Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2014-10-24 to 2014-12-10

Government of Newfoundland & Labrador
Department of Environment & Conservation
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 October 24, 2014, to December 10, 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 good to excellent at the beginning, and poor to excellent at the end, of the deployment period (Table 1). The Poor rating for turbidity is most likely related to some type of organic debris trapped inside the sensor guard and interfering with normal readings. The fact that this was an extended deployment period of close to two months may have had a bearing on ratings at the time of removal.
- **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	2014-10-24	2014-12-10
Temperature	Excellent	Excellent
pH	Excellent	Excellent
Specific Conductivity	Good	Excellent
Dissolved Oxygen	Good	Fair
Turbidity	Excellent	Poor

Deployment Notes

Water quality monitoring for this deployment period started on October 24, 2014 and continued without any significant operational issues until December 10, 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 1.94 m to 2.98 m at Humber River at Humber Village, with corresponding flow ranging from 211.24 m^3/sec to 395.85 m^3/sec (Figure 1).

- Stage and flow values seem typical for the late fall period with variations related to weather conditions.

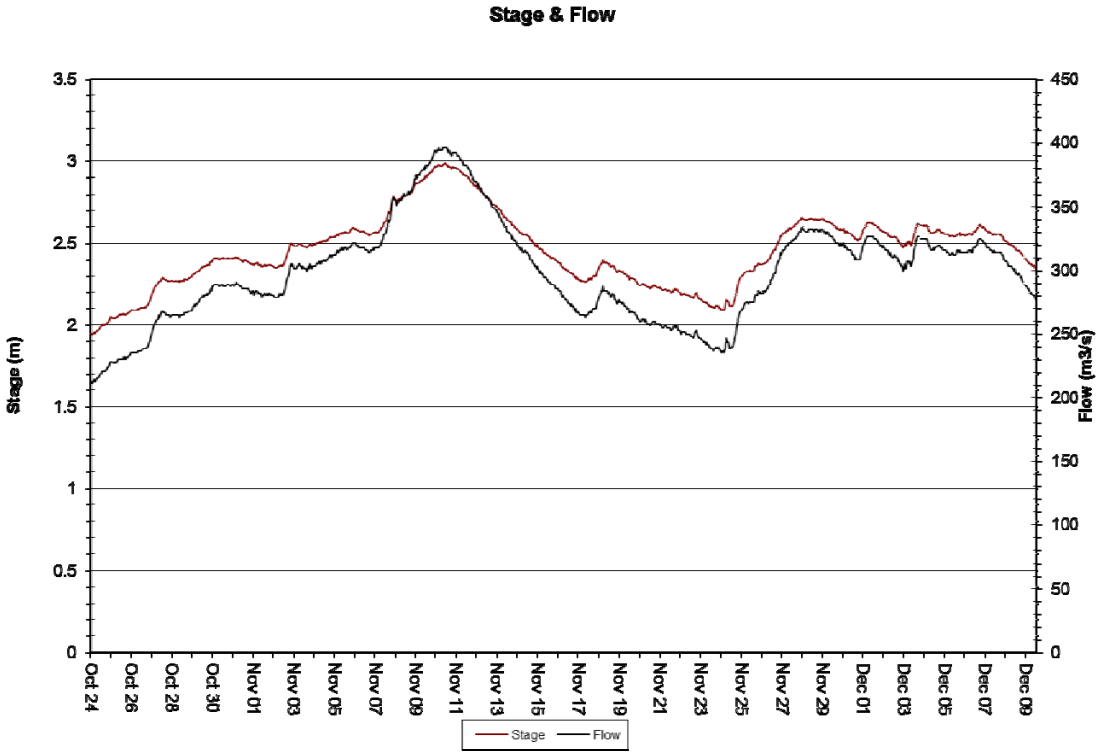

Figure 1: Stage Height (m) at Humber River from October 24, 2014, to December 10, 2014

Temperature

- **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 the water temperature at Humber River ranged from 3.93˚C to 10.67˚C (Figure 2).
- Water temperature shows a decreasing trend over the deployment period which is consistent with the transition from mid to late fall.
- Water temperature shows a diurnal trend which is related to corresponding air temperature trends.

