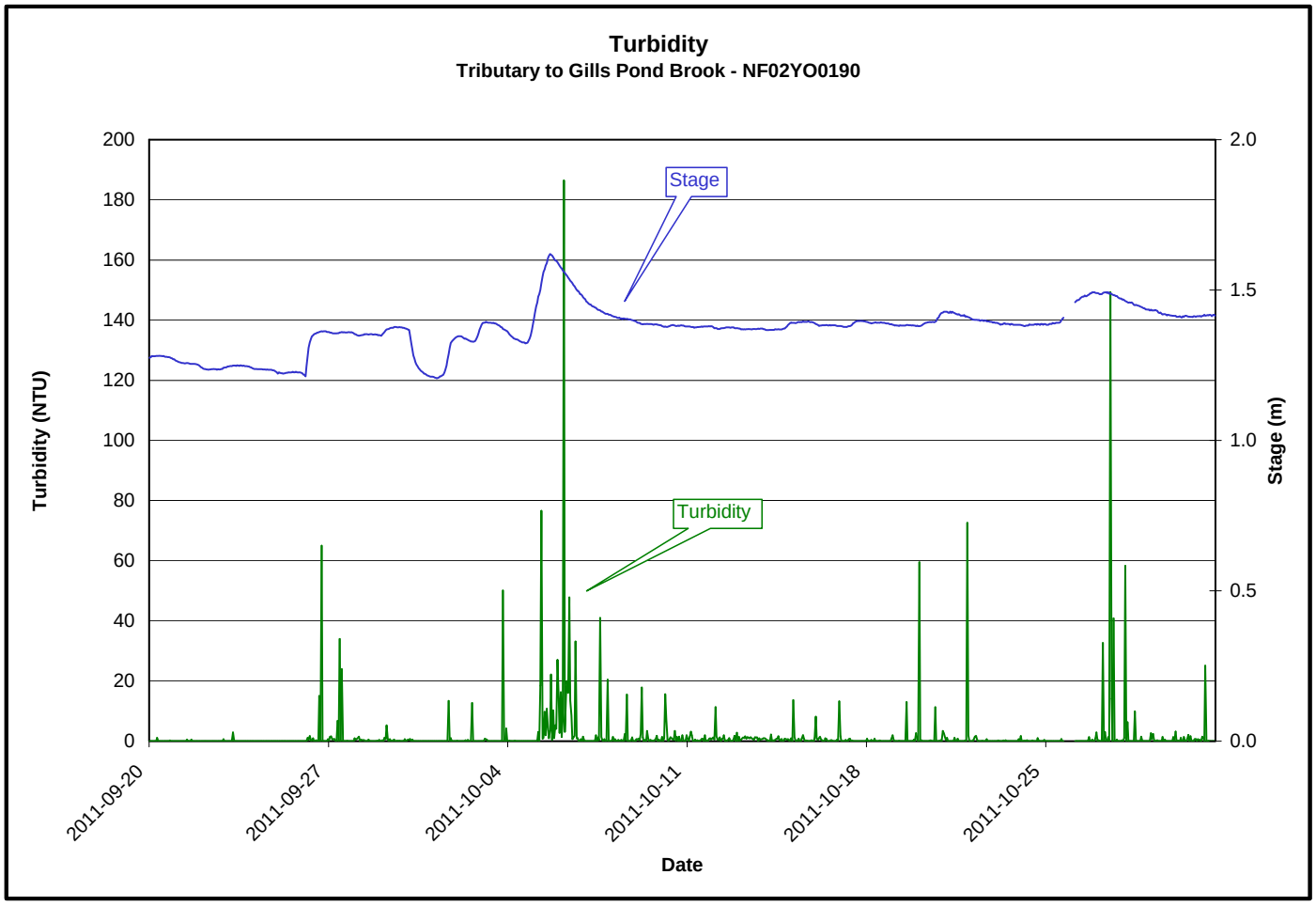

Figure 5

- The stage or water level ranged from a minimum of 1.21 m to a maximum of 1.62 m. The flow or discharge ranged from a minimum of 0.01 m^3/s to a maximum of 1.84 m^3/s (**Figure 6)**.
- The higher levels correspond to periods of discharge from Polishing Pond, while the peaks correspond to precipitation events.
- All values are within the normal range.

