



# Real Time Water Quality Report

## Humber River at Humber Village

Deployment Period  
2015-09-23 to 2015-12-09



Government of Newfoundland & Labrador  
Department of Environment and Conservation  
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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 September 23, 2015, to December 09, 2015.

## 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 instruments deployed at the water monitoring stations.
- The performances of all sensors were rated fair to excellent at the beginning and 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

Stage of deployment	Humber River	
	Beginning	End
Date	2015-09-23	2015-12-09
Temperature	Excellent	Excellent
pH	Excellent	Excellent
Specific Conductivity	Fair	Excellent
Dissolved Oxygen	Excellent	Excellent
Turbidity	Excellent	Excellent

## Deployment Notes

Water quality monitoring for this deployment period started on September 23, 2015 and continued without any significant operational issues until December 09, 2015, when the instrument was removed for routine calibration and maintenance. This was a relatively long deployment period of 77 days. Fortunately, with cold water conditions water quality tends to be quite stable, there is less biofouling, and the field instrument keeps good calibration for extended periods.

## Data Interpretation

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

(i.) Stage (m)	(iv.) Specific conductivity ( $\mu\text{S}/\text{cm}$ )
(ii.) Temperature ( $^{\circ}\text{C}$ )	(v.) Dissolved oxygen (mg/l)
(iii.) pH	(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 1.92 m to 3.09 m at Humber River, with corresponding flow ranging from 208.15 m<sup>3</sup>/sec to 417.96 m<sup>3</sup>/sec (Figure 1).
- Flows over the deployment period were typical for the fall season. There are three distinct spikes in flow over the deployment period (see inside red ovals) which are all related to significant rainfall events over the week preceding the spikes (see climate data in Appendix B)

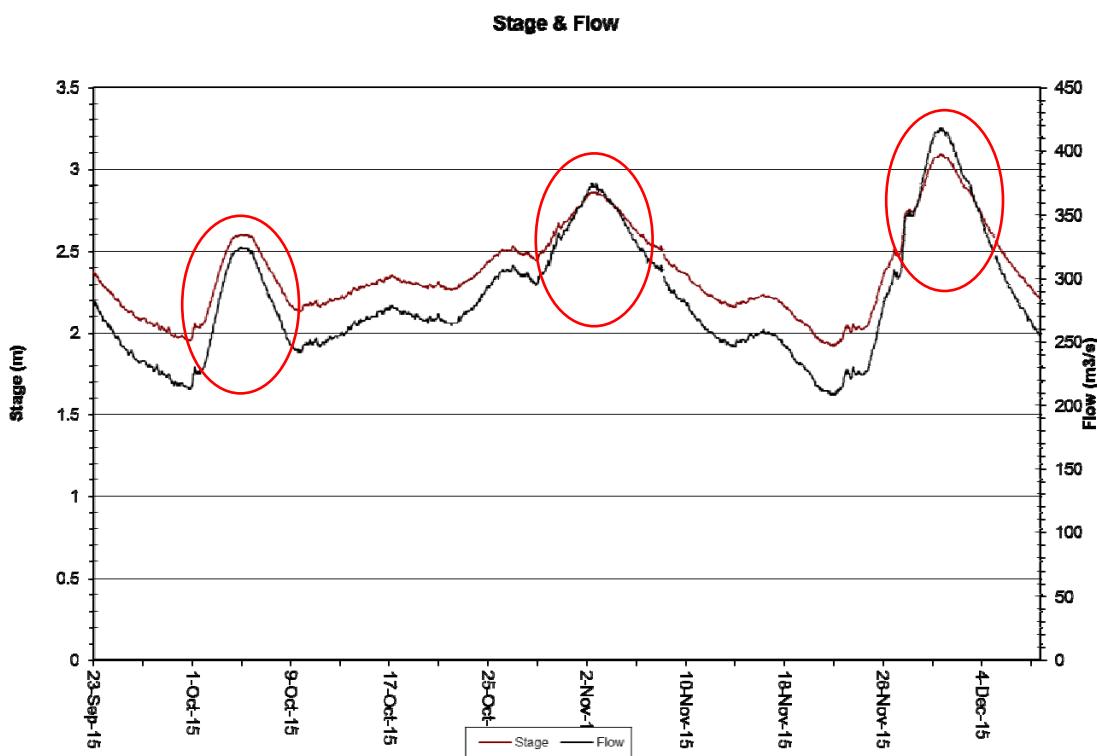


Figure 1: Stage Height (m) at Humber River from September 23, 2015, to December 09, 2015

