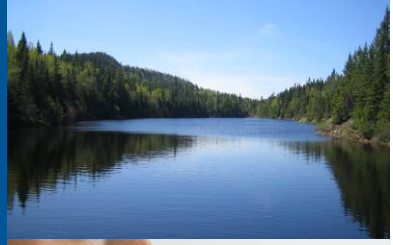




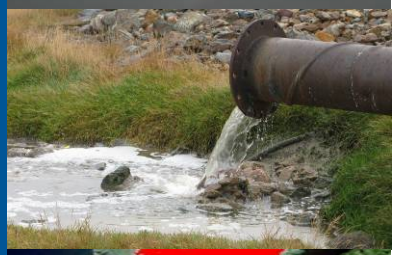


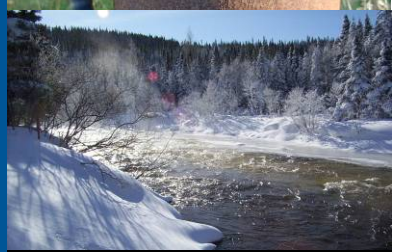

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2016-06-21 to 2016-08-11

Government of Newfoundland & Labrador
Department of Environment and Climate Change
Water Resources Management Division
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General

- This station is operated as part of the Provincial Real Time Water Quality (RTWQ) network.
- This station is operated year round.
- Staff of the Water Resources Management Division (WRMD) monitors the real-time web page on a regular basis. Any unusual observations are investigated.
- This site is easily accessed and the instrument is normally removed on a monthly to bi-monthly basis for maintenance and calibration and is reinstalled within one to two days. During the winter months the deployment periods tend to be longer as the instrument is often frozen into place and difficult to remove.
- This monthly deployment report, presents water quality and water quantity data recorded at the Humber River at Humber Village station from June 21, 2016, to August 11, 2016.

Quality Assurance / Quality Control

- Water quality instrument performance is tested at the beginning and end of its deployment period. The process is outlined in Appendix A.
- Instruments are assigned a performance rating (i.e., poor, marginal, fair, good or excellent) for each water quality parameter measured.
- Table 1 shows the performance ratings of five water quality parameters (i.e., temperature, pH, specific conductivity, dissolved oxygen and turbidity) measured by the deployed instrument.
- The performances of all sensors were rated good to excellent at the beginning, and good to excellent at the end, of the deployment period (Table 1).
- **With the exception of water quantity data (stage height), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request**.

Table 1: Water quality instrument performance at the beginning and end of the deployment

	Humber River	
Stage of deployment	**Beginning**	**End**
Date	2016-06-21	2016-08-11
Temperature	Good	Excellent
pH	Excellent	Good
Specific Conductivity	Good	Excellent
Dissolved Oxygen	Excellent	Excellent
Turbidity	Good	Excellent

Deployment Notes

Water quality monitoring for this deployment period started on June 21, 2016 and continued without any significant operational issues until August 11, 2016, when the instrument was removed for routine calibration and maintenance.

Data Interpretation

- Data records were interpreted for each station during the deployment period for the following six parameters:

  (i.) Stage (m)
  (ii.) Temperature (^{o}C)
  (iii.) pH
  (iv.) Specific conductivity (µS/cm)
  (v.) Dissolved oxygen (mg/l)
  (vi.) Turbidity (NTU)

Stage

- **The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request**.

- During this deployment period stage values ranged from 1.56 m to 2.45 m at Humber River at Humber Village, with corresponding flow ranging from 155.59 m^3/sec to 296.10 m^3/sec (Figure 1).

- Flows over the deployment period were typical for the summer months with a gradual decline from spring runoff conditions, to the lower levels normally experienced during mid-summer.