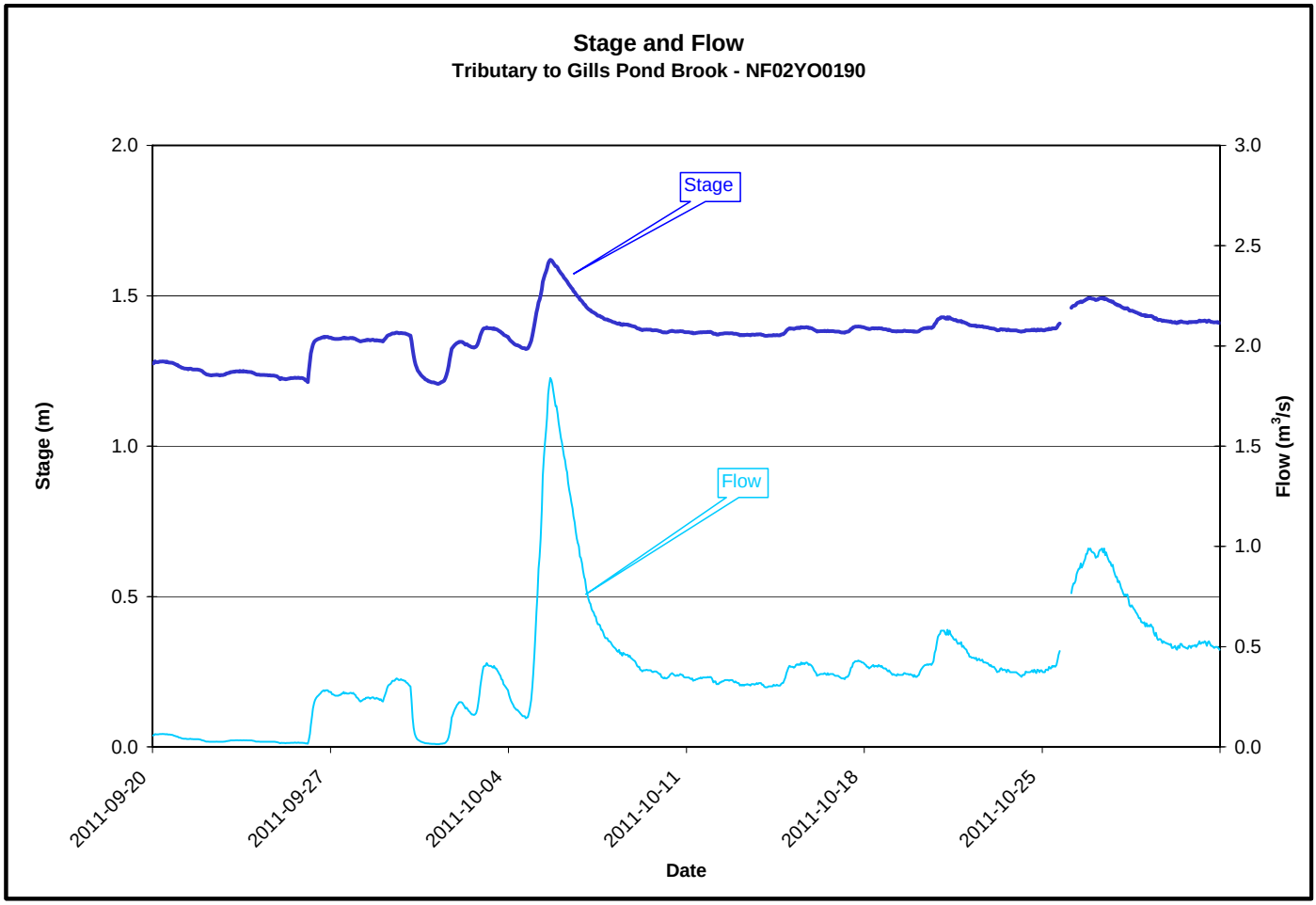

Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 0.13 ˚C to a maximum of 16.54 ˚C.
- Temperatures generally decreased throughout the deployment period.
- There appears to be little correlation with stage, although during peak flows, the diurnal variation in temperature is less, presumably due to precipitation, cloud cover and lower daytime ambient temperatures.

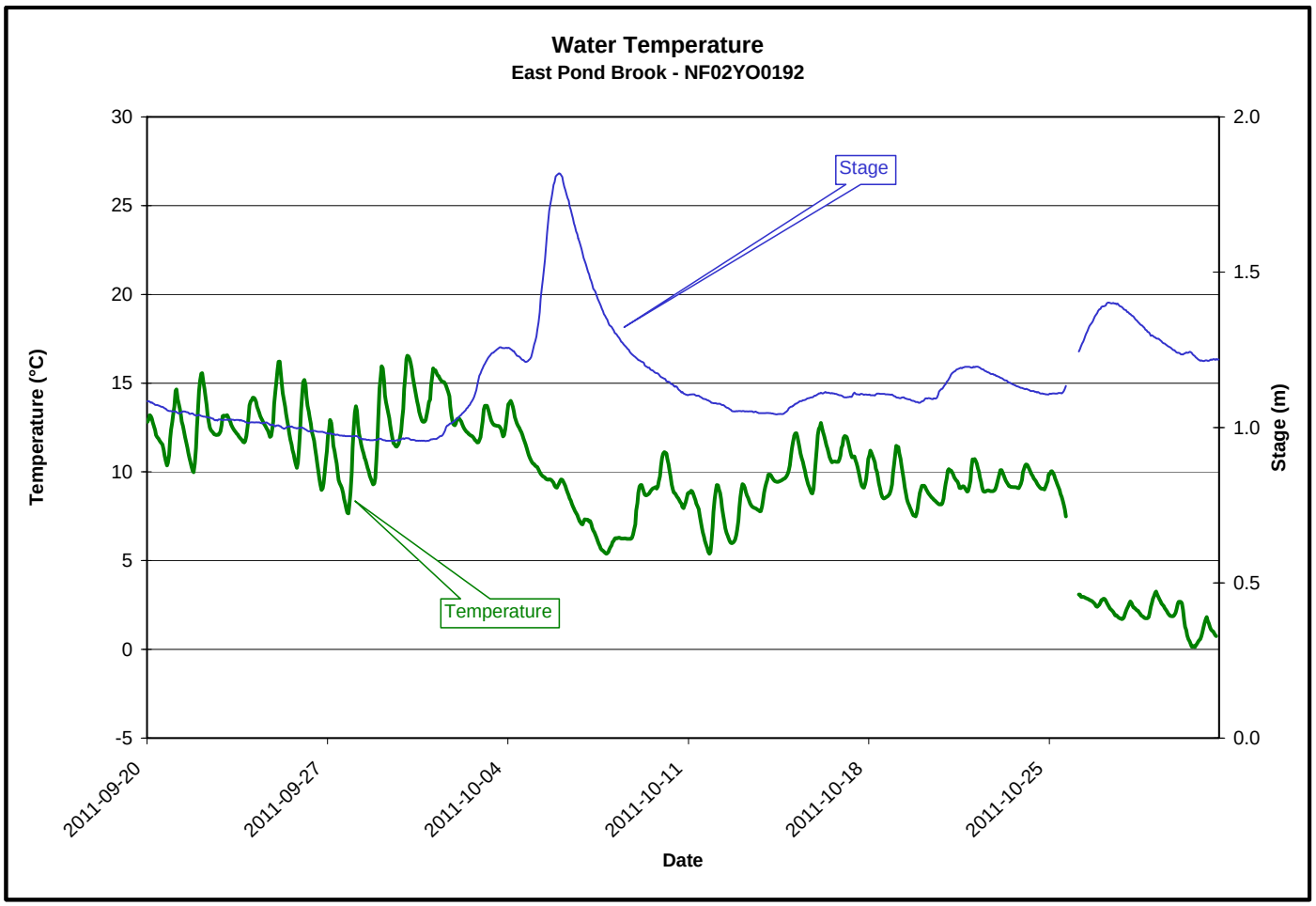

Figure 7

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 5.51 to a maximum of 7.06 with pH decreasing throughout the deployment period.
- There is a temporary decrease on pH corresponding with peak flows.
- In the latter two thirds of the deployment period, all of the values fell 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 quite low, and values near and below the limit are not unusual.