## Temperature

- During this deployment period water temperature at Humber River ranged from 4.82°C to 15.19°C (Figure 2).
- Temperature shows a steady declining trend over the deployment period which is consistent with the transition from fall to winter.
- During the middle of October there is a noticeable dip in temperature (see inside red oval) which appears to be related to a combination of cooler air temperatures and several days of rain.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

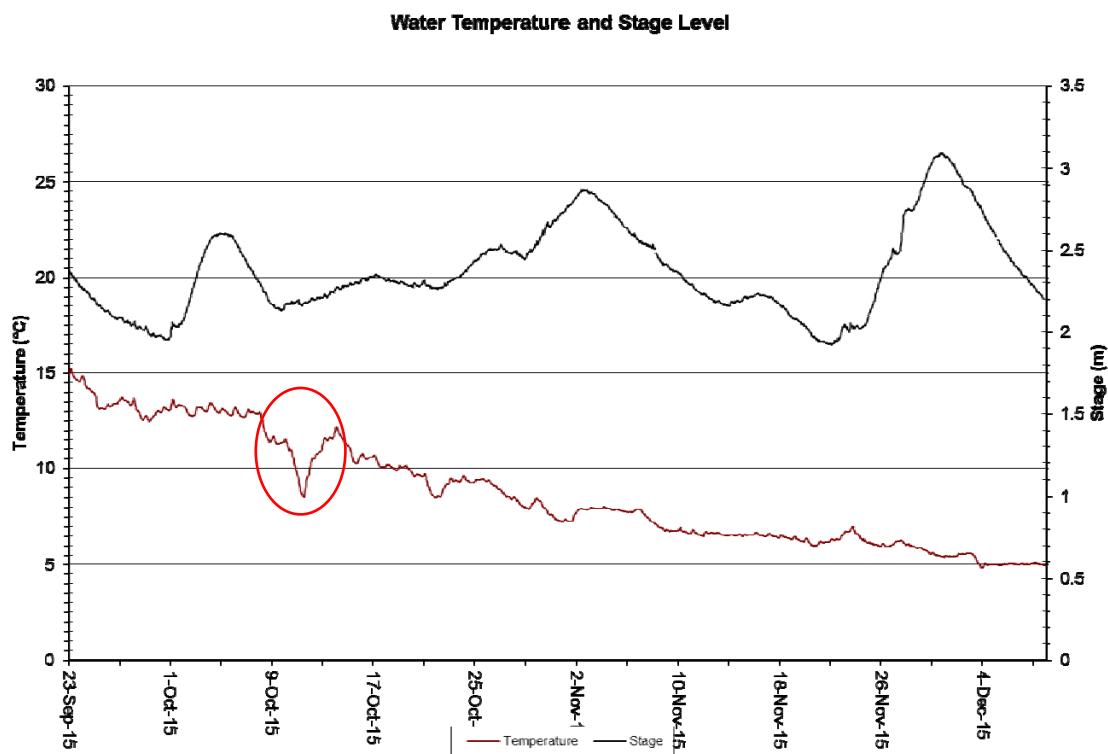


Figure 2: Temperature (°C) at Humber River from September 23, 2015, to December 09, 2015

## pH

- During this deployment period pH values at Humber River ranged from 6.57 units to 6.91 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 6.78, 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).

