Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2018-01-26 to 2018-11-21

Government of Newfoundland & Labrador
Department of Municipal Affairs and Environment
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 January 26, 2018, to November 21, 2018. It should be noted that this deployment period was much longer than normal.

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 excellent at the beginning and poor to excellent at the end of the deployment period (Table 1). It is not surprising that the pH sensor was rated poor after this extended deployment period.
- **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	2018-01-26	2018-11-21
Temperature	Excellent	Excellent
pH	Excellent	Poor
Specific Conductivity	Excellent	Excellent
Dissolved Oxygen	Excellent	Excellent
Turbidity	Excellent	Excellent

Deployment Notes

Water quality monitoring for this deployment period started on January 26, 2018 and continued without any significant operational issues until November 21, 2018, when the instrument was removed for routine calibration and maintenance. It should be noted that this deployment period was much longer than normal.

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 1.68 m to 4.43 m at Humber River at Humber Village, with corresponding flow ranging from 172.44 m^3/sec to 723.85 m^3/sec (Figure 1).

- Flows over the deployment period were typical for the Humber River with the most significant peak during spring runoff and another peak in the fall when hurricane season rains can be quite significant (see climate data located in Appendix B).

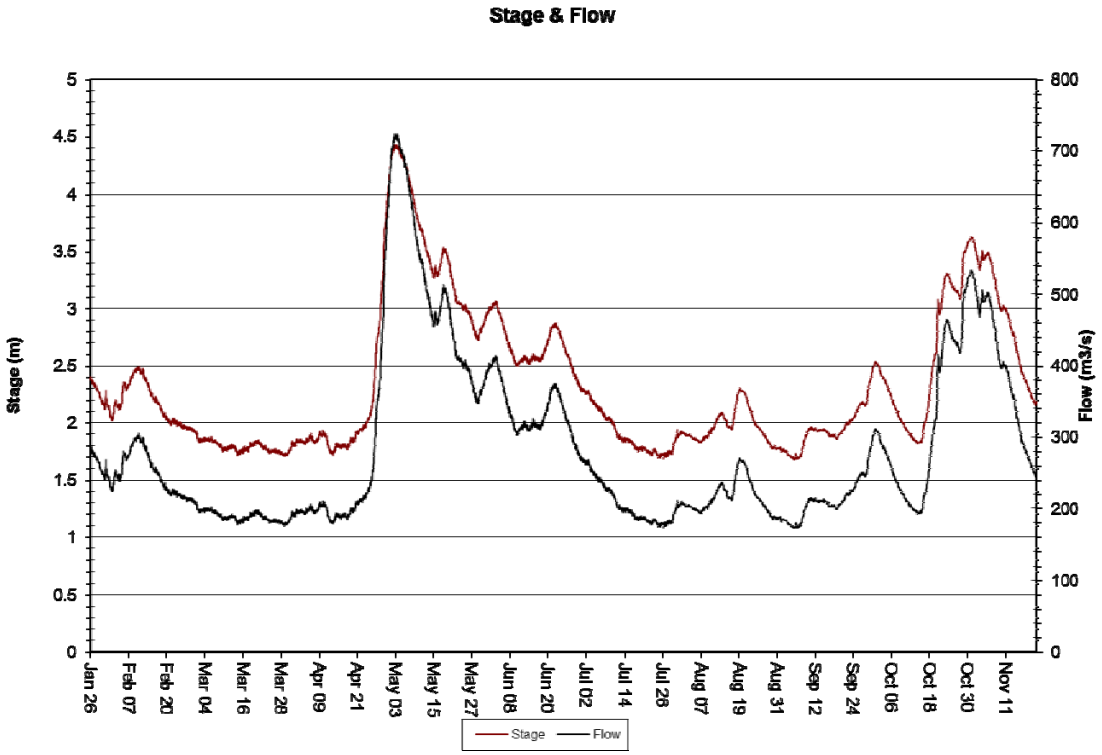

Figure 1: Stage & Flow at Humber River from January 26, 2018, to November 21, 2018

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 0.12˚C to 21.25 ˚C (Figure 2).
- Water temperature shows a steady increase from winter to summer and then a decline as fall sets in.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