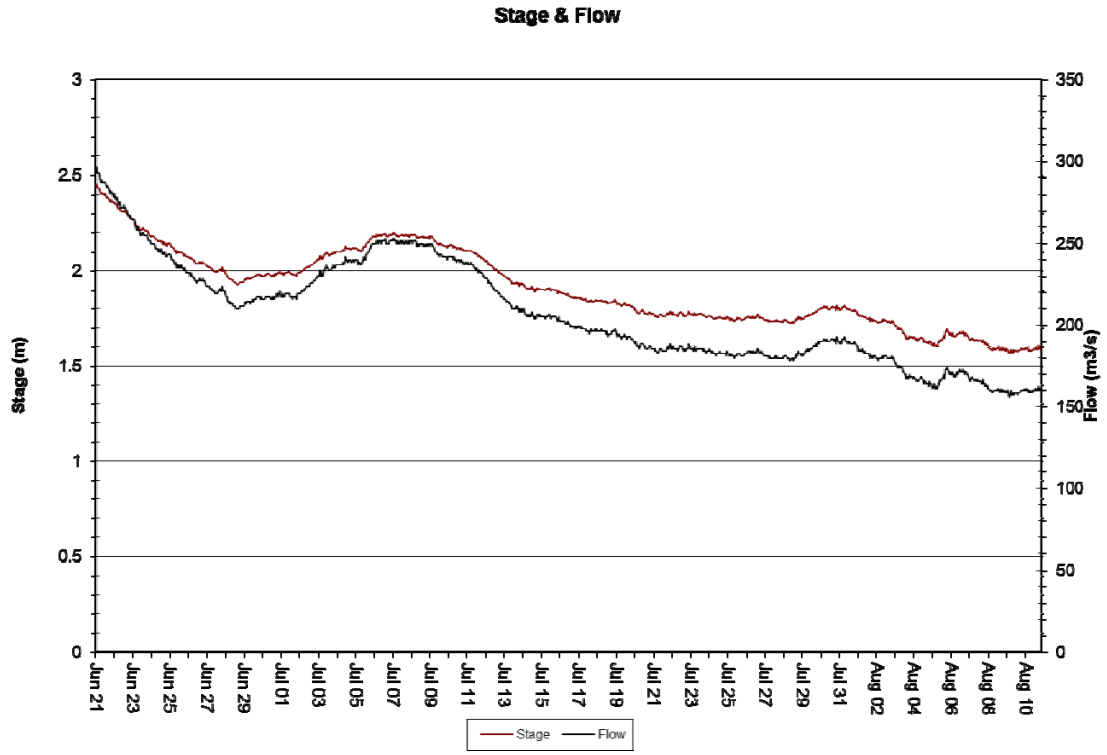

Figure 1: Stage Height (m) at Humber River from June 21, 2016, to August 11, 2016

Temperature

- During this deployment period the water temperature at Humber River ranged from 6.62˚C to 18.34˚C (Figure 2).
- Water temperature shows an increasing trend over the deployment period which is consistent with the transition from late spring to mid-summer.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