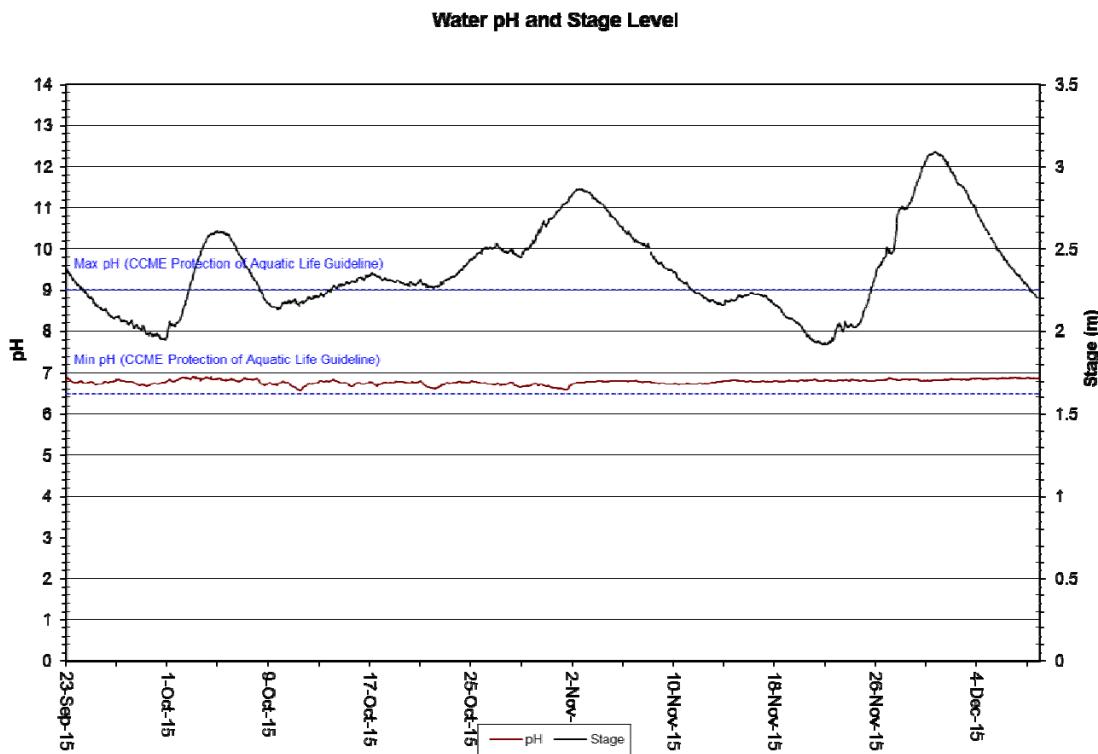


Figure 3: pH values recorded at Humber River from September 23, 2015, to December 09, 2015

## Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 31.7  $\mu\text{S}/\text{cm}$  to 33.9  $\mu\text{S}/\text{cm}$  (Figure 4).
- Specific conductivity appears to be relatively stable during the deployment period.

