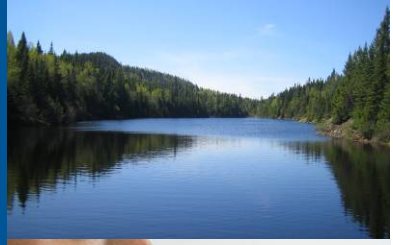




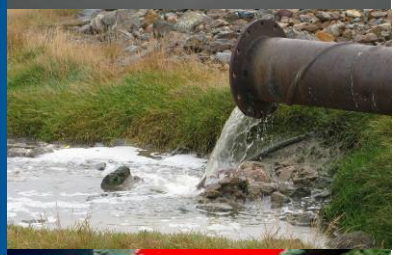


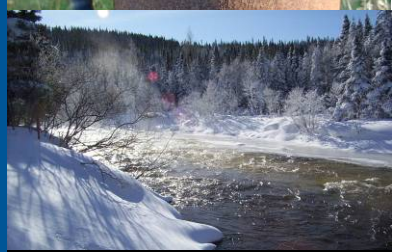

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2014-04-25 to 2014-07-03

Government of Newfoundland & Labrador
Department of Environment & Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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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 April 25, 2014, to July 03, 2014.

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 marginal to excellent at the beginning, and marginal to excellent at the end, of the deployment period (Table 1). There was no field reading for turbidity at the end of the deployment, however at that time the turbidity reading was very high, most likely related to some type of organic debris trapped inside the sensor guard and interfering with normal readings.
- **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	2014-04-25	2014-07-03
Temperature	Good	Good
pH	Excellent	Excellent
Specific Conductivity	Marginal	Fair
Dissolved Oxygen	Fair	Marginal
Turbidity	Excellent	NA

Deployment Notes

Water quality monitoring for this deployment period started on April 25, 2014 and continued without any significant operational issues until July 03, 2014, 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 2.38 m to 4.33 m at Humber River at Humber Village, with corresponding flow ranging from 297.00 m^3/sec to 702.00 m^3/sec (Figure 1).

- Stage and flow values seem typical for the late spring/ early summer period with variations related to spring runoff and weather conditions.