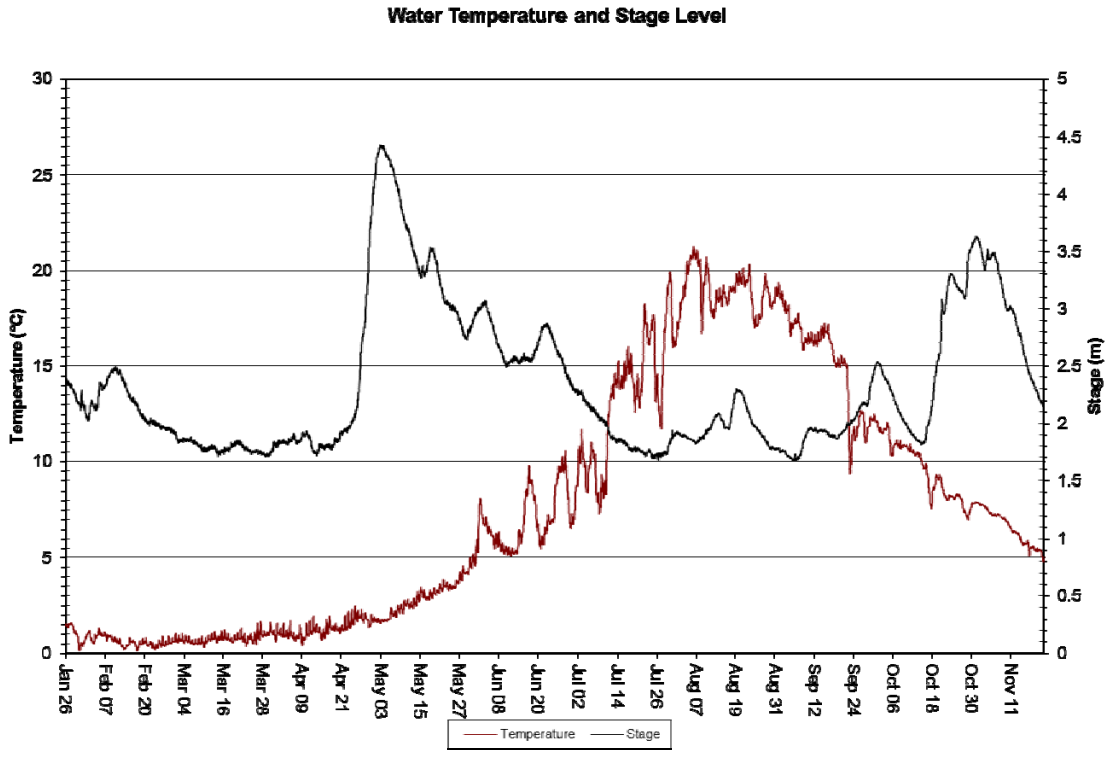

Figure 2: Temperature (°C) at Humber River from January 26, 2018, to November 21, 2018

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 7.05 units to 7.63 units (Figure 3).
- pH was relatively stable throughout the deployment period, however it appears to begin drifting slowly off calibration over the latter half of the deployment. This calibration drift is not surprising given the extended deployment period.
- With a median value of 7.19, 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).

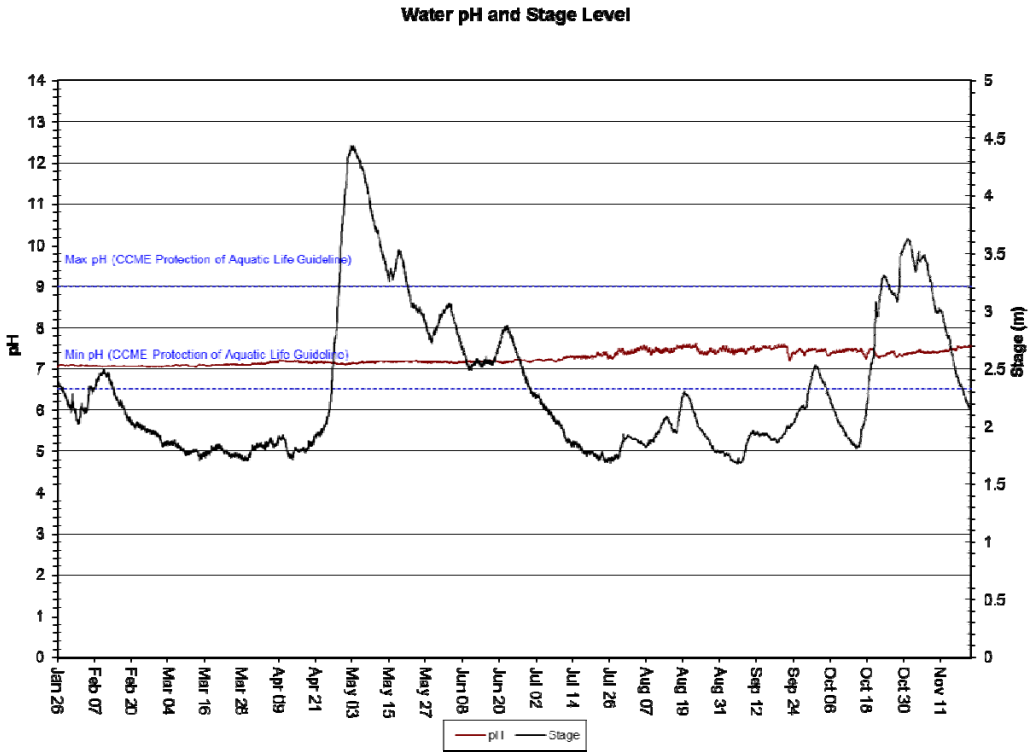

Figure 3: pH values recorded at Humber River from January 26, 2018, to November 21, 2018

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 37.2 µS/cm to 50.7 µS/cm (Figure 4).
- Specific conductivity is relatively stable over the deployment period; however there is a significant spike around February 5, 2018 (see inside red oval). This spike in specific conductivity corresponds with a period of rapid increase in flow due to rainfall and warm weather, which increased the level of dissolved material in the river water.