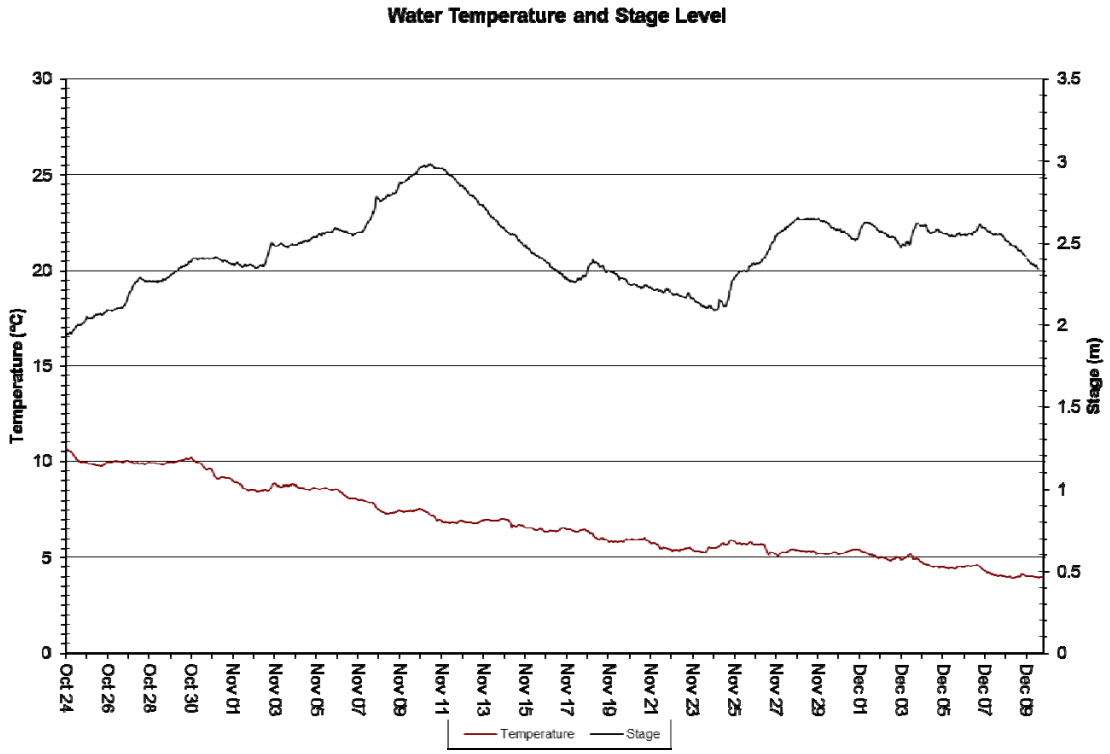

Figure 2: Temperature (°C) at Humber River from October 24, 2014, to December 10, 2014

pH

- **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 pH values at Humber River ranged from 6.32 units to 7.17 units (Figure 3).
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 7.28, most 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).