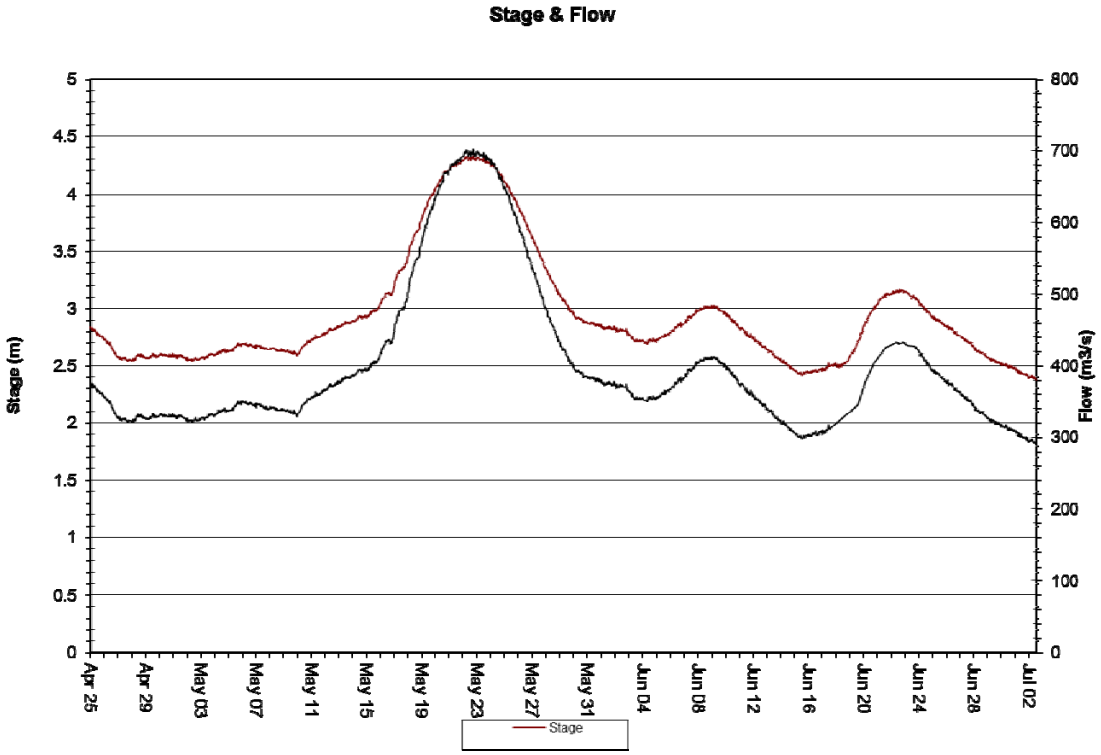

Figure 1: Stage Height (m) at Humber River from April 25, 2014, to July 03, 2014

Temperature

- During this deployment period the water temperature at Humber River ranged from 0.20˚C to 14.48˚C (Figure 2).
- Water temperature shows an increasing trend over the deployment period which is consistent with the transition from spring to summer.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

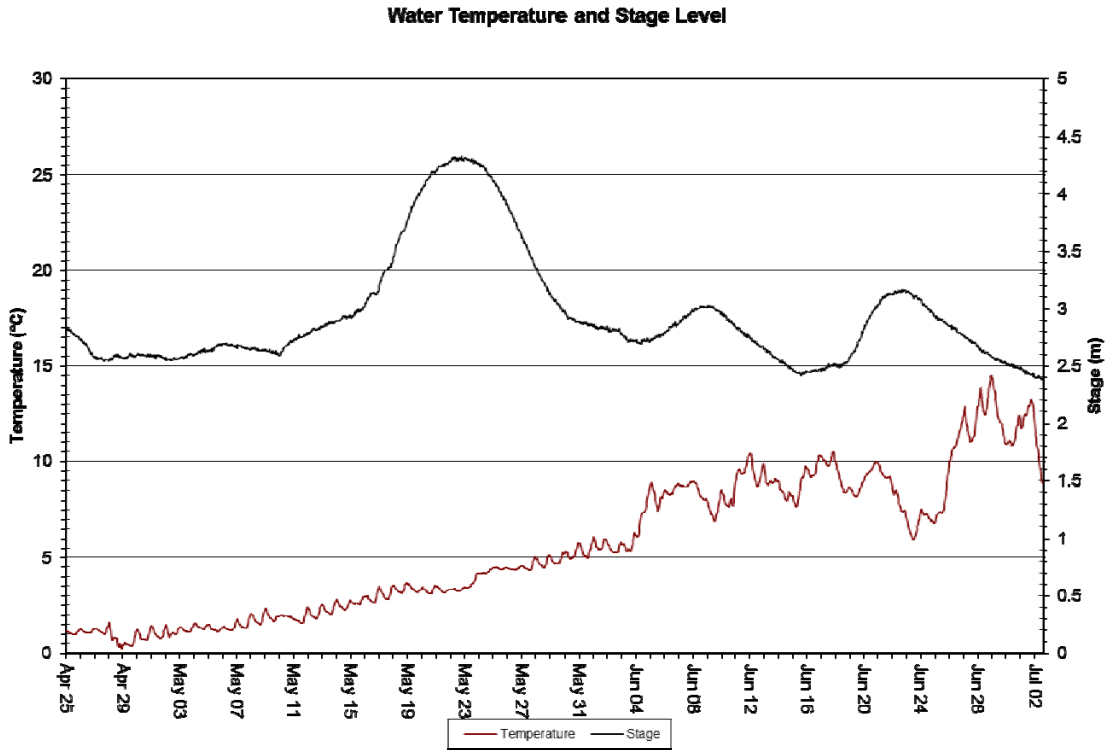

Figure 2: Temperature (^{o}C) at Humber River from April 25, 2014, to July 03, 2014

pH

- During this deployment period pH values at Humber River ranged from 6.58 units to 7.53 units (Figure 3).
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 7.28, 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).