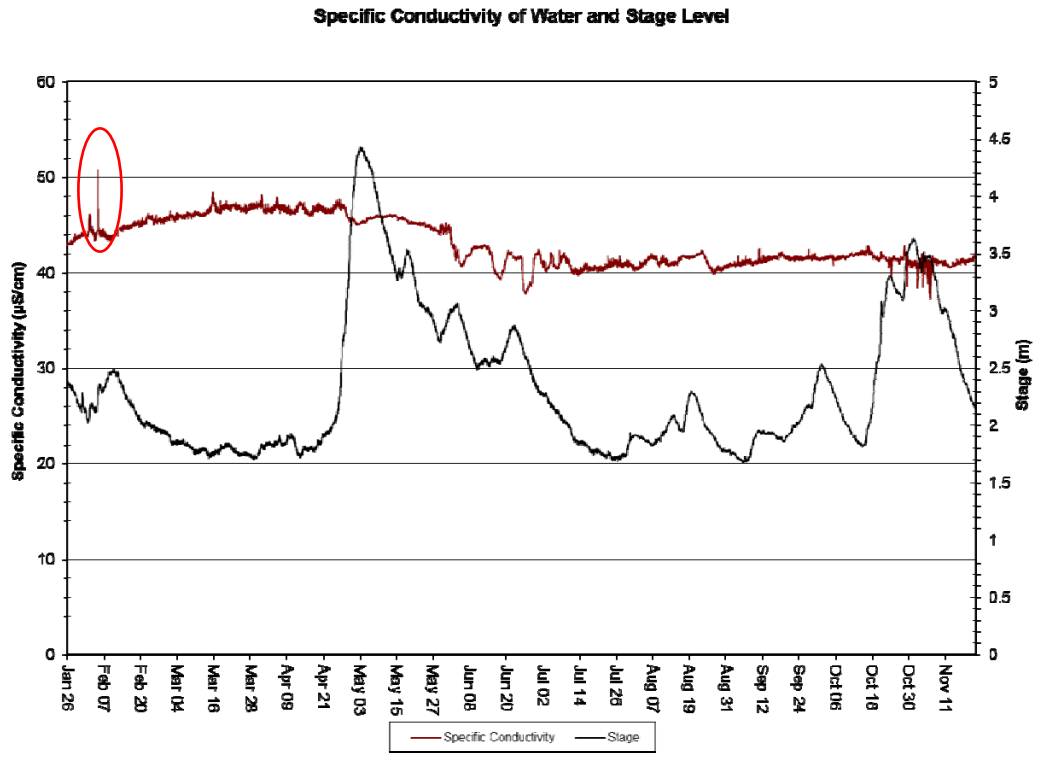

Figure 4: Specific conductivity (µs/cm) at Humber River from January 26, 2018, to November 21, 2018

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.02 mg/l (92.1% saturation) to 13.88 mg/l (107.0% saturation) (Figure 5).
- DO, % saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a significant dip during the warmer months of summer. This dip is related to the increasing temperature trend when water can hold less oxygen than during colder temperatures.
- DO shows diurnal fluctuations which are related to the diurnal temperature trends for the same period.
- 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 most of the DO values were at, or 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).