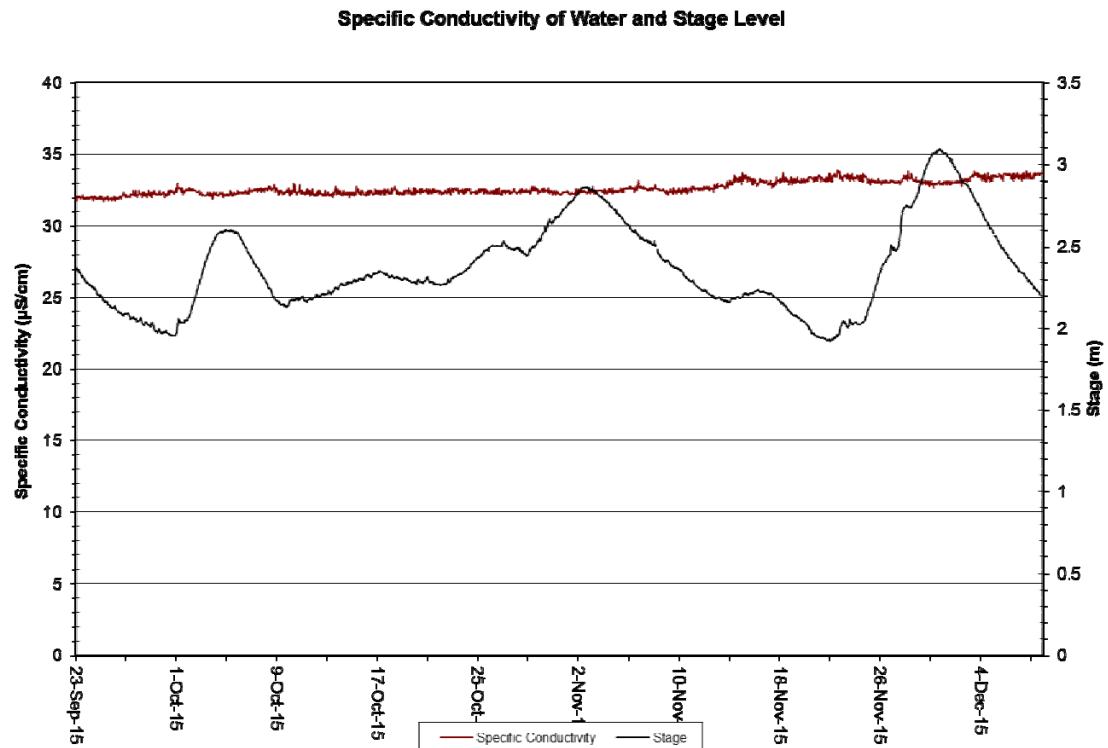


Figure 4: Specific conductivity ( $\mu\text{S}/\text{cm}$ ) at Humber River from Sept. 23, 2015, to Dec. 13, 2015

## Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.55 mg/l (89.6% saturation) to 11.83 mg/l (96.4% saturation) (Figure 5).
- Over the deployment period DO(mg/l) shows a steady increasing trend which is related to a cooling water 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), as well as above the minimum guideline (9.5 mg/l) set for the protection of early life stages, as determined by the Canadian Council of Ministers of the Environment (2007).