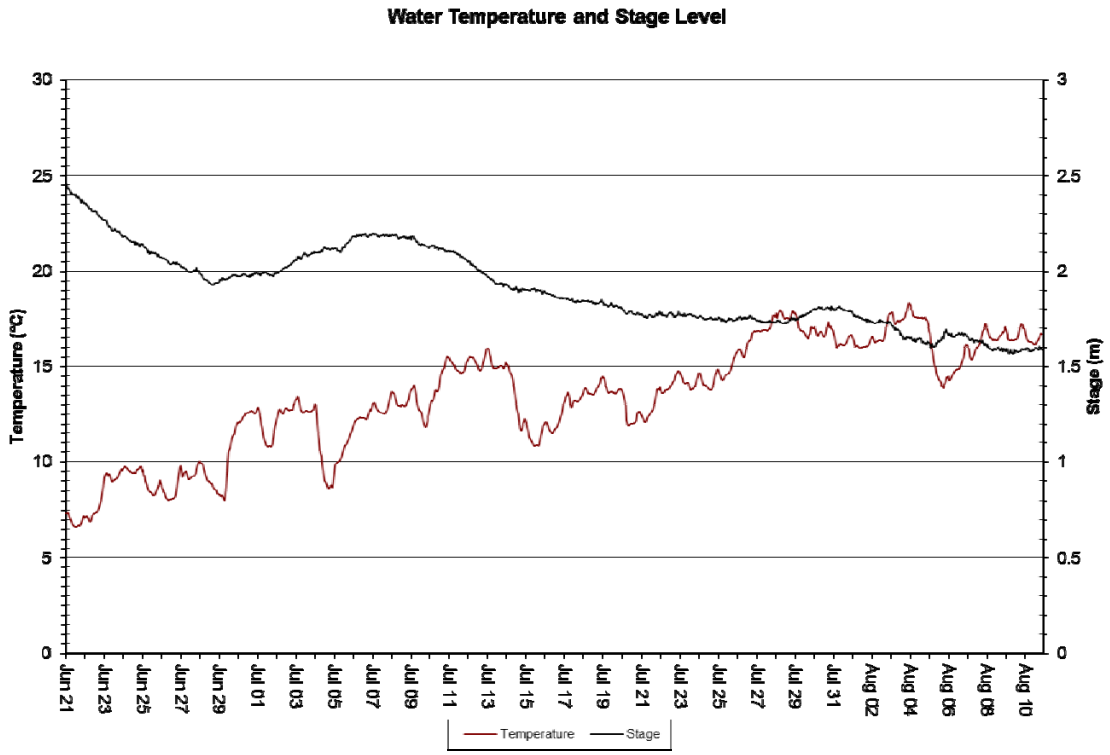

Figure 2: Temperature (°C) at Humber River from June 21, 2016, to August 11, 2016

pH

- During this deployment period pH values at Humber River ranged from 6.78 units to 7.31 units (Figure 3).
- pH was quite stable throughout the deployment period.
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 7.10, all of the pH values recorded at Humber River during this deployment period were within the guidelines for pH for the protection of aquatic life (i.e., 6.5 to 9.0 units), as defined by the Canadian Council of Ministers of the Environment (2007).

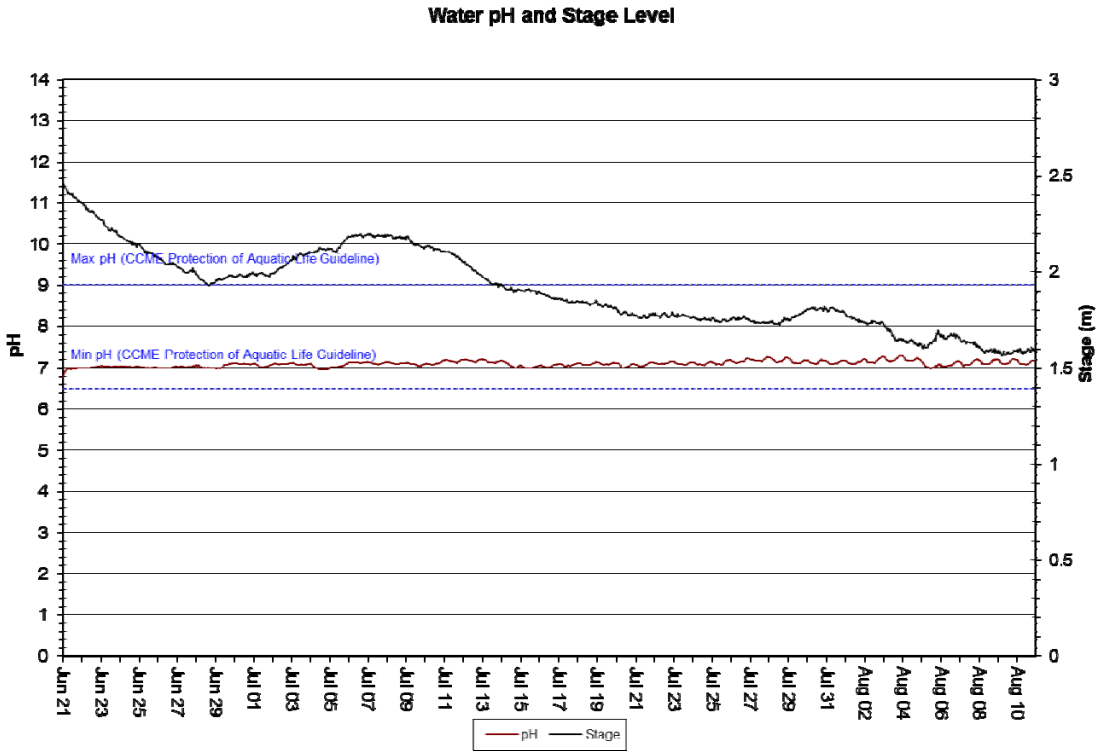

Figure 3: pH values recorded at Humber River from June 21, 2016, to August 11, 2016