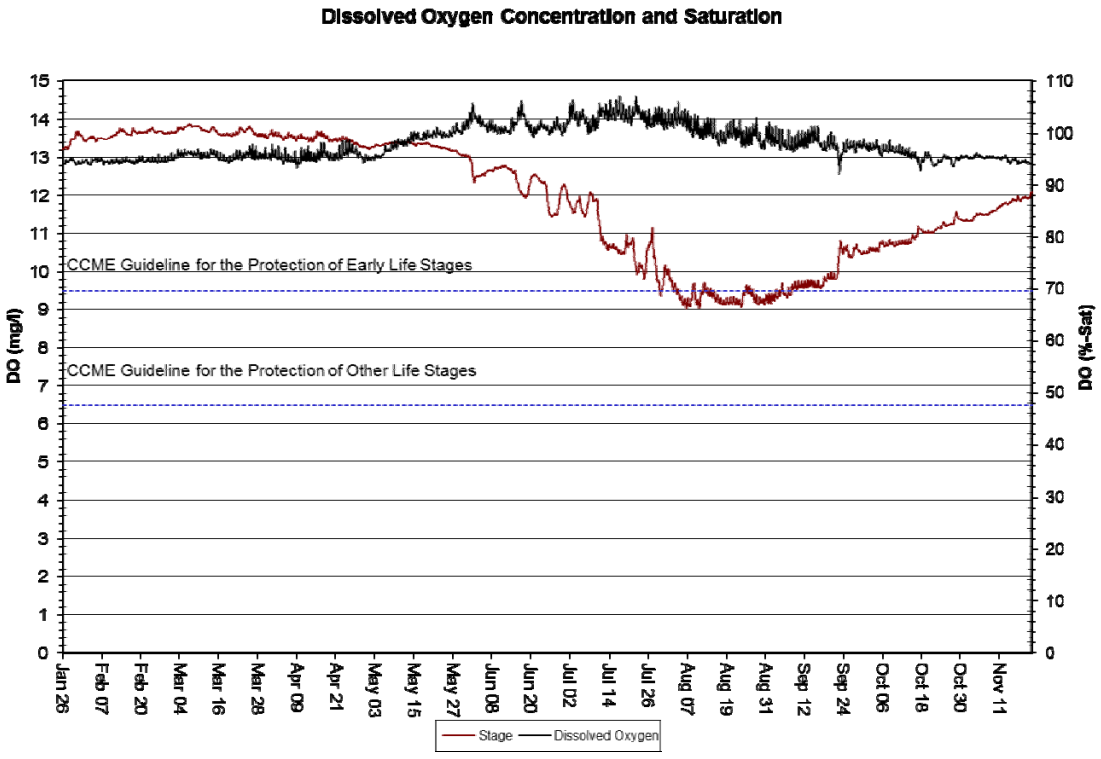

Figure 5: DO (mg/l & % saturation) at Humber River from January 26, 2018, to November 21, 2018

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 375.8 NTU (Figure 6).
- Around August 1, 2018, there is an extreme spike in turbidity (see inside red oval) which is mostly likely related to organic matter trapped near the sensor head rather than actual turbidity levels in the river.

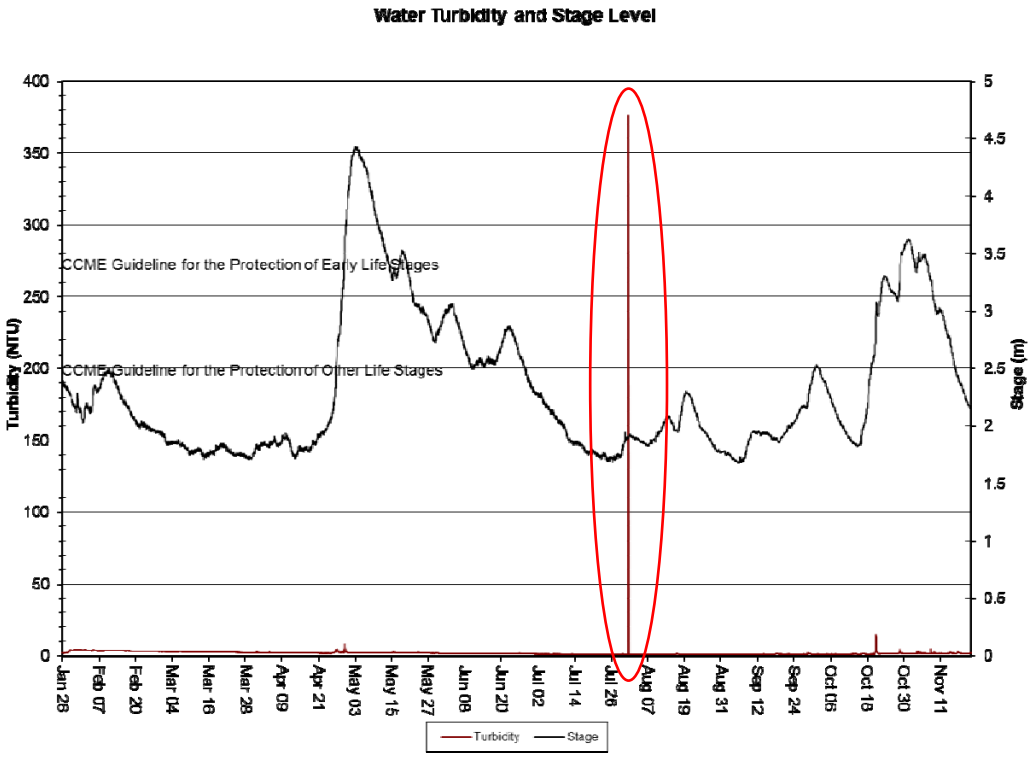

Figure 6: Turbidity (NTU) at Humber River from January 26, 2018, to November 21, 2018

