Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2012-11-28 to 2013-01-31

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

Prepared by:

Ian Bell
Environmental Scientist

Department of Environment & Conservation
Water Resources Management Division
PO Box 2006, Corner Brook, NL, A2H 6J8

t. 709.637.2431
f. 709.637.2541
e. ianbell@gov.nl.ca

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 daily 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.
- This monthly deployment report, presents water quality and water quantity data recorded at the Humber River at Humber Village station from November 28, 2012, to January 31, 2013.

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.

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

	Humber River	
Stage of deployment	**Beginning**	**End**
Date	2012-11-28	2013-01-31
Temperature	Excellent	Good
pH	Excellent	Fair
Specific Conductivity	Good	Fair
Dissolved Oxygen	Excellent	Marginal
Turbidity	Excellent	Excellent

The performances of all sensors were rated good to excellent at the beginning of the deployment period. While temperature and turbidity rated good and excellent respectively upon removal, pH and specific conductivity only ranked fair and dissolved oxygen was rated marginal (Table 1). The fair and marginal ratings at the end are most likely related to the relatively long deployment period of 64 days.

Deployment Notes

- Water quality monitoring for this deployment period started on November 28, 2012 at 12:15 pm and continued without any significant operational issues until January 31, 2013, 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

- Stage values ranged from 1.69 m to 2.32 m at Humber River with corresponding flow ranging from 172.00 m^3/sec to 280 m^3/sec from November 28, 2012 to January 31, 2013 (Figure 1).

- While there are numerous daily and short term fluctuations there appears to be a gentle declining trend throughout the deployment period.
- There is a noticeable peak in stage height and flow around December 24 (see inside red oval – Figure 1) which corresponds with several days of significant precipitation.