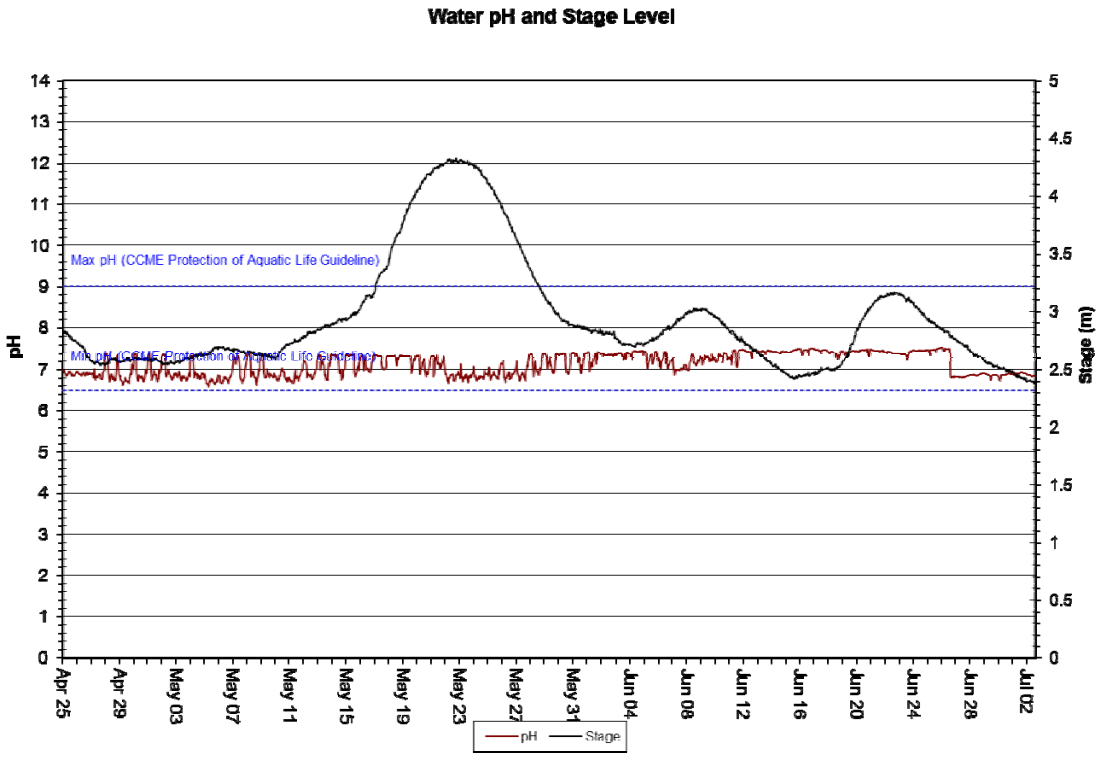

Figure 3: pH values recorded at Humber River from April 25, 2014, to July 03, 2014

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 30.2 µS/cm to 39.0 µS/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent.