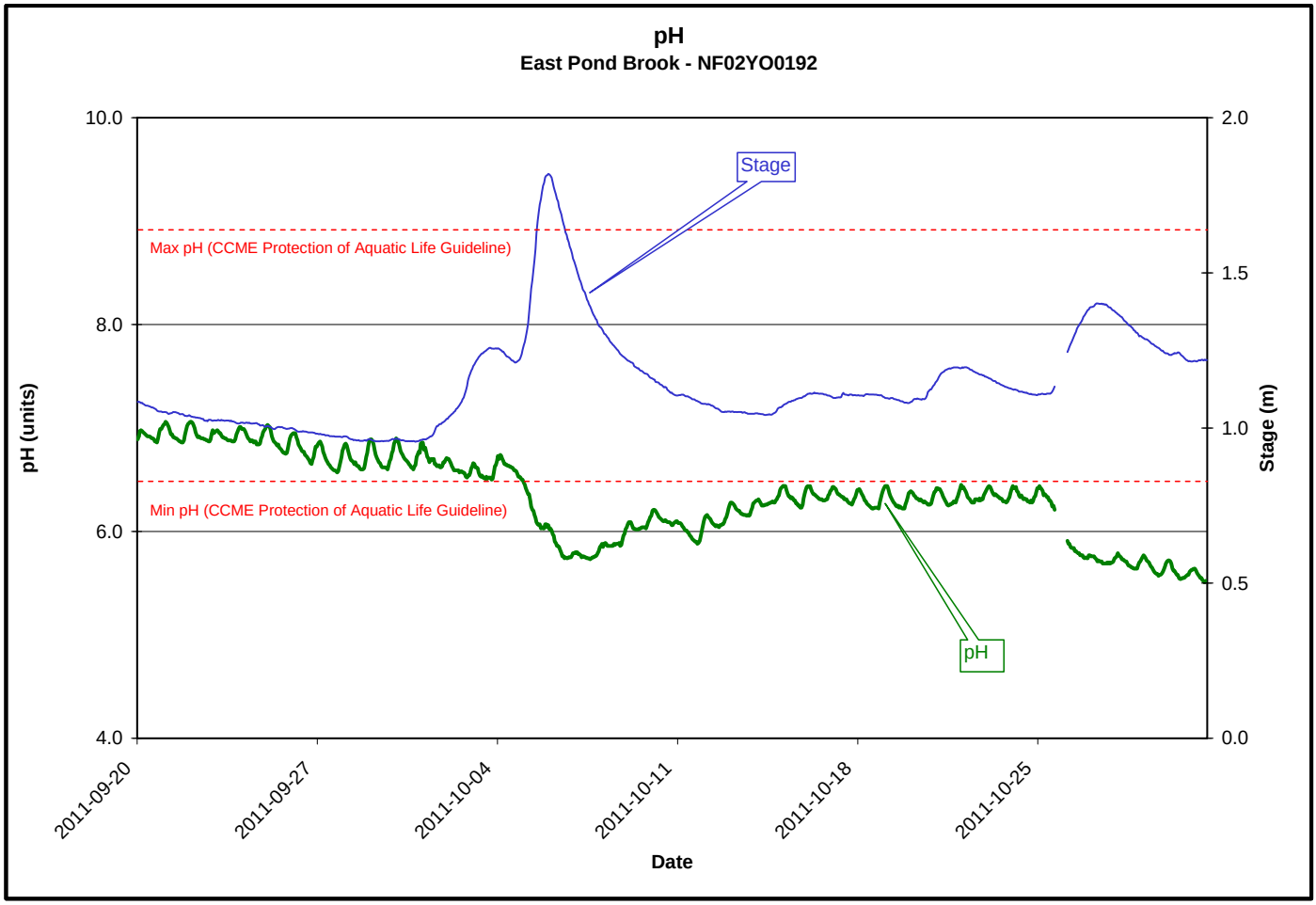

Figure 8

- The specific conductivity **(Figure 9)** ranged from a minimum of 19.8 µS/cm to a maximum of 40.0 µS/cm, with a slight decrease over the deployment period.
- There is a temporary decrease on specific conductivity corresponding with peak flows.
- All values are within the normal range.