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from January 26, 2018, to November 21, 2018.
- The performances of all sensors were rated excellent at the beginning and poor to excellent at the end of the deployment period. The pH sensor received a "poor" performance at the end of the deployment as it had drifted off calibration over the extended deployment period.
- Variations in water quality/quantity values recorded at each station are summarized below:
    - During this deployment period stage values ranged from 1.68 m to 4.43 m at Humber River at Humber Village, with corresponding flow ranging from 172.44 m^3/sec to 723.85 m^3/sec. These flows were typical for the Humber River with the most significant peak during spring runoff and another peak in the fall when hurricane season rains can be quite significant.
    - During this deployment period the water temperature at Humber River ranged from 0.12˚C to 21.25 ˚C. Water temperature shows a steady increase from winter to summer and then a decline as fall sets in.
    - During this deployment period pH values at Humber River ranged from 7.05 units to 7.63 units. pH was relatively stable throughout the deployment period, however it appears to begin drifting slowly off calibration over the latter half of the deployment. 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 37.2 µS/cm to 50.7 µS/cm and was relatively stable over the deployment period.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.02 mg/l (92.1% saturation) to 13.88 mg/l (107.0% saturation). DO, % saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a significant dip during the warmer months of summer when water can hold less oxygen than during colder temperatures. 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 most of the DO values were at, or 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 375.8 NTU. Most likely the spike in turbidity around August 1, 2018, is related to organic matter trapped near the sensor head rather than actual turbidity levels in the river.

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 (01-25-2018 to 11-21-2018)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
1/25/2018	-4.5	-8.5	-6.5	24.5	0	3.2
1/26/2018	-8	-10	-9	27	0	0.4
1/27/2018	1	-13	-6	24	0	2.6
1/28/2018	2	-6.5	-2.3	20.3	0	1.6
1/29/2018	-6.5	-8	-7.3	25.3	0	0
1/30/2018	4	-12	-4	22	0	16.8
1/31/2018	3	-8	-2.5	20.5	0	3.2
2/1/2018	2	-7	-2.5	20.5	0	9.2
2/2/2018	5.5	-3.5	1	17	0	26.6
2/3/2018	-7	-10.5	-8.8	26.8	0	7.6
2/4/2018	0.5	-13	-6.3	24.3	0	9
2/5/2018	7	-5.5	0.8	17.2	0	37
2/6/2018	-7	-9	-8	26	0	0
2/7/2018	-4	-11	-7.5	25.5	0	25.2
2/8/2018	-4	-7	-5.5	23.5	0	2
2/9/2018	-6.5	-11.5	-9	27	0	2.2
2/10/2018	0	-14	-7	25	0	13.2
2/11/2018	-0.5	-5	-2.8	20.8	0	0
2/12/2018	4	-9	-2.5	20.5	0	1.6
2/13/2018	-7	-10	-8.5	26.5	0	1.6
2/14/2018	-2.5	-13.5	-8	26	0	1.6
2/15/2018	2.5	-6.5	-2	20	0	0
2/16/2018	3	-3.5	-0.3	18.3	0	2.4
2/17/2018	-11	-13.5	-12.3	30.3	0	0.6
2/18/2018	-6	-13.5	-9.8	27.8	0	0
2/19/2018	-0.5	-12	-6.3	24.3	0	0
2/20/2018	0	-4	-2	20	0	0
2/21/2018	3	-13.5	-5.3	23.3	0	8.6
2/22/2018	-8	-10	-9	27	0	0
2/23/2018	-6	-11.5	-8.8	26.8	0	1.8
2/24/2018	-3	-9.5	-6.3	24.3	0	1
2/25/2018	-5.5	-18.5	-12	30	0	0
2/26/2018	0	-16.5	-8.3	26.3	0	16.6
2/27/2018	-0.5	-5.5	-3	21	0	0
2/28/2018	-1	-5	-3	21	0	1.8
3/1/2018	3	-2.5	0.3	17.7	0	0
3/2/2018	4.5	-3	0.8	17.2	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
3/3/2018	4	1	2.5	15.5	0	0.4
3/4/2018	3.5	0	1.8	16.2	0	0
3/5/2018	2	-1	0.5	17.5	0	0
3/6/2018	1	-2	-0.5	18.5	0	0
3/7/2018	0	-2	-1	19	0	0
3/8/2018	0	-2.5	-1.3	19.3	0	0
3/9/2018	2	-2	0	18	0	11.2
3/10/2018	3	-3	0	18	0	0.4
3/11/2018	2.5	-2	0.3	17.7	0	0.4
3/12/2018	3.5	-2	0.8	17.2	0	0.4
3/13/2018	5	-1	2	16	0	0
3/14/2018	4	-1.5	1.3	16.7	0	2.8
3/15/2018	8	1.5	4.8	13.2	0	13
3/16/2018	3.5	-1.5	1	17	0	0.6
3/17/2018	1.5	-2.5	-0.5	18.5	0	2.2
3/18/2018	0.5	-4	-1.8	19.8	0	6.4
3/19/2018	0.5	-3.5	-1.5	19.5	0	0.2
3/20/2018	2	-3	-0.5	18.5	0	0
3/21/2018	2	-5.5	-1.8	19.8	0	0
3/22/2018	2	-5.5	-1.8	19.8	0	20.2
3/23/2018	2.5	-2.5	0	18	0	5.4
3/24/2018	1	-2.5	-0.8	18.8	0	0.4
3/25/2018	0.5	-5.5	-2.5	20.5	0	0
3/26/2018	1.5	-15	-6.8	24.8	0	0
3/27/2018	6	-12	-3	21	0	0
3/28/2018	5	-7	-1	19	0	3.2
3/29/2018	3	-1	1	17	0	0.8
3/30/2018	8	-0.5	3.8	14.2	0	6.4
3/31/2018	4.5	1	2.8	15.2	0	1.6
4/1/2018	4.5	-5.5	-0.5	18.5	0	4
4/2/2018	0.5	-2	-0.8	18.8	0	0.6
4/3/2018	-2	-4.5	-3.3	21.3	0	0.2
4/4/2018	0.5	-8.5	-4	22	0	14.6
4/5/2018	7.5	-2	2.8	15.2	0	3
4/6/2018	-3.5	-8.5	-6	24	0	2.4
4/7/2018	0	-7	-3.5	21.5	0	6
4/8/2018	3.5	-5	-0.8	18.8	0	37.2
4/9/2018	-2	-3.5	-2.8	20.8	0	14.4