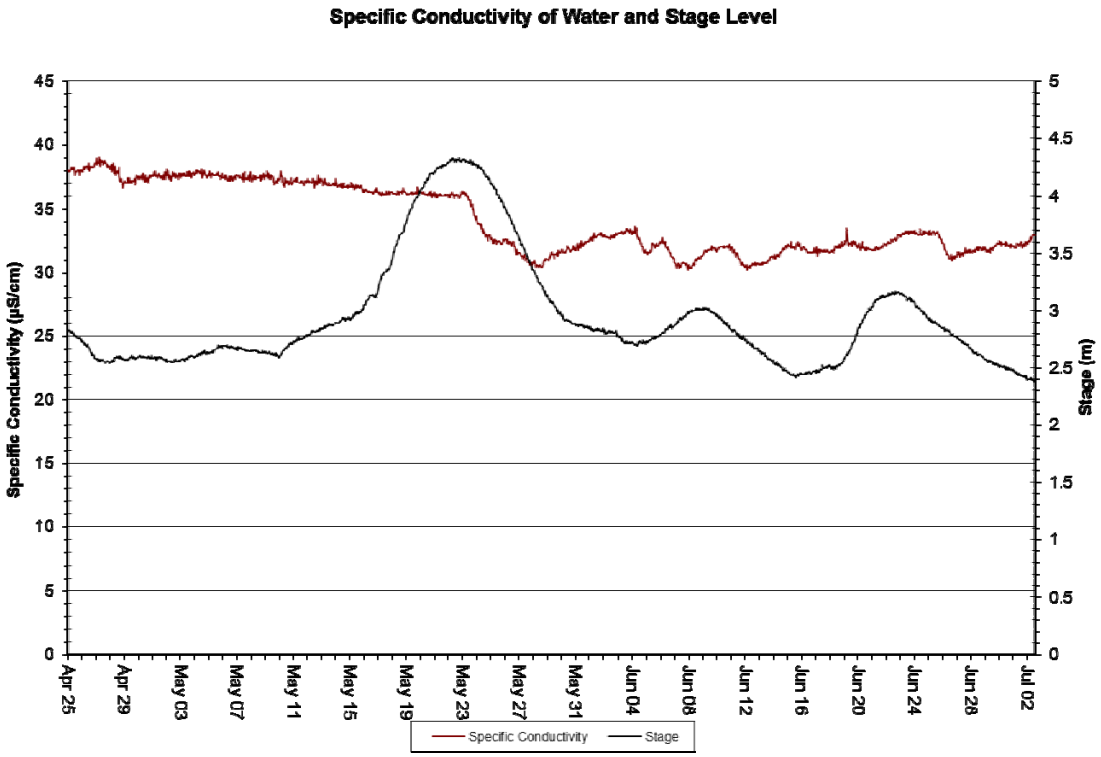

Figure 4: Specific conductivity (µs/cm) at Humber River from April 25, 2014, to July 03, 2014

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.73 mg/l (88.6% saturation) to 14.33 mg/l (101.2% saturation) (Figure 5).
- DO (mg/l) shows a gradual decreasing trend which is due to the increasing temperature trend.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- During this deployment period all of the DO values at Humber River were above the minimum guideline set for other life stages (6.5 mg/l) and 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).

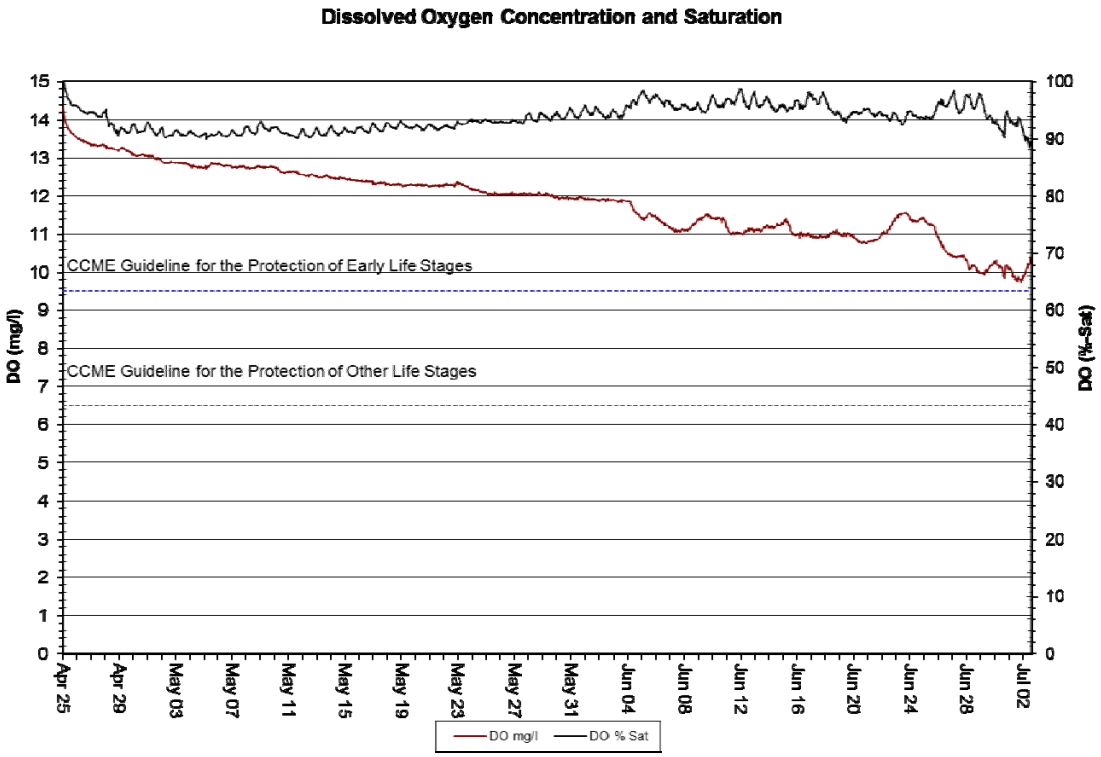

Figure 5: DO (mg/l & % saturation) at Humber River from April 25, 2014, to July 03, 2014

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 30.4 NTU (Figure 6).
- Near the end of the deployment period there were some extremely high turbidity readings which were most likely caused by organic debris or other matter trapped near the sensors. The extremely high false readings were removed from the dataset.