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 41.8 µS/cm to 45.2 µS/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent.

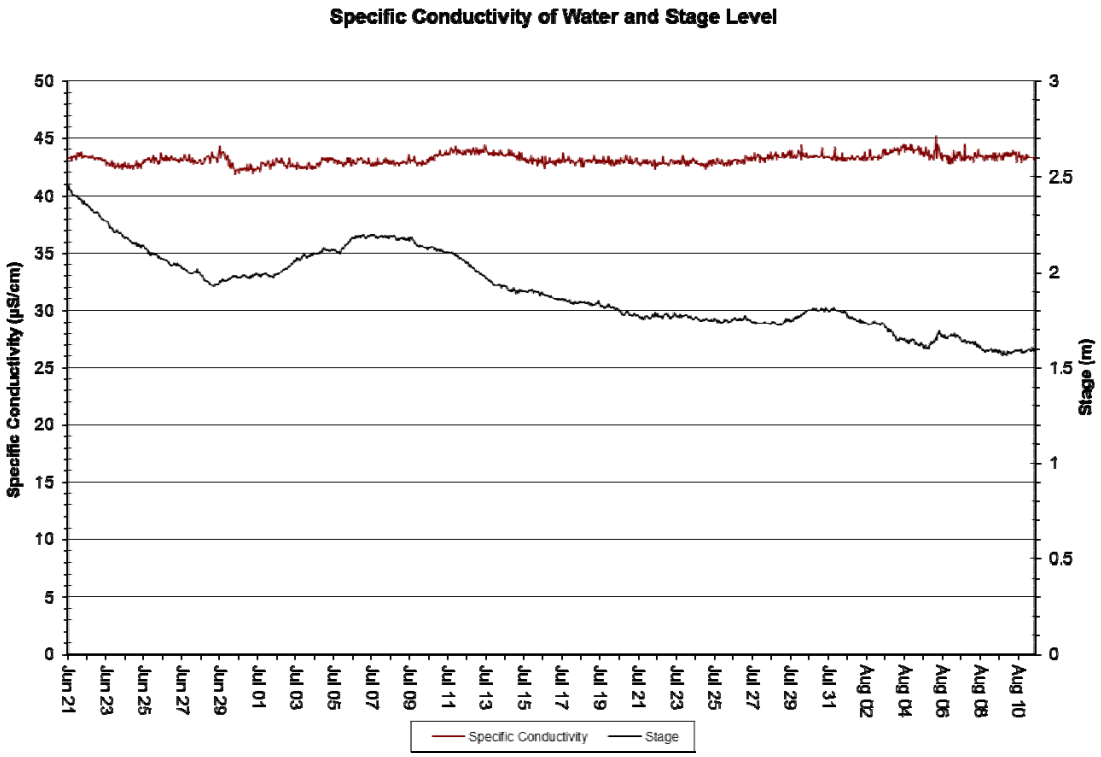

Figure 4: Specific conductivity (µs/cm) at Humber River from June 21, 2016, to August 11, 2016

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.33 mg/l (96.2% saturation) to 11.99 mg/l (103.3% saturation) (Figure 5).
- Over the deployment period DO(mg/l)shows a gentle decreasing trend which is related to the increasing temperature trend for the same period.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- All of the DO values at Humber River were above both the minimum guideline set for other life stages (6.5 mg/l), and all but a few of the recorded values were also above the minimum guideline set for the protection of early life stages(9.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