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
4/10/2018	1	-4.5	-1.8	19.8	0	0
4/11/2018	4	-5	-0.5	18.5	0	0
4/12/2018	6	-11.5	-2.8	20.8	0	0
4/13/2018	4.5	-9.5	-2.5	20.5	0	1.6
4/14/2018	1	-4.5	-1.8	19.8	0	2.6
4/15/2018	-3	-8	-5.5	23.5	0	0
4/16/2018	0.5	-9.5	-4.5	22.5	0	0
4/17/2018	10	-8.5	0.8	17.2	0	1.6
4/18/2018	3.5	2	2.8	15.2	0	3.8
4/19/2018	6	0.5	3.3	14.7	0	1.4
4/20/2018	2	-0.5	0.8	17.2	0	12.4
4/21/2018	2	-2	0	18	0	1.4
4/22/2018	2.5	-1	0.8	17.2	0	0
4/23/2018	9	-4.5	2.3	15.7	0	0
4/24/2018	12.5	-1	5.8	12.2	0	0
4/25/2018	16	3.5	9.8	8.2	0	0
4/26/2018	15	8	11.5	6.5	0	5.2
4/27/2018	10	6.5	8.3	9.7	0	0.4
4/28/2018	19.5	2	10.8	7.2	0	1.4
4/29/2018	9	6.5	7.8	10.2	0	28.4
4/30/2018	16	2	9	9	0	1.8
5/1/2018	14.5	1	7.8	10.2	0	3.4
5/2/2018	7	3	5	13	0	1.6
5/3/2018	5	1	3	15	0	0.6
5/4/2018	5	0.5	2.8	15.2	0	6.8
5/5/2018	9	2	5.5	12.5	0	4.4
5/6/2018	10	4.5	7.3	10.7	0	3.6
5/7/2018	5.5	2.5	4	14	0	0
5/8/2018	14	-2	6	12	0	0
5/9/2018	7	4	5.5	12.5	0	0
5/10/2018	14.5	-2	6.3	11.7	0	0
5/11/2018	9	4.5	6.8	11.2	0	0.4
5/12/2018	3.5	-1	1.3	16.7	0	0
5/13/2018	10	-1	4.5	13.5	0	0
5/14/2018	16.5	0.5	8.5	9.5	0	0
5/15/2018	22.5	7.5	15	3	0	8.6
5/16/2018	5.5	-1	2.3	15.7	0	5.6
5/17/2018	5.5	-1.5	2	16	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
5/18/2018	6.5	-2	2.3	15.7	0	0
5/19/2018	9	-1	4	14	0	0.4
5/20/2018	11.5	2	6.8	11.2	0	4.2
5/21/2018	11	3	7	11	0	6.8
5/22/2018	9.5	1	5.3	12.7	0	7.4
5/23/2018	9	3.5	6.3	11.7	0	4.6
5/24/2018	3	-1.5	0.8	17.2	0	4.8
5/25/2018	4	-3	0.5	17.5	0	0
5/26/2018	9.5	2	5.8	12.2	0	0.8
5/27/2018	11	-0.5	5.3	12.7	0	0
5/28/2018	16	1.5	8.8	9.2	0	2
5/29/2018	11	5	8	10	0	11.2
5/30/2018	9	2	5.5	12.5	0	0
5/31/2018	19	-0.5	9.3	8.7	0	0
6/1/2018	24	3	13.5	4.5	0	0
6/2/2018	16	9	12.5	5.5	0	1.4
6/3/2018	5	3	4	14	0	0
6/4/2018	5.5	0.5	3	15	0	0
6/5/2018	13.5	-1	6.3	11.7	0	0
6/6/2018	13.5	3.5	8.5	9.5	0	0
6/7/2018	15	0	7.5	10.5	0	0
6/8/2018	21.5	2	11.8	6.2	0	5.6
6/9/2018	14.5	7.5	11	7	0	5.2
6/10/2018	12	5	8.5	9.5	0	0
6/11/2018	7	3	5	13	0	0
6/12/2018	15	1.5	8.3	9.7	0	12.4
6/13/2018	9.5	7	8.3	9.7	0	0.6
6/14/2018	16.5	2.5	9.5	8.5	0	0
6/15/2018	18	2.5	10.3	7.7	0	0
6/16/2018	18	3	10.5	7.5	0	0
6/17/2018	16	1	8.5	9.5	0	0
6/18/2018	11.5	0	5.8	12.2	0	21.5
6/19/2018	14	7.5	10.8	7.2	0	6
6/20/2018	18	9	13.5	4.5	0	4.4
6/21/2018	21	10.5	15.8	2.2	0	0
6/22/2018	17	13	15	3	0	0
6/23/2018	24.5	10	17.3	0.7	0	0.8
6/24/2018	18	12.5	15.3	2.7	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)
6/25/2018	13	5.5	9.3	8.7	0	4.6
6/26/2018	10	2	6	12	0	7.6
6/27/2018	21	4	12.5	5.5	0	2.4
6/28/2018	25	8	16.5	1.5	0	0
6/29/2018	22.5	16	19.3	0	1.3	10
6/30/2018	21	15	18	0	0	12.8
7/1/2018	17	12	14.5	3.5	0	1
7/2/2018	24	8.5	16.3	1.7	0	0
7/3/2018	24.5	15.5	20	0	2	0
7/4/2018	23.5	16	19.8	0	1.8	0
7/5/2018	23.5	9.5	16.5	1.5	0	0
7/6/2018	28	14.5	21.3	0	3.3	10
7/7/2018	16	12.5	14.3	3.7	0	0
7/8/2018	24	11.5	17.8	0.2	0	0
7/9/2018	26.5	17	21.8	0	3.8	0
7/10/2018	27.5	18	22.8	0	4.8	0
7/11/2018	22.5	15.5	19	0	1	0.4
7/12/2018	18.5	12.5	15.5	2.5	0	0
7/13/2018	23.5	8.5	16	2	0	0