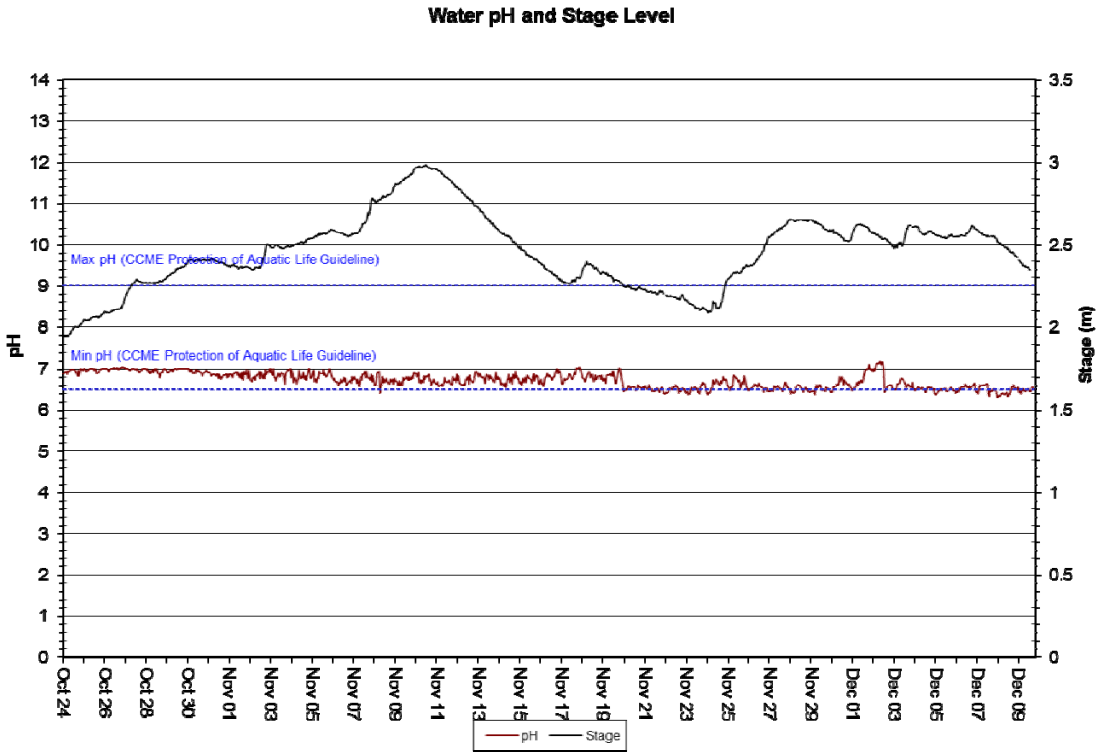

Figure 3: pH values recorded at Humber River from October 24, 2014, to December 10, 2014

Specific Conductivity

- **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 specific conductivity at Humber River ranged from 36.4 µS/cm to 38.5 µS/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent.