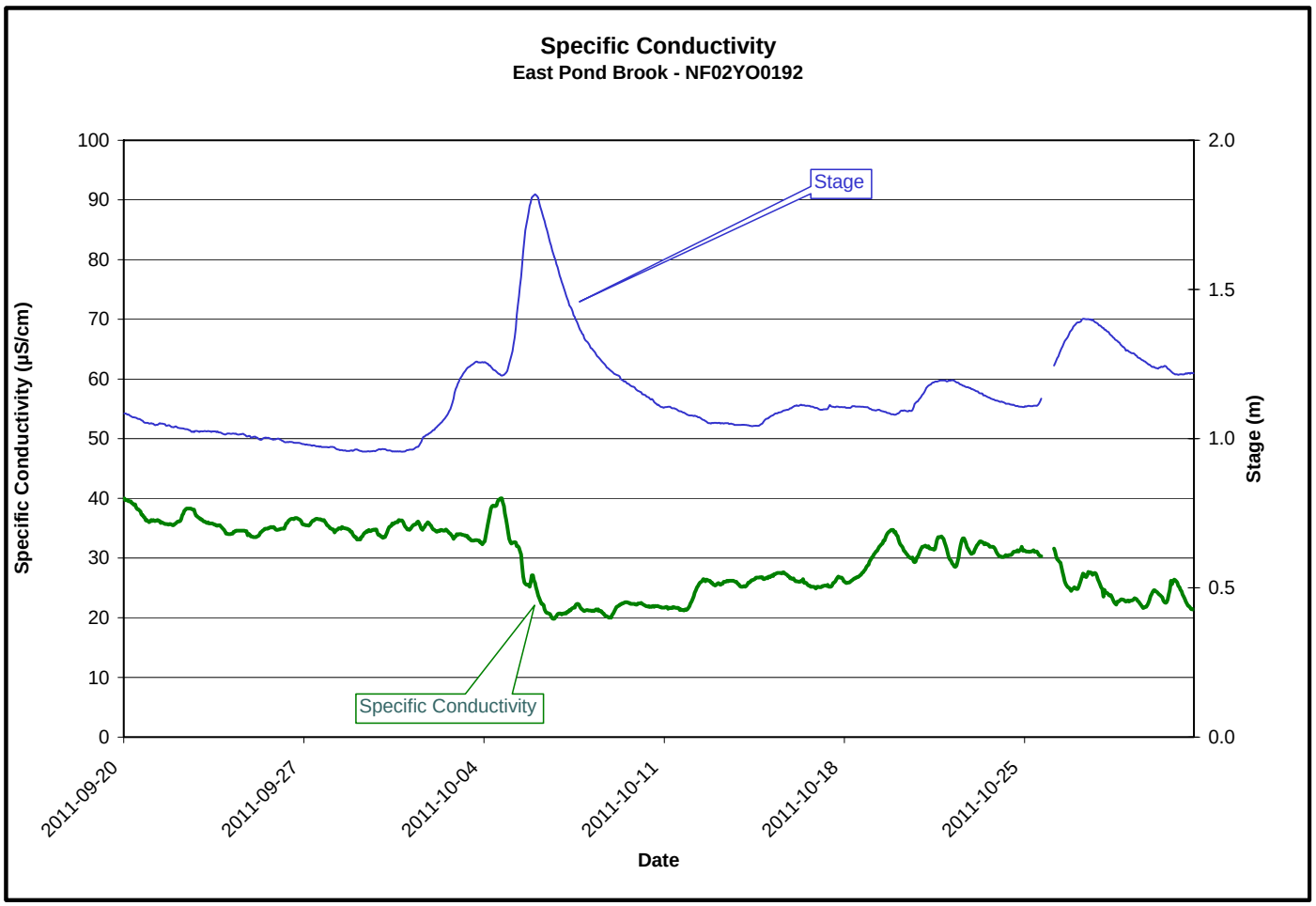

Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 8.77 mg/L to a maximum of 13.26 mg/L over the deployment period, with the percent saturation ranging between 87.1 and 95.7.
- Dissolved oxygen is inversely proportional to water temperature.
- Throughout all of the deployment period, most 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.

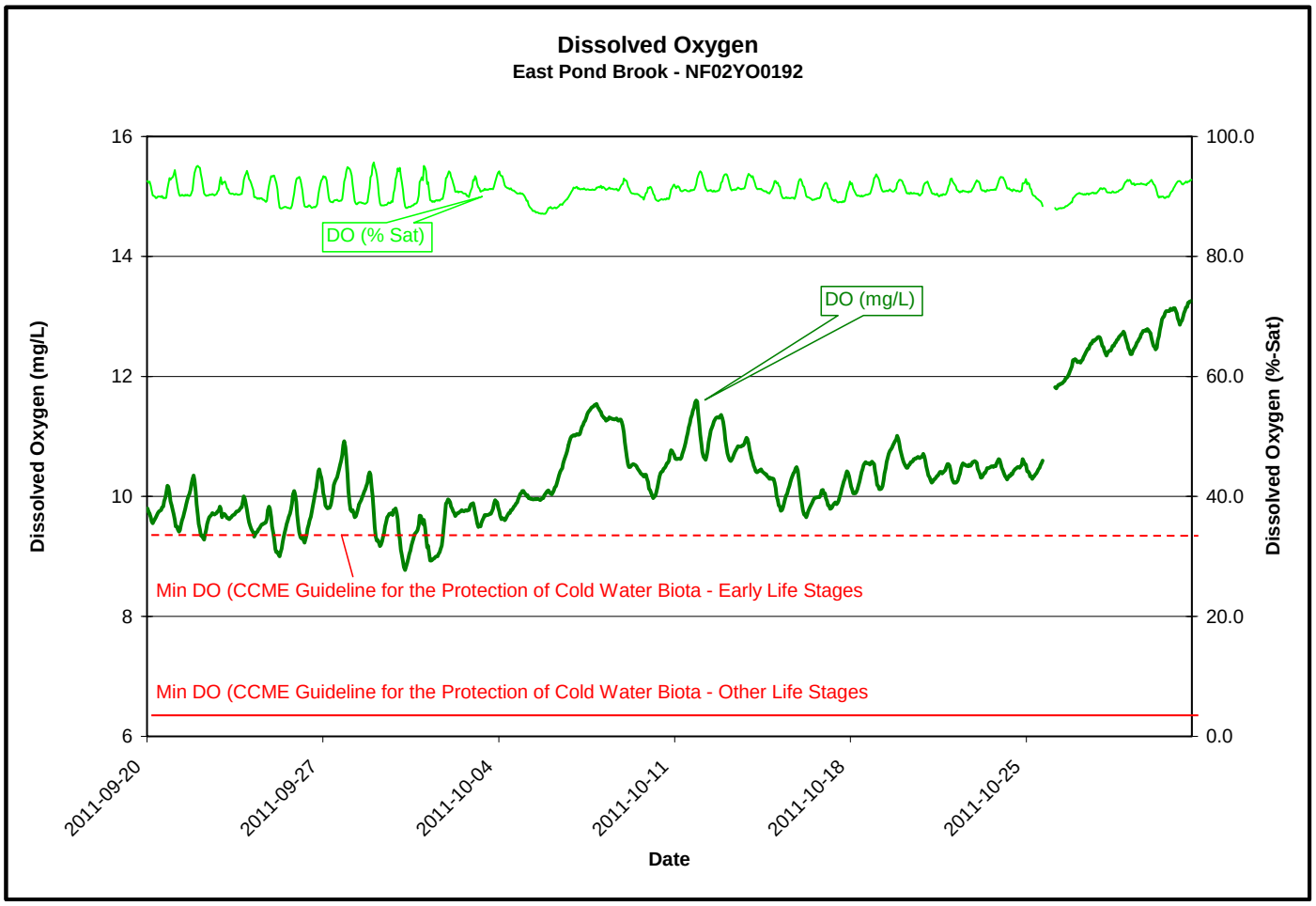

Figure 10

- The turbidity values **(Figure 11)** ranged from a minimum of 0.0 NTU to a maximum of 21.9 NTU.
- Turbidity values in this stream are typically near zero; the peaks typically being insignificant events when natural in-stream debris and/or air bubbles passed near the sensor.
- Neither *in situ* nor grab sample measurements nor visual observations indicated turbidity issues.