7/14/2018	23.5	9.5	16.5	1.5	0	5.6
7/15/2018	25	12.5	18.8	0	0.8	1.6
7/16/2018	24	16	20	0	2	2.8
7/17/2018	24.5	17	20.8	0	2.8	0
7/18/2018	28.5	17	22.8	0	4.8	2.4
7/19/2018	25	17.5	21.3	0	3.3	0
7/20/2018	28.5	12	20.3	0	2.3	0
7/21/2018	28.5	15.5	22	0	4	0.8
7/22/2018	25.5	16.5	21	0	3	2.2
7/23/2018	23	18	20.5	0	2.5	15.8
7/24/2018	23.5	14.5	19	0	1	0.8
7/25/2018	26.5	20	23.3	0	5.3	0
7/26/2018	29	21.5	25.3	0	7.3	7
7/27/2018	24	21.5	22.8	0	4.8	0
7/28/2018	27	12.5	19.8	0	1.8	0
7/29/2018	28.5	21.5	25	0	7	4.8
7/30/2018	27.5	18.5	23	0	5	0
7/31/2018	27.5	17	22.3	0	4.3	0
8/1/2018	29.5	16.5	23	0	5	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
8/2/2018	28	18.5	23.3	0	5.3	3.2
8/3/2018	24.5	19	21.8	0	3.8	0
8/4/2018	27	15.5	21.3	0	3.3	0.8
8/5/2018	20.5	18.5	19.5	0	1.5	2
8/6/2018	27	18.5	22.8	0	4.8	6.4
8/7/2018	27	18	22.5	0	4.5	16
8/8/2018	22	18	20	0	2	0.6
8/9/2018	27.5	12	19.8	0	1.8	14.4
8/10/2018	26	18	22	0	4	0.4
8/11/2018	21	16	18.5	0	0.5	0
8/12/2018	23	15	19	0	1	0
8/13/2018	29.5	18.5	24	0	6	0
8/14/2018	29.5	18	23.8	0	5.8	0
8/15/2018	26	20	23	0	5	1.4
8/16/2018	15	13	14	4	0	0.2
8/17/2018	18	10	14	4	0	0
8/18/2018	18.5	10	14.3	3.7	0	0
8/19/2018	22	12	17	1	0	0
8/20/2018	25.5	9.5	17.5	0.5	0	0
8/21/2018	24	12.5	18.3	0	0.3	0
8/22/2018	26	10.5	18.3	0	0.3	0
8/23/2018	27	15.5	21.3	0	3.3	0.6
8/24/2018	27.5	18.5	23	0	5	0
8/25/2018	26	18	22	0	4	0
8/26/2018	28.5	16	22.3	0	4.3	0
8/27/2018	27.5	12.5	20	0	2	1.4
8/28/2018	28	18.5	23.3	0	5.3	0
8/29/2018	22	20	21	0	3	8.4
8/30/2018	17.5	14	15.8	2.2	0	7.8
8/31/2018	19.5	14	16.8	1.2	0	0
9/1/2018	20	8.5	14.3	3.7	0	0
9/2/2018	21	10.5	15.8	2.2	0	0
9/3/2018	27.5	11	19.3	0	1.3	6.8
9/4/2018	21	19	20	0	2	0
9/5/2018	18.5	11	14.8	3.2	0	2
9/6/2018	21	12	16.5	1.5	0	3.8
9/7/2018	19	9.5	14.3	3.7	0	0
9/8/2018	15.5	9.5	12.5	5.5	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
9/9/2018	15	5.5	10.3	7.7	0	0
9/10/2018	16.5	4.5	10.5	7.5	0	0
9/11/2018	21	7.5	14.3	3.7	0	18.8
9/12/2018	19.5	13.5	16.5	1.5	0	2.8
9/13/2018	23	7.5	15.3	2.7	0	0
9/14/2018	23.5	9.5	16.5	1.5	0	0
9/15/2018	27	14	20.5	0	2.5	0.6
9/16/2018	18	11	14.5	3.5	0	0.8
9/17/2018	18.5	8.5	13.5	4.5	0	25.4
9/18/2018	5.5	3.5	4.5	13.5	0	5.2
9/19/2018	11	-0.5	5.3	12.7	0	0.8
9/20/2018	11.5	3.5	7.5	10.5	0	0
9/21/2018	13.5	1.5	7.5	10.5	0	11
9/22/2018	16	8.5	12.3	5.7	0	2.2
9/23/2018	17	3	10	8	0	3
9/24/2018	9.5	3.5	6.5	11.5	0	0
9/25/2018	9	2	5.5	12.5	0	0
9/26/2018	20	2	11	7	0	16.8
9/27/2018	20	12.5	16.3	1.7	0	2.8
9/28/2018	14.5	3.5	9	9	0	22
9/29/2018	14.5	10	12.3	5.7	0	0
9/30/2018	12	6	9	9	0	0
10/1/2018	11.5	1.5	6.5	11.5	0	1.6
10/2/2018	10.5	1.5	6	12	0	0
10/3/2018	11.5	-1.5	5	13	0	1.8
10/4/2018	19.5	9.5	14.5	3.5	0	0
10/5/2018	9.5	6.5	8	10	0	1.2
10/6/2018	8.5	3	5.8	12.2	0	0.6
10/7/2018	6	-0.5	2.8	15.2	0	0
10/8/2018	8.5	-0.5	4	14	0	0
10/9/2018	8	1	4.5	13.5	0	0.8
10/10/2018	5.5	5	5.3	12.7	0	0.6
10/11/2018	6	1	3.5	14.5	0	0
10/12/2018	7	0	3.5	14.5	0	0.6
10/13/2018	11	3.5	7.3	10.7	0	0.6
10/14/2018	9	5	7	11	0	4.8
10/15/2018	10.5	3.5	7	11	0	7.8
10/16/2018	15	5	10	8	0	19.8