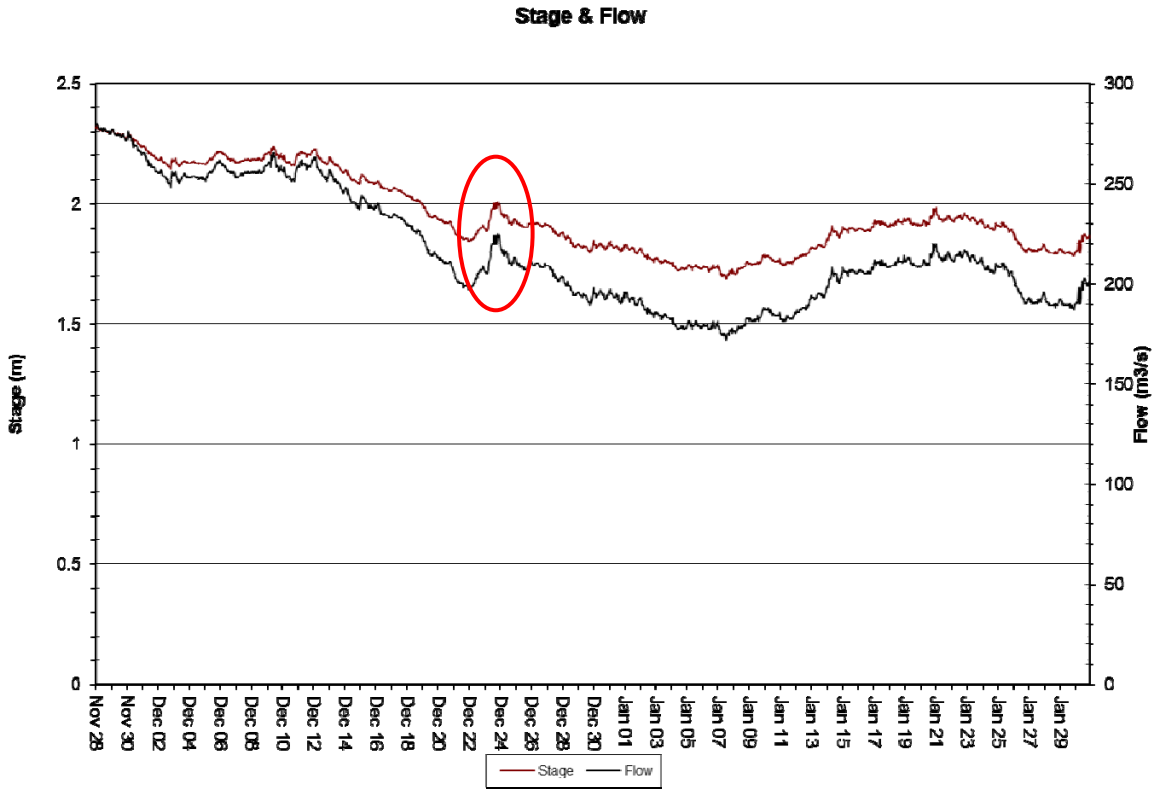

Figure 1: Stage Height (m) at Humber River from November 28, 2012 to January 31, 2013

Temperature

- Water temperature ranged from 0.32˚C to 6.33˚C at Humber River from November 28, 2012 to January 31 (Figure 2).
- Water temperature displays diurnal variations which are related to diurnal variations in ambient air temperatures.
- There is a declining temperatures trend over the deployment period which is consistent with the transition from late fall to winter.
- There is a significant dip in temperature around December 28th (see inside red oval – Figure 2) which is related to particularly cold temperatures for the preceding day.

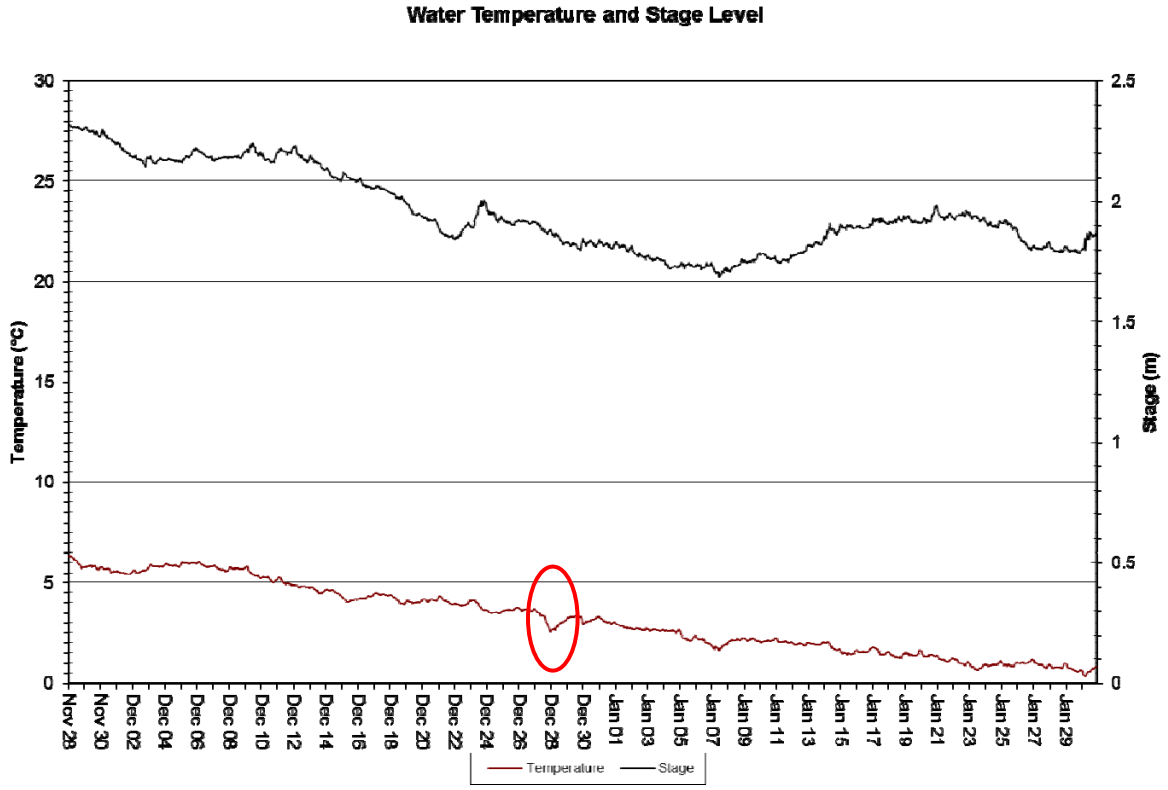

Figure 2: Temperature (°C) at Humber River from November 28, 2012 to January 31, 2013