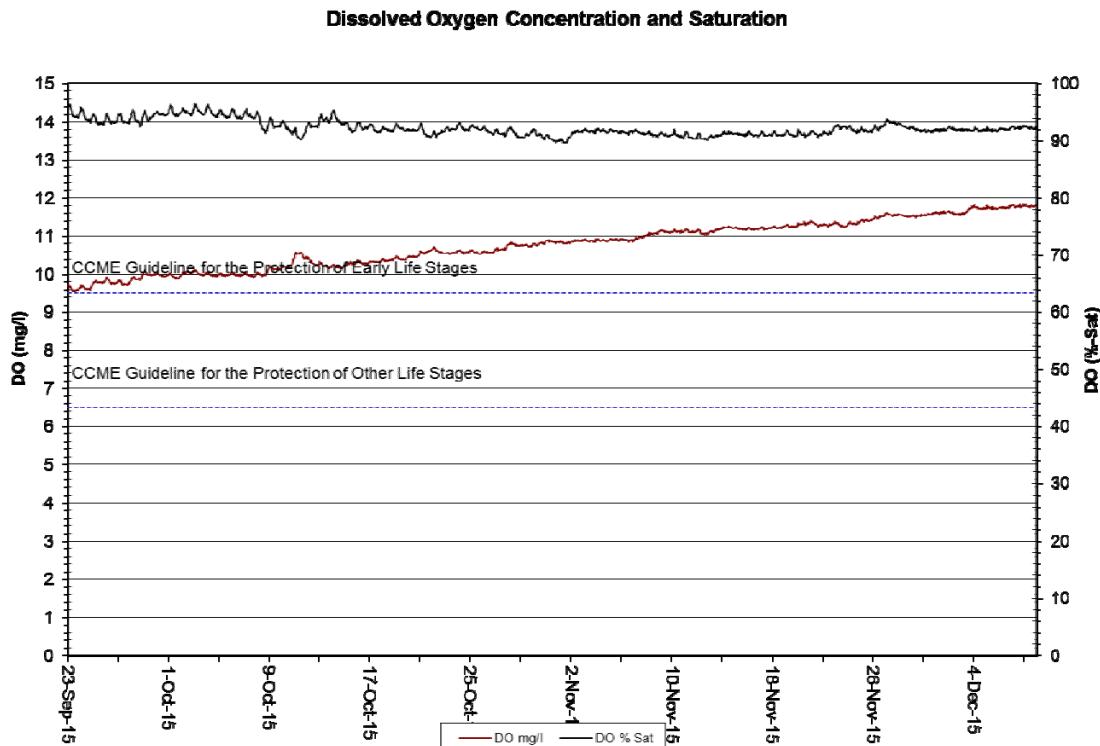


Figure 5: DO (mg/l & % saturation) at Humber River from Sept. 23, 2015, to December 09, 2015

## Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 55.2 NTU (Figure 6).
- During this deployment period there were several spikes in turbidity beyond normal background turbidity levels. Most likely these spikes are due to false readings related to organic debris being temporarily lodged around the sensor head.

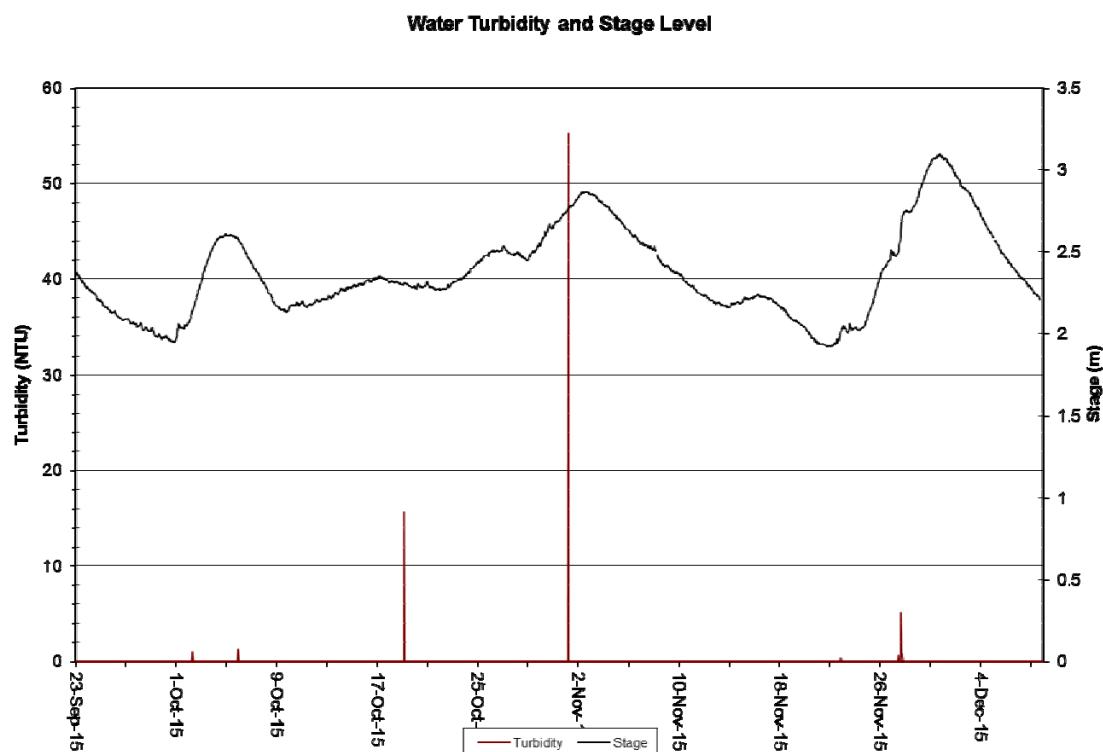


Figure 6: Turbidity (NTU) at Humber River from September 23, 2015, to December 09, 2015