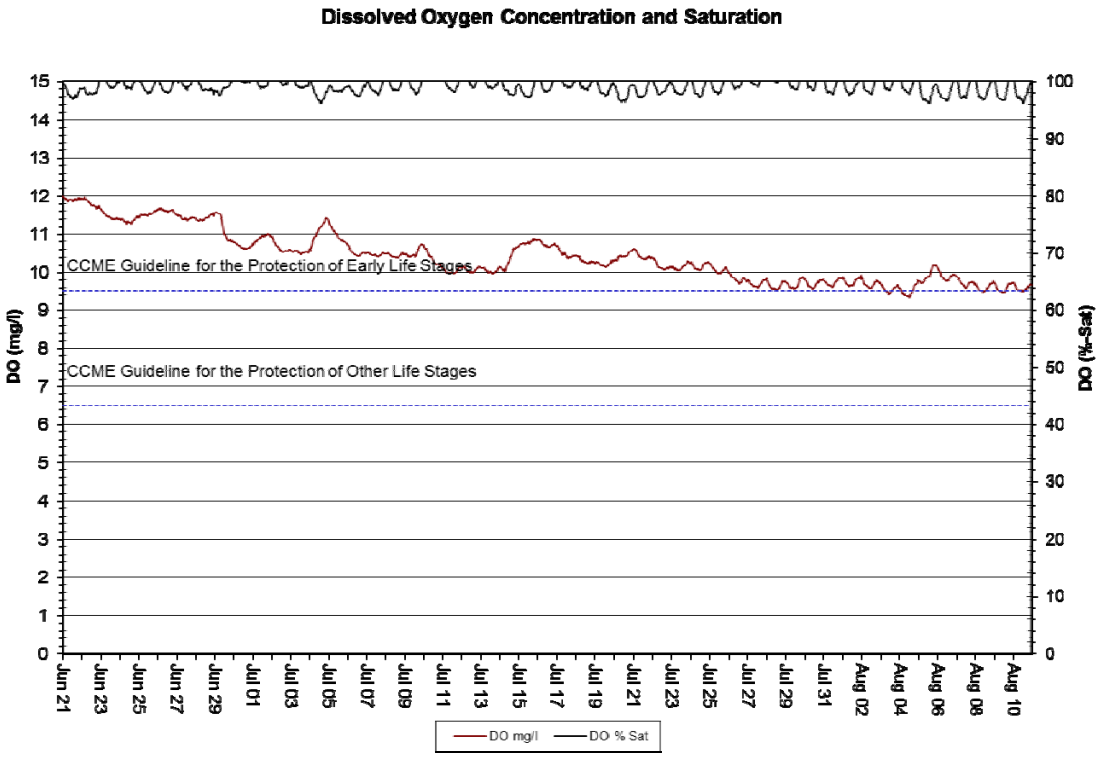

Figure 5: DO (mg/l & % saturation) at Humber River from June 21, 2016, to August 11, 2016

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 3.2 NTU (Figure 6).