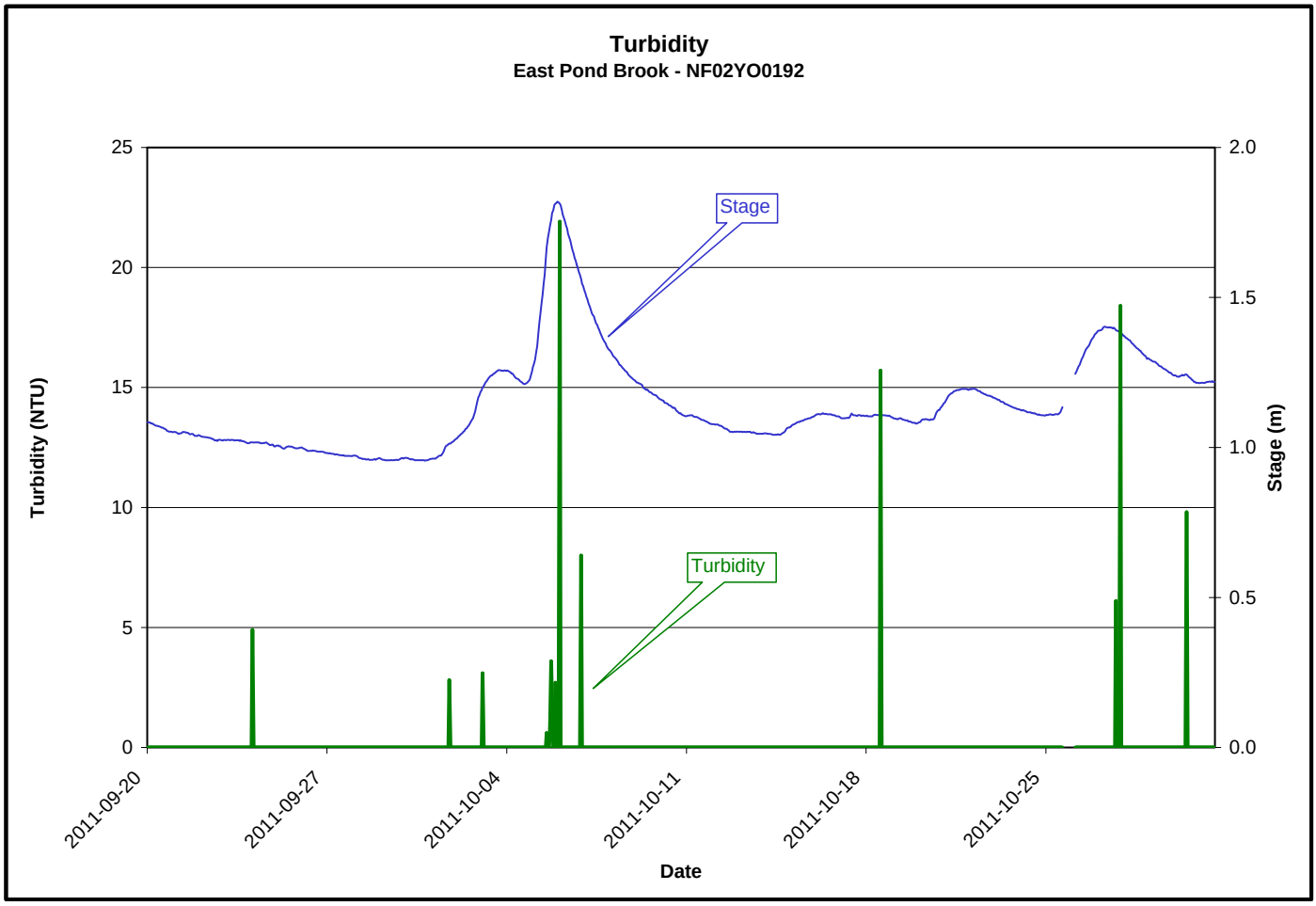

Figure 11

- The stage or water level ranged from a minimum of 0.96 m to a maximum of 1.82 m. The flow or discharge ranged from a minimum of 0.26 m^3/s to a maximum of 11.20 m^3/s **(Figure 12)**.
- Peaks are the result of precipitation/runoff events.
- Both stage and flow are within normal ranges.