## Conclusion

- This monthly deployment report presents water quality and water quantity data recorded at Humber River from September 23, 2015, to December 09, 2016.
- The performances of all sensors were rated fair to excellent at the beginning of the deployment period and excellent at the end.
- Variations in water quality/quantity values recorded at each station are summarized below:

- During this deployment period stage values ranged from 1.92 m to 3.09 m at Humber River, with corresponding flow ranging from 208.15 m<sup>3</sup>/sec to 417.96 m<sup>3</sup>/sec. Flows over the deployment period were typical for the fall season.
- During this deployment period water temperature at Humber River ranged from 4.82°C to 15.19°C. Temperature shows a steady declining trend over the deployment period which is consistent with the transition from fall to winter.
- During this deployment period pH values at Humber River ranged from 6.57 units to 6.91 units. pH was quite stable throughout the deployment period and with a median value of 6.78, 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 31.7 µS/cm to 33.9 µS/cm. Specific conductivity appears to be relatively stable during the deployment period.
- During this deployment period DO values at Humber River ranged from 9.55 mg/l (89.6% saturation) to 11.83 mg/l (96.4% saturation). Over the deployment period DO (mg/l) shows a steady increasing trend which is related to a cooling water temperature trend for the same period. All of the DO values at Humber River were above both the minimum guideline set for other life stages (6.5 mg/l), as well as above the minimum guideline (9.5 mg/l) set for the protection of early life stages, 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 55.2 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)<sup>1</sup>.
- 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.

Parameter	Rating				
	Excellent	Good	Fair	Marginal	Poor
Temperature (°C)	$\leq \pm 0.2$	$> \pm 0.2$ to 0.5	$> \pm 0.5$ to 0.8	$> \pm 0.8$ to 1	$> \pm 1$
pH (unit)	$\leq \pm 0.2$	$> \pm 0.2$ to 0.5	$> \pm 0.5$ to 0.8	$> \pm 0.8$ to 1	$> \pm 1$
Sp. Conductance ( $\mu\text{S}/\text{cm}$ )	$\leq \pm 3$	$> \pm 3$ to 10	$> \pm 10$ to 15	$> \pm 15$ to 20	$> \pm 20$
Sp. Conductance $> 35 \mu\text{S}/\text{cm}$ (%)	$\leq \pm 3$	$> \pm 3$ to 10	$> \pm 10$ to 15	$> \pm 15$ to 20	$> \pm 20$
Dissolved Oxygen (mg/l) (% Sat)	$\leq \pm 0.3$	$> \pm 0.3$ to 0.5	$> \pm 0.5$ to 0.8	$> \pm 0.8$ to 1	$> \pm 1$
Turbidity $< 40$ NTU (NTU)	$\leq \pm 2$	$> \pm 2$ to 5	$> \pm 5$ to 8	$> \pm 8$ to 10	$> \pm 10$
Turbidity $> 40$ NTU (%)	$\leq \pm 5$	$> \pm 5$ to 10	$> \pm 10$ to 15	$> \pm 15$ to 20	$> \pm 20$