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
10/17/2018	5.5	3.5	4.5	13.5	0	3.6
10/18/2018	6.5	1.5	4	14	0	24
10/19/2018	8	1	4.5	13.5	0	1
10/20/2018	16	0	8	10	0	53.8
10/21/2018	13	9.5	11.3	6.7	0	0
10/22/2018	5	3	4	14	0	2.6
10/23/2018	5.5	0	2.8	15.2	0	1.8
10/24/2018	7	-1.5	2.8	15.2	0	7.8
10/25/2018	12.5	2.5	7.5	10.5	0	1.8
10/26/2018	3	2	2.5	15.5	0	2.2
10/27/2018	1	-0.5	0.3	17.7	0	8
10/28/2018	5	-2	1.5	16.5	0	59
10/29/2018	15	2	8.5	9.5	0	1
10/30/2018	12.5	6	9.3	8.7	0	0.4
10/31/2018	6.5	5.5	6	12	0	1.8
11/1/2018	5.5	2.5	4	14	0	1.8
11/2/2018	6.5	3.5	5	13	0	1.2
11/3/2018	15.5	3.5	9.5	8.5	0	36.8
11/4/2018	7	5	6	12	0	6.6
11/5/2018	3.5	2.5	3	15	0	0
11/6/2018	8.5	0.5	4.5	13.5	0	11.6
11/7/2018	14.5	3	8.8	9.2	0	6.4
11/8/2018	7.5	5	6.3	11.7	0	0.8
11/9/2018	5	2.5	3.8	14.2	0	1
11/10/2018	6	0	3	15	0	10.6
11/11/2018	2	-1.5	0.3	17.7	0	9.8
11/12/2018	3	-2	0.5	17.5	0	1
11/13/2018	2	-1.5	0.3	17.7	0	12
11/14/2018	3	-3	0	18	0	19.6
11/15/2018	-2	-4	-3	21	0	1
11/16/2018	-1	-4	-2.5	20.5	0	13.4
11/17/2018	0.5	-5	-2.3	20.3	0	5.6
11/18/2018	-1.5	-4	-2.8	20.8	0	1.8
11/19/2018	1	-4.5	-1.8	19.8	0	1
11/20/2018	-0.5	-6	-3.3	21.3	0	13
11/21/2018	2.5	-2.5	0	18	0	5