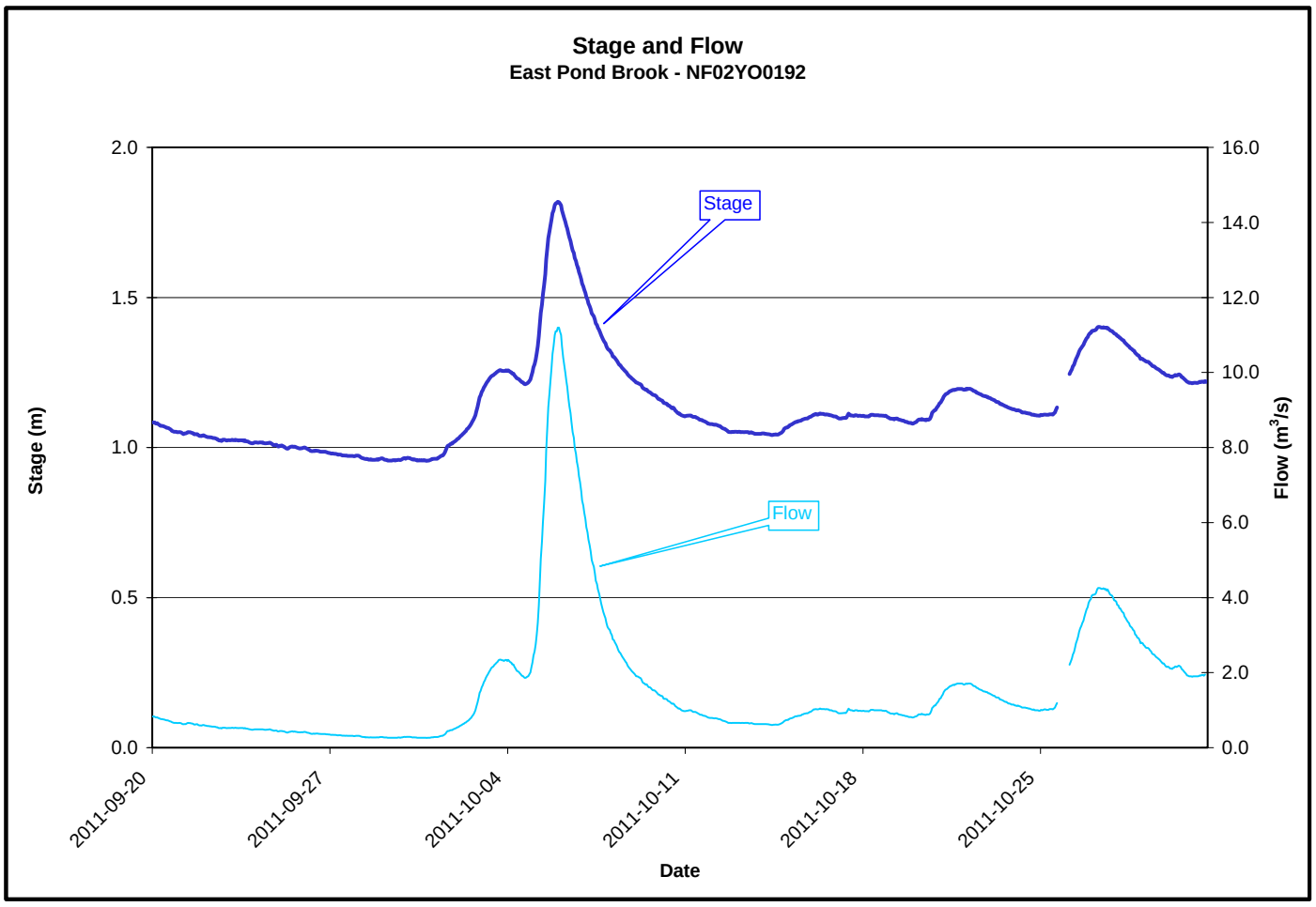

Figure 12

WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 5.45 ˚C to a maximum of 5.80 ˚C with a slight increase over the deployment period.
- There appears to be little correlation with water elevation.

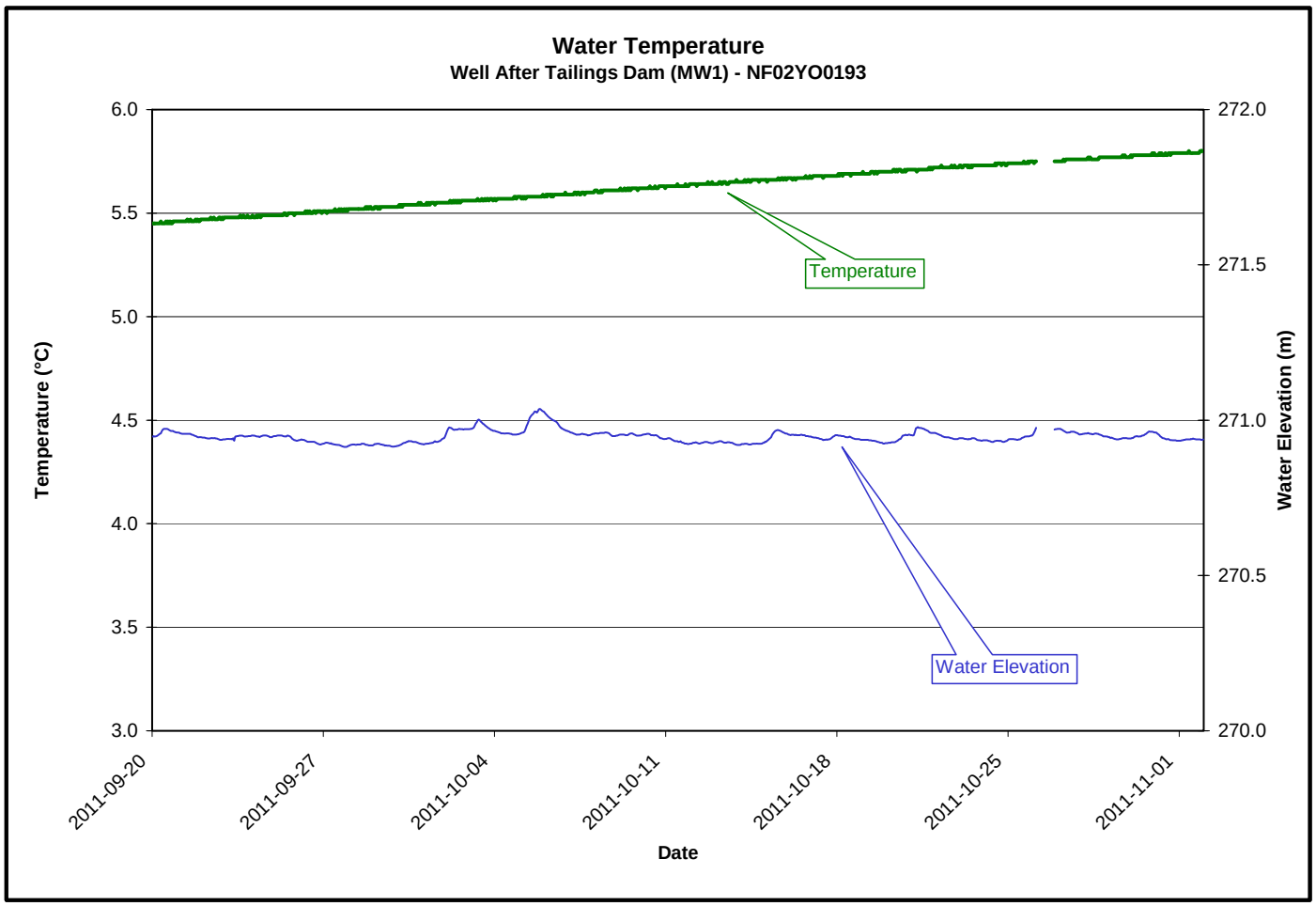

Figure 13

- The pH (**Figure 14**) ranged from a minimum of 8.45 to a maximum of 8.60, with little variability over the deployment period.
- There does not appear to be any correlation with water elevation.