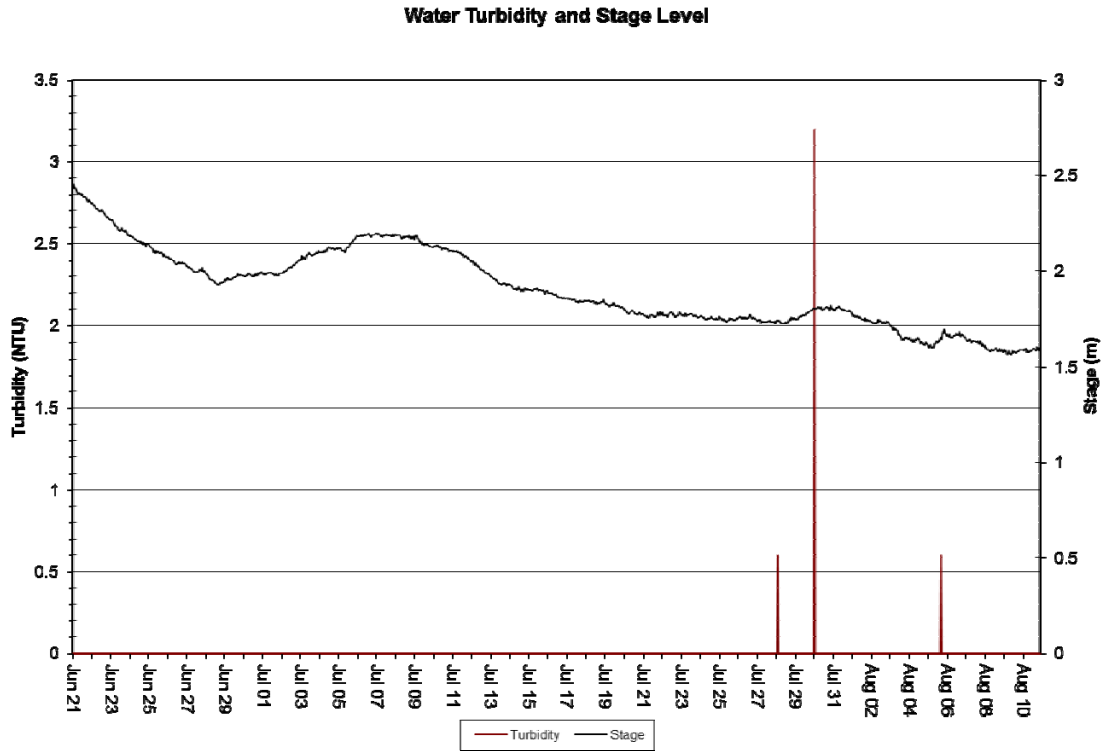

Figure 6: Turbidity (NTU) at Humber River from June 21, 2016, to August 11, 2016

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from June 21, 2016, to August 11, 2016.
- The performances of all sensors were rated good to excellent at the beginning and good to excellent at the end of the deployment period.
- Variations in water quality/quantity values recorded at each station are summarized below:
    - During this deployment period stage values ranged from 1.56 m to 2.45 m at Humber River at Humber Village, with corresponding flow ranging from 155.59 m3/sec to 296.10 m3/sec. Flows over the deployment period were typical for the summer months with a gradual decline from spring runoff conditions, to the lower levels normally experienced during mid-summer.
    - During this deployment period the water temperature at Humber River ranged from 6.62˚C to 18.34˚C with an increasing trend over the deployment period which is consistent with the transition from late spring to mid-summer.
    - During this deployment period pH values at Humber River ranged from 6.78 units to 7.31 units and were quite stable throughout the deployment period. All of the pH values recorded at Humber River during this deployment period were within the guidelines for pH for the protection of aquatic life (i.e., 6.5 to 9.0 units), as defined by the Canadian Council of Ministers of the Environment (2007).
    - During this deployment period specific conductivity at Humber River ranged from 41.8 µS/cm to 45.2 µS/cm and was relatively stable with no noticeable trends apparent.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.33 mg/l (96.2% saturation) to 11.99 mg/l (103.3% saturation) with a gentle decreasing trend. All of the DO values at Humber River were above both the minimum guideline set for other life stages (6.5 mg/l), and all but a few of the recorded values were also above the minimum guideline set for the protection of early life stages(9.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).
    - During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 3.2 NTU.

References

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated December, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg. (Website: http://ceqg-rcqe.ccme.ca/download/en/222/)

APPENDIX A
Quality Assurance / Quality Control Procedures

- As part of the Quality Assurance / Quality Control (QA/QC) protocol, the performance of a station's water quality instrument (i.e., Field Sonde) is rated at the beginning and end of its deployment period. The procedure is based on the approach used by the United States Geological Survey (Wagner *et al.* 2006)[1].
- At the beginning of the deployment period, a fully cleaned and calibrated QA/QC water quality instrument (i.e., QA/QC Sonde) is placed *in-situ* with the fully cleaned and calibrated Field Sonde. After Sonde readings have stabilized, which may take up to five minutes in some cases, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde. If the readings from both Sondes are in close agreement, the QA/QC Sonde can be removed from the water. If the readings are not in close agreement, there will be attempts to reconcile the problem on site (e.g., removing air bubbles from sensors, etc.). If no fix is made, the Field Sonde may be removed for recalibration.
- At the end of the deployment period, a fully cleaned and calibrated QA/QC Sonde is once again deployed *in-situ* with the Field Sonde, which has already been deployment for 30-40 days. After Sonde readings have stabilized, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde.
- Performance ratings are based on differences listed in the table below.