pH

- pH values ranged from 6.44 units to 7.50 units at Humber River from November 28, 2012 to January 31, 2013 (Figure 3).
- pH values show regular diurnal fluctuations which are related to the diurnal temperature fluctuations.
- pH was relatively stable throughout the deployment period, however around January 7 there was a significant sudden drop in pH (see inside red oval – Figure 3). It is difficult to provide a conclusive explanation for this sudden drop in pH, however it does coincide with a slight drop in flow and a noticeable drop in temperature; either of which could affect pH.
- With a mean value of 7.20, pH values recorded at Humber River were almost all 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).

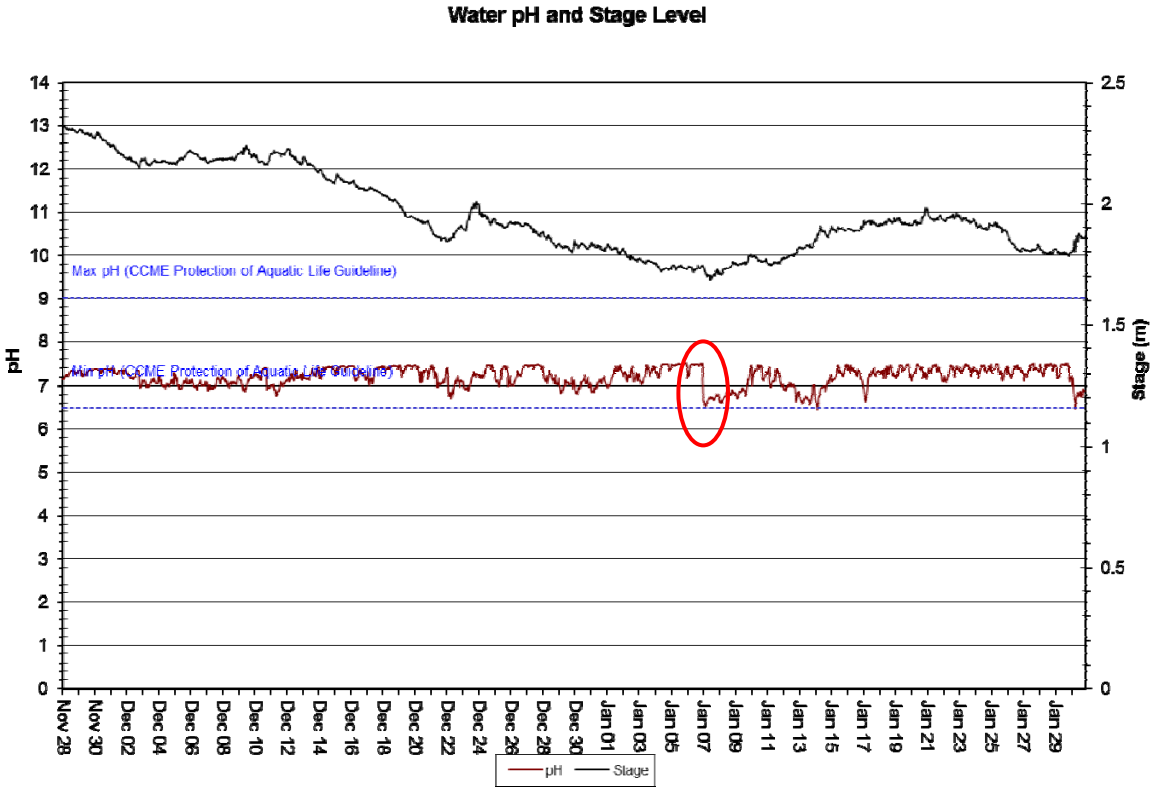

Figure 3: pH values recorded at Humber River from November 28, 2012 to January 31, 2013

Specific Conductivity

- Specific Conductivity ranged from 39.7 µS/cm to 