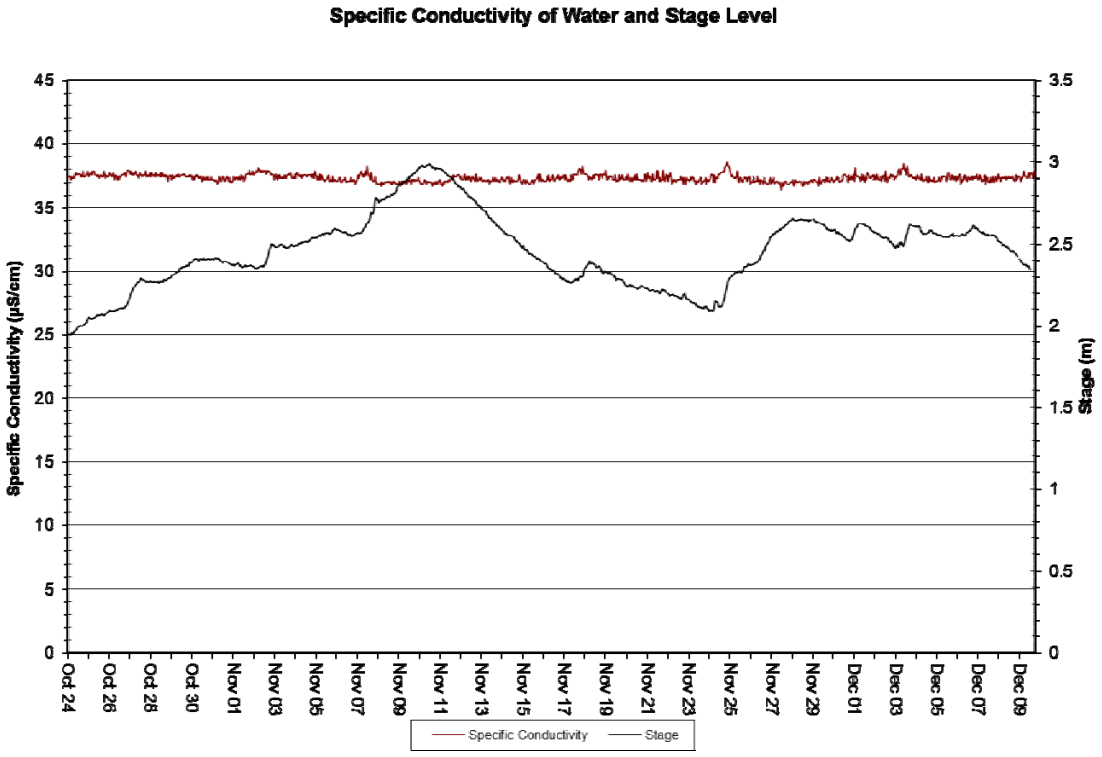

Figure 4: Specific conductivity (µs/cm) at Humber River from October 24, 2014, to December 10, 2014

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 10.16 mg/l (88.0% saturation) to 11.98 mg/l (94.8% saturation) (Figure 5).
- DO (mg/l) shows a gradual increasing trend which is due to the decreasing temperature trend.
- DO shows a diurnal trend which is related to corresponding air temperature trends.
- 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).

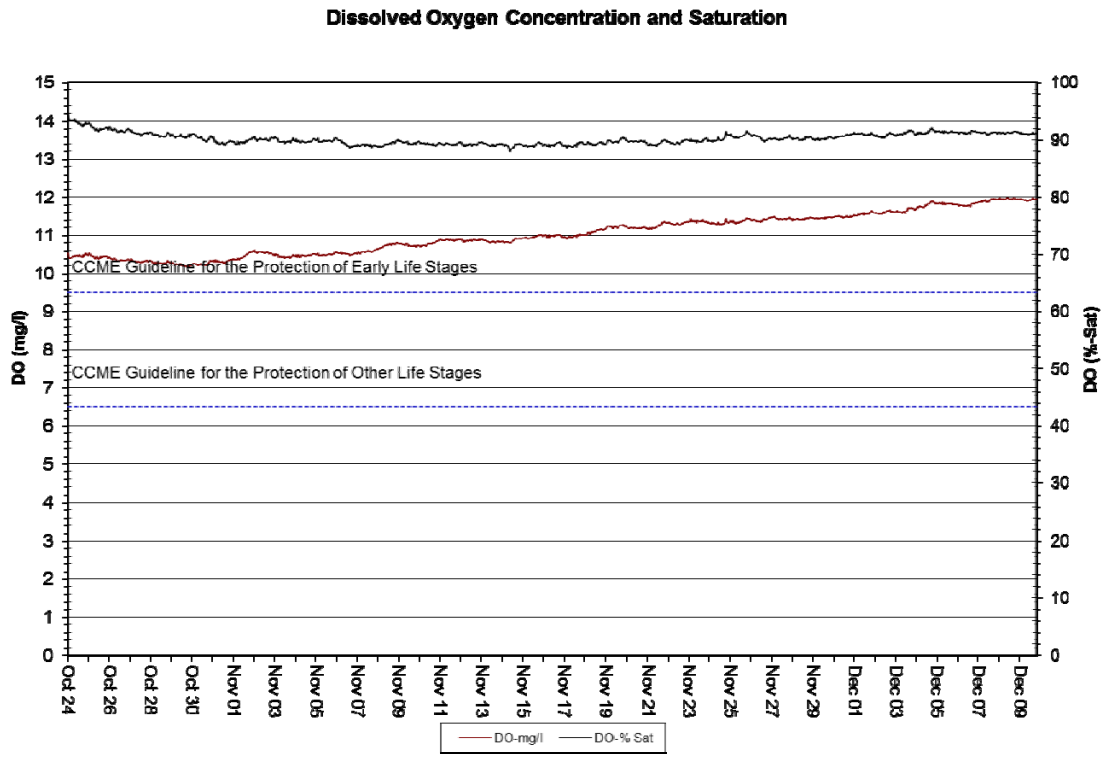

Figure 5: DO (mg/l & % saturation) at Humber River from October 24, 2014, to December 10, 2014