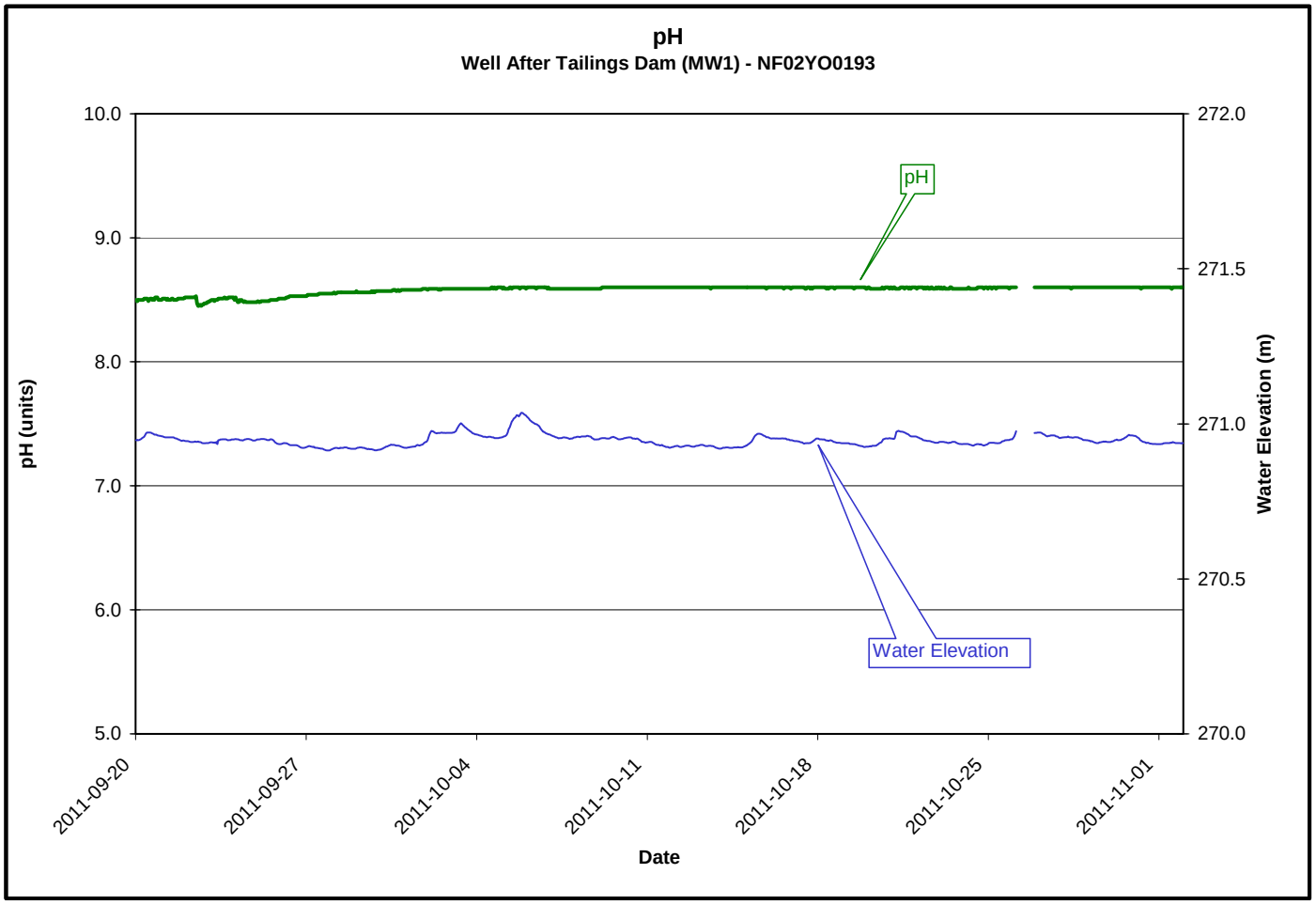

Figure 14

- The specific conductivity **(Figure 15)** ranged from a minimum of 0.621 mS/cm to a maximum of 0.635 mS/cm over the deployment period.
- There was a slight increase in the specific conductivity during the reporting period.