<sup>1</sup> 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 (Sept. 23, 2015, to Dec. 9, 2015)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
9/23/2015	20	8.5	14.3	3.7	0	0
9/24/2015	16	8	12	6	0	1.7
9/25/2015	11	6	8.5	9.5	0	2.1
9/26/2015	9	3.5	6.3	11.7	0	1.2
9/27/2015	17	2	9.5	8.5	0	0
9/28/2015	22.5	10	16.3	1.7	0	0
9/29/2015	22	14	18	0	0	0.4
9/30/2015	19.5	15	17.3	0.7	0	24
10/1/2015	21	9.5	15.3	2.7	0	8.5
10/2/2015	7	5.5	6.3	11.7	0	0
10/3/2015	10	3	6.5	11.5	0	0
10/4/2015	14	0	7	11	0	0
10/5/2015	15.5	3.5	9.5	8.5	0	0
10/6/2015	16	7.5	11.8	6.2	0	0
10/7/2015	14.5	5.5	10	8	0	4
10/8/2015	10.5	7	8.8	9.2	0	0.4
10/9/2015	13	1	7	11	0	12.5
10/10/2015	13.5	5.5	9.5	8.5	0	9.6
10/11/2015	9	2	5.5	12.5	0	3.9
10/12/2015	13	3	8	10	0	0
10/13/2015	20	7	13.5	4.5	0	9.4
10/14/2015	22.5	10.5	16.5	1.5	0	0.4
10/15/2015	14.5	10.5	12.5	5.5	0	0.4
10/16/2015	14	2	8	10	0	5.5
10/17/2015	8.5	5.5	7	11	0	0.4
10/18/2015	8	2	5	13	0	4.5
10/19/2015	6	2	4	14	0	4.4
10/20/2015	9.5	0	4.8	13.2	0	3.9
10/21/2015	8	3.5	5.8	12.2	0	0.9
10/22/2015	10.5	3.5	7	11	0	16.9
10/23/2015	12	5.5	8.8	9.2	0	0.8
10/24/2015	4.5	-1.5	1.5	16.5	0	0
10/25/2015	12	-1.5	5.3	12.7	0	6.9
10/26/2015	7.5	6.5	7	11	0	0
10/27/2015	4	1.5	2.8	15.2	0	1.6
10/28/2015	2.5	-2.5	0	18	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
10/29/2015	17.5	-1.5	8	10	0	25.6
10/30/2015	9	4.5	6.8	11.2	0	2.4
10/31/2015	2.5	2	2.3	15.7	0	0.4
11/1/2015	5	1.5	3.3	14.7	0	11.9
11/2/2015	7	2	4.5	13.5	0	2.9
11/3/2015	3	0	1.5	16.5	0	1
11/4/2015	1.5	-0.5	0.5	17.5	0	1.4
11/5/2015	1.5	-0.5	0.5	17.5	0	0.8
11/6/2015	12.5	-1.5	5.5	12.5	0	4.9
11/7/2015	9.5	2	5.8	12.2	0	0
11/8/2015	4.5	0	2.3	15.7	0	0
11/9/2015	6	-0.5	2.8	15.2	0	2.9
11/10/2015	4	2	3	15	0	0
11/11/2015	3.5	-5	-0.8	18.8	0	0
11/12/2015	3.5	-6.5	-1.5	19.5	0	0
11/13/2015	4.5	-4.5	0	18	0	2.5
11/14/2015	4.5	2.5	3.5	14.5	0	11.7
11/15/2015	3	1	2	16	0	8.5
11/16/2015	2.5	0	1.3	16.7	0	0
11/17/2015	3.5	-2.5	0.5	17.5	0	1.8
11/18/2015	1	-1.5	-0.3	18.3	0	0
11/19/2015	1	-2.5	-0.8	18.8	0	0
11/20/2015	2.5	-5	-1.3	19.3	0	0
11/21/2015	4	-5	-0.5	18.5	0	0.5
11/22/2015	13	2.5	7.8	10.2	0	11.7
11/23/2015	17	6	11.5	6.5	0	3.7
11/24/2015	4.5	1.5	3	15	0	0
11/25/2015	0.5	-5	-2.3	20.3	0	2.4
11/26/2015	6	-5	0.5	17.5	0	0
11/27/2015	11	0.5	5.8	12.2	0	33
11/28/2015	2.5	-2.5	0	18	0	0.8
11/29/2015	0.5	-5	-2.3	20.3	0	4.4
11/30/2015	-3.5	-11	-7.3	25.3	0	0
12/1/2015	1	-8.5	-3.8	21.8	0	0
12/2/2015	4.5	-2	1.3	16.7	0	16.7
12/3/2015	2.5	0	1.3	16.7	0	0.6
12/4/2015	0	-8	-4	22	0	0.8
12/5/2015	0.5	-8	-3.8	21.8	0	1

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
12/6/2015	4.5	-3	0.8	17.2	0	0.8
12/7/2015	4.5	0	2.3	15.7	0	7
12/8/2015	3	0.5	1.8	16.2	0	0.6
12/9/2015	3	-1	1	17	0	0.6