Turbidity

- **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 turbidity values at Humber River ranged from 0.0 NTU to 1286.9 NTU (Figure 6); however the extremely high turbidity reading are most likely related to interference from organic debris causing false readings. These false high readings will be removed from the dataset.

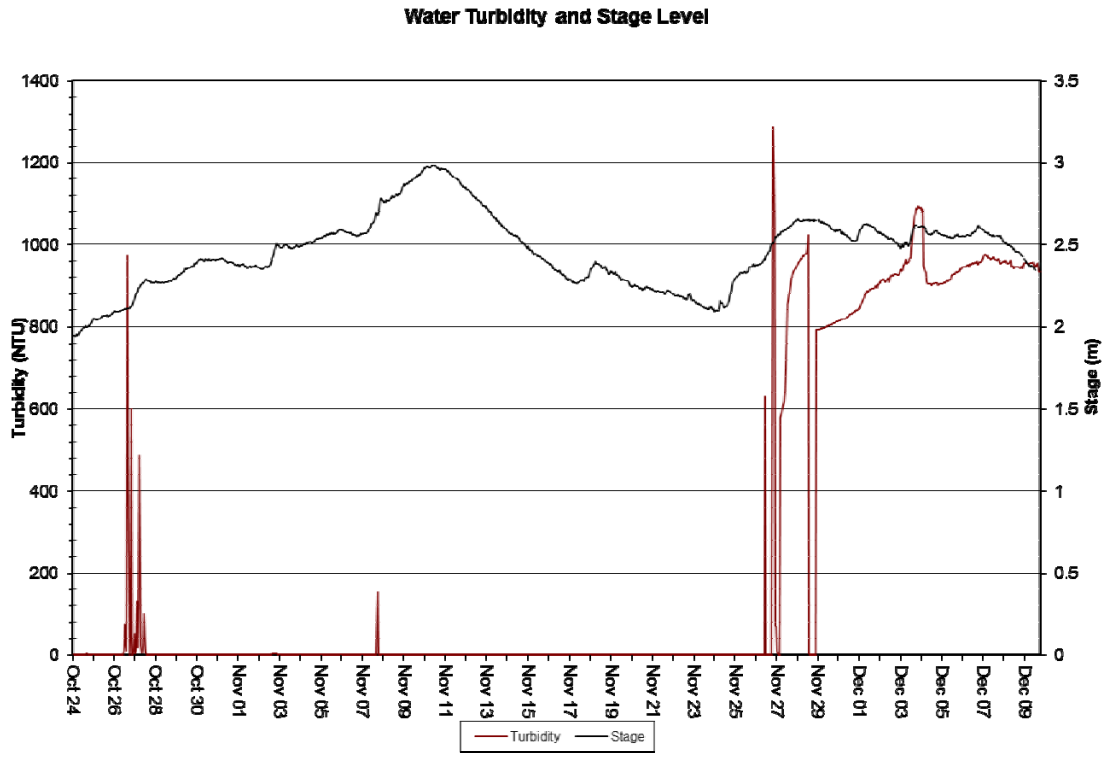

Figure 6: Turbidity (NTU) at Humber River from October 24, 2014, to December 10, 2014

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from October 24, 2014, to December 10, 2014.