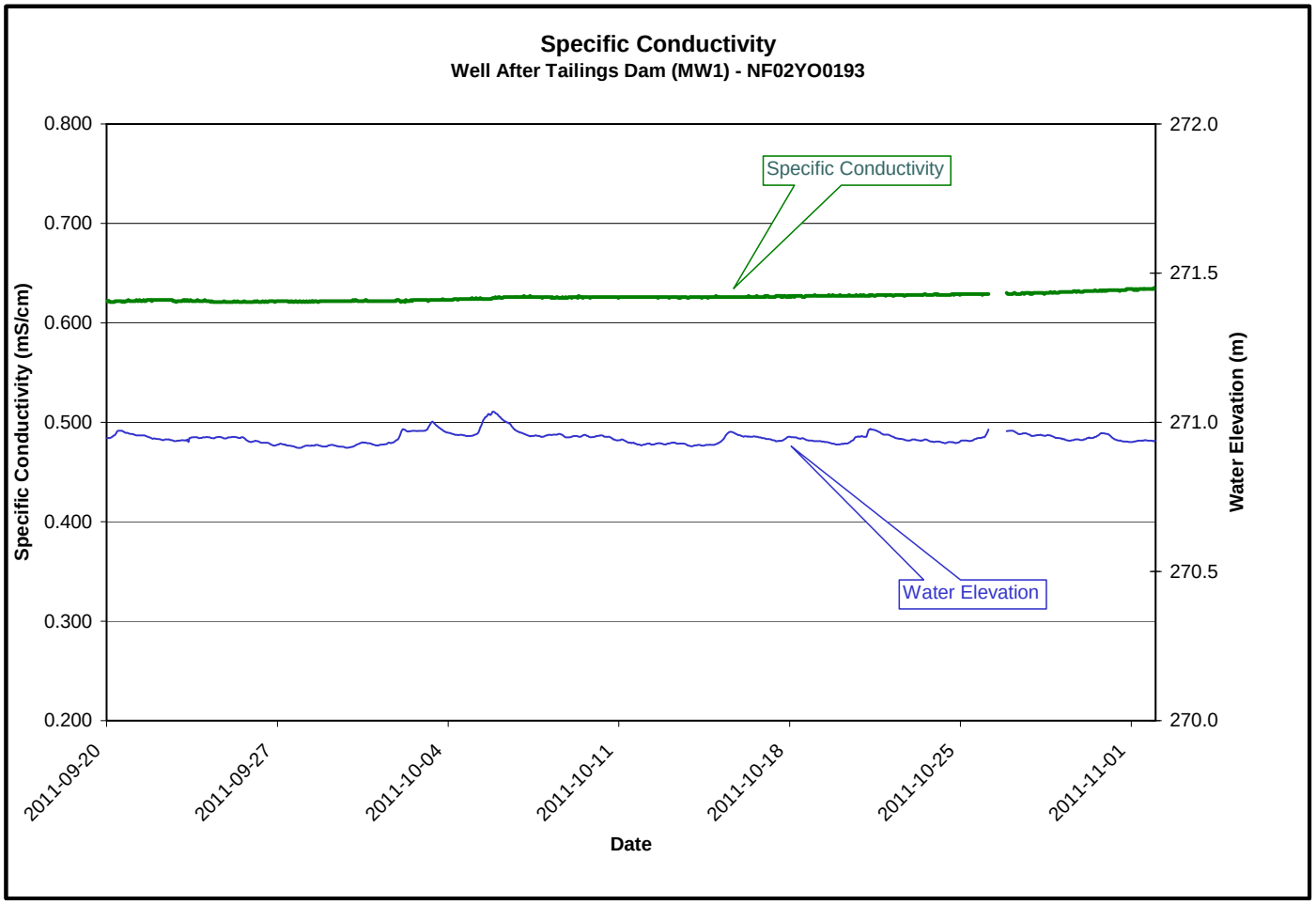

Figure 15

- The Water Elevation **(Figure 16)** ranged from a minimum of 270.91 m to a maximum of 271.04 m. with little variation over the reporting period.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by runoff from precipitation.

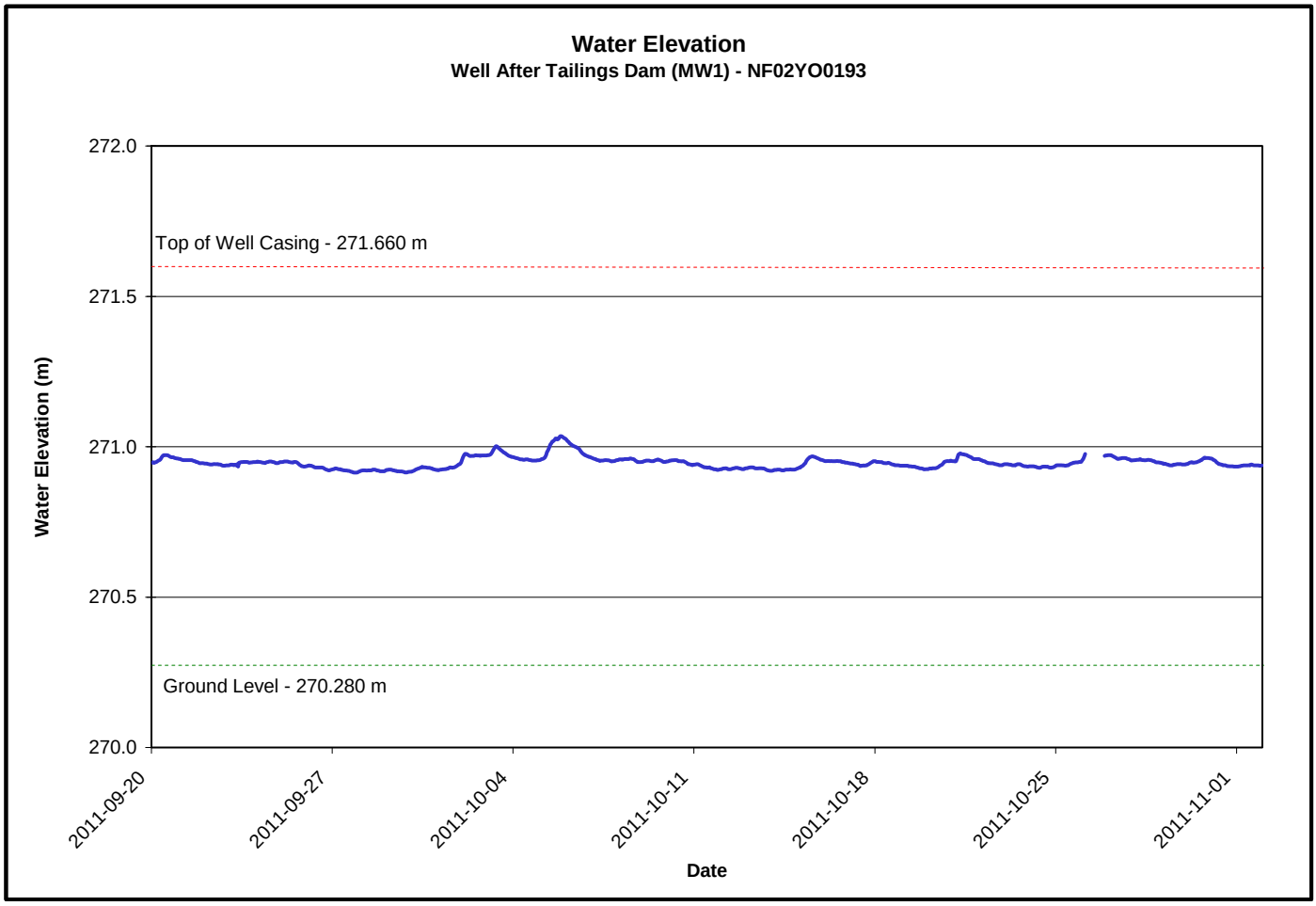

Figure 16

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