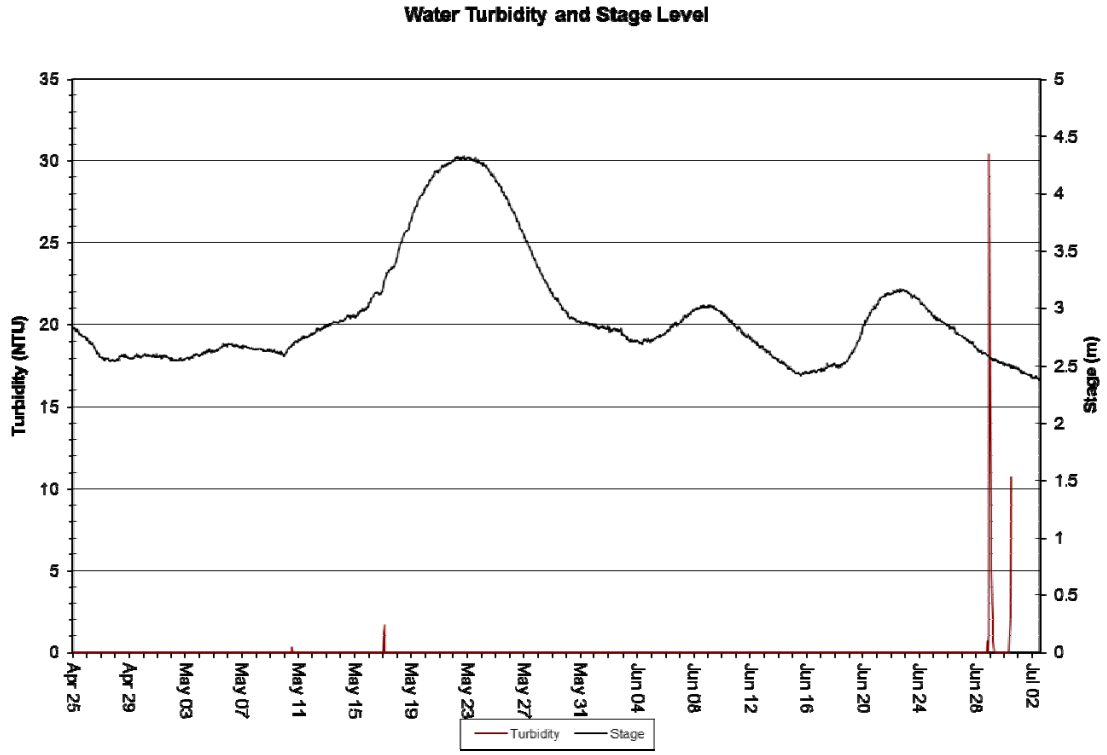

Figure 6: Turbidity (NTU) at Humber River from April 25, 2014, to July 03, 2014

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from April 25, 2014, to July 03, 2014.

- The performances of all sensors were rated marginal to excellent at the beginning, and marginal 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 2.38 m to 4.33 m at Humber River at Humber Village, with corresponding flow ranging from 297.00 m^3/sec to 702.00 m^3/sec. Stage and flow values seem typical for the late spring/ early summer period with variations related to spring runoff and weather conditions.
    - During this deployment period the water temperature at Humber River ranged from 0.20˚C to 14.48˚C. Water temperature shows an increasing trend over the deployment period which is consistent with the transition from spring to summer.
    - During this deployment period pH values at Humber River ranged from 6.58 units to 7.53 units. With a median value of 7.28, 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 30.2 µS/cm to 39.0 µS/cm (Figure 4). Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.73 mg/l (88.6% saturation) to 14.33 mg/l (101.2% saturation). DO (mg/l) shows a gradual decreasing trend which is due to the increasing temperature trend. During this deployment period all of the DO values at Humber River were above the minimum guideline set for other life stages (6.5 mg/l) and 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 30.4 NTU. Near the end of the deployment period there were some extremely high turbidity readings which were most likely caused by organic debris or other matter trapped near the sensors. The extremely high false readings were removed from the dataset.