- The performances of all sensors were rated good to excellent at the beginning, and poor to excellent at the end, of the deployment period. The poor reading for Turbidity was most likely related to some type of organic debris trapped inside the sensor guard and interfering with normal readings.
- Variations in water quality/quantity values recorded at each station are summarized below:

    - During this deployment period stage values ranged from 1.94 m to 2.98 m at Humber River at Humber Village, with corresponding flow ranging from 211.24 m^3/sec to 395.85 m^3/sec. Stage and flow values seem typical for the late fall period with variations related to weather conditions.
    - During this deployment period the water temperature at Humber River ranged from 3.93˚C to 10.67˚C and showed a decreasing trend over the deployment period which is consistent with the transition from mid to late fall.
    - During this deployment period pH values at Humber River ranged from 6.32 units to 7.17 units and with a median value of 7.28, most 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 36.4 µS/cm to 38.5 µS/cm and 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 10.16 mg/l (88.0% saturation) to 11.98 mg/l (94.8% saturation) and showed a gradual increasing trend which is due to the decreasing 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 1286.9 NTU; however the extremely high turbidity readings are most likely related to interference from organic debris causing false readings.

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 (10-24-2014 to 12-10-2014)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
10/24/2014	10	2.5	6.3	11.7	0	4.9
10/25/2014	6	4	5	13	0	9.6
10/26/2014	8	4.5	6.3	11.7	0	2.9
10/27/2014	9.5	6	7.8	10.2	0	5.9
10/28/2014	5.5	4	4.8	13.2	0	0
10/29/2014	16.5	0	8.3	9.7	0	1.9
10/30/2014	16	6	11	7	0	0.3
10/31/2014	9.5	4.5	7	11	0	0
11/1/2014	6	0	3	15	0	9.7
11/2/2014	10.5	1.5	6	12	0	2.1
11/3/2014	12.5	3.5	8	10	0	2.4
11/4/2014	6	3.5	4.8	13.2	0	2.3
11/5/2014	10.5	0	5.3	12.7	0	4.5
11/6/2014	10.5	2	6.3	11.7	0	0.7
11/7/2014	9	0.5	4.8	13.2	0	24.9
11/8/2014	3.5	0	1.8	16.2	0	9.5
11/9/2014	5.5	0	2.8	15.2	0	0.7
11/10/2014	4.5	2	3.3	14.7	0	0
11/11/2014	1.5	0.5	1	17	0	1
11/12/2014	3	-1.5	0.8	17.2	0	1.9
11/13/2014	8	0.5	4.3	13.7	0	1.1
11/14/2014	4.5	1.5	3	15	0	33.9
11/15/2014	3	0.5	1.8	16.2	0	4.4
11/16/2014	1.5	-3.5	-1	19	0	1
11/17/2014	2.5	-1	0.8	17.2	0	22.2
11/18/2014	10.5	0.5	5.5	12.5	0	0.4
11/19/2014	0	-2	-1	19	0	8.8
11/20/2014	1.5	-3	-0.8	18.8	0	10
11/21/2014	1	-3	-1	19	0	2.4
11/22/2014	2.5	-5.5	-1.5	19.5	0	6
11/23/2014	3	-6	-1.5	19.5	0	0
11/24/2014	12	-7.5	2.3	15.7	0	8.1
11/25/2014	12.5	-1	5.8	12.2	0	0
11/26/2014	5	2	3.5	14.5	0	25.6
11/27/2014	-0.5	-2	-1.3	19.3	0	2
11/28/2014	-3	-4.5	-3.8	21.8	0	7
11/29/2014	-3	-5	-4	22	0	0.8

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
11/30/2014	7	-7	0	18	0	6.1
12/1/2014	10	-2	4	14	0	7.6
12/2/2014	-5.5	-7	-6.3	24.3	0	0.8
12/3/2014	12	-12	0	18	0	21.3
12/4/2014	4.5	0	2.3	15.7	0	4.4
12/5/2014	-4.5	-7	-5.8	23.8	0	0.8
12/6/2014	3	-9.5	-3.3	21.3	0	14.1
12/7/2014	3	-4	-0.5	18.5	0	2.2
12/8/2014	-7.5	-12.5	-10	28	0	0
12/9/2014	-6	-10	-8	26	0	0
12/10/2014	-1	-8.5	-4.8	22.8	0	0.8