	Rating				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (°C)	≤ ±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

[1] Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 10, 2006, at *http://pubs.water.usgs.gov/tm1d3*

APPENDIX B

Environment Canada Weather Data – Corner Brook (06-21-2016 to 08-11-2016)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
6/21/2016	26	10.5	18.3	0	0.3	2.2
6/22/2016	21	10.5	15.8	2.2	0	1.2
6/23/2016	23.5	12.5	18	0	0	0
6/24/2016	19	12.5	15.8	2.2	0	0.4
6/25/2016	23.5	7.5	15.5	2.5	0	0
6/26/2016	30	12	21	0	3	0
6/27/2016	28.5	14	21.3	0	3.3	0
6/28/2016	29	15.5	22.3	0	4.3	0
6/29/2016	22.5	18	20.3	0	2.3	20.8
6/30/2016	23	12.5	17.8	0.2	0	5.2
7/1/2016	22	14.5	18.3	0	0.3	0.4
7/2/2016	26	12	19	0	1	5.6
7/3/2016	20.5	12.5	16.5	1.5	0	14
7/4/2016	19.5	12	15.8	2.2	0	0
7/5/2016	22.5	12.5	17.5	0.5	0	18.8
7/6/2016	10.5	8	9.3	8.7	0	0.8
7/7/2016	15.5	6	10.8	7.2	0	0
7/8/2016	19	5.5	12.3	5.7	0	0
7/9/2016	21.5	6	13.8	4.2	0	0
7/10/2016	23.5	7.5	15.5	2.5	0	0
7/11/2016	16.5	11	13.8	4.2	0	1.8
7/12/2016	19.5	10	14.8	3.2	0	0.4
7/13/2016	21.5	6	13.8	4.2	0	1.4
7/14/2016	22.5	14	18.3	0	0.3	3.4
7/15/2016	21	18	19.5	0	1.5	2.6
7/16/2016	26	17	21.5	0	3.5	0
7/17/2016	25.5	10.5	18	0	0	3
7/18/2016	21	14	17.5	0.5	0	0.4
7/19/2016	21.5	16.5	19	0	1	0.2
7/20/2016	18	11.5	14.8	3.2	0	1.2
7/21/2016	21.5	13	17.3	0.7	0	0.2
7/22/2016	26.5	14	20.3	0	2.3	0.2
7/23/2016	23.5	17.5	20.5	0	2.5	3
7/24/2016	22.5	14.5	18.5	0	0.5	0
7/25/2016	24	12	18	0	0	0
7/26/2016	27.5	11	19.3	0	1.3	10.4

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
7/27/2016	22.5	15.5	19	0	1	0
7/28/2016	25.5	17.5	21.5	0	3.5	11.6
7/29/2016	24.5	15.5	20	0	2	4
7/30/2016	24	17	20.5	0	2.5	0
7/31/2016	22.5	14.5	18.5	0	0.5	0
8/1/2016	20.5	12.5	16.5	1.5	0	0
8/2/2016	18.5	9.5	14	4	0	0
8/3/2016	22.5	7.5	15	3	0	0
8/4/2016	25	9.5	17.3	0.7	0	4
8/5/2016	22.5	16	19.3	0	1.3	26.8
8/6/2016	24.5	17.5	21	0	3	9
8/7/2016	25	16.5	20.8	0	2.8	0
8/8/2016	24	17	20.5	0	2.5	0.4
8/9/2016	23	16	19.5	0	1.5	0
8/10/2016	25	12.5	18.8	0	0.8	0
8/11/2016	25	15.5	20.3	0	2.3	0