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 (4-25-2014 to 7-3-2014)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
4/25/2014	4.5	0.5	2.5	15.5	0	0.5
4/26/2014	4	0.5	2.3	15.7	0	0
4/27/2014	7	1.5	4.3	13.7	0	0.3
4/28/2014	7.5	2	4.8	13.2	0	0.5
4/29/2014	2	0	1	17	0	0
4/30/2014	6.5	-5	0.8	17.2	0	0
5/1/2014	8.5	-0.5	4	14	0	0
5/2/2014	10.5	1.5	6	12	0	0.6
5/3/2014	6.5	0.5	3.5	14.5	0	0.4
5/4/2014	11	0.5	5.8	12.2	0	0.2
5/5/2014	6.5	2.5	4.5	13.5	0	4.2
5/6/2014	4.5	-1	1.8	16.2	0	0.2
5/7/2014	4	0	2	16	0	0
5/8/2014	9	-1.5	3.8	14.2	0	0
5/9/2014	11	-2	4.5	13.5	0	0
5/10/2014	11	0	5.5	12.5	0	20
5/11/2014	2.5	-1	0.8	17.2	0	6.3
5/12/2014	7.5	-3.5	2	16	0	0
5/13/2014	7.5	-2	2.8	15.2	0	0
5/14/2014	12	-2	5	13	0	0
5/15/2014	15.5	0	7.8	10.2	0	0
5/16/2014	18	9	13.5	4.5	0	0
5/17/2014	23	7.5	15.3	2.7	0	0
5/18/2014	24.5	7.5	16	2	0	0
5/19/2014	23.5	9	16.3	1.7	0	0.4
5/20/2014	14	7.5	10.8	7.2	0	0.6
5/21/2014	20.5	7	13.8	4.2	0	2.8
5/22/2014	12	6.5	9.3	8.7	0	5.8
5/23/2014	7	2.5	4.8	13.2	0	1.9
5/24/2014	6.5	2.5	4.5	13.5	0	0
5/25/2014	7	2	4.5	13.5	0	0.4
5/26/2014	7.5	2	4.8	13.2	0	0
5/27/2014	8.5	2.5	5.5	12.5	0	0
5/28/2014	9.5	3.5	6.5	11.5	0	0
5/29/2014	20.5	0	10.3	7.7	0	0
5/30/2014	21.5	5.5	13.5	4.5	0	0
5/31/2014	17.5	7	12.3	5.7	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
6/1/2014	18.5	3	10.8	7.2	0	0
6/2/2014	23.5	8.5	16	2	0	0
6/3/2014	18.5	12.5	15.5	2.5	0	0
6/4/2014	26	12	19	0	1	0.6
6/5/2014	23.5	14.5	19	0	1	18.8
6/6/2014	15.5	12	13.8	4.2	0	13.6
6/7/2014	8.5	5	6.8	11.2	0	5
6/8/2014	8.5	5	6.8	11.2	0	4
6/9/2014	13.5	6	9.8	8.2	0	0
6/10/2014	14	8.5	11.3	6.7	0	0.3
6/11/2014	10	8	9	9	0	0.5
6/12/2014	12	4.5	8.3	9.7	0	0
6/13/2014	17.5	2	9.8	8.2	0	0
6/14/2014	20.5	6	13.3	4.7	0	0
6/15/2014	20.5	9.5	15	3	0	18.9
6/16/2014	14	10	12	6	0	3
6/17/2014	20.5	8.5	14.5	3.5	0	0
6/18/2014	26	7	16.5	1.5	0	9.4
6/19/2014	12	10	11	7	0	19.4
6/20/2014	8.5	5.5	7	11	0	6.7
6/21/2014	10.5	6	8.3	9.7	0	0
6/22/2014	11.5	7	9.3	8.7	0	0
6/23/2014	23	6.5	14.8	3.2	0	0
6/24/2014	26.5	8.5	17.5	0.5	0	4.6
6/25/2014	17	14.5	15.8	2.2	0	8
6/26/2014	22	8.5	15.3	2.7	0	0
6/27/2014	25	12	18.5	0	0.5	0
6/28/2014	24	9	16.5	1.5	0	0
6/29/2014	25.5	10	17.8	0.2	0	2.4
6/30/2014	24.5	12.5	18.5	0	0.5	0
7/1/2014	29.5	14.5	22	0	4	0
7/2/2014	30	20	25	0	7	0
7/3/2014	24.5	21	22.8	0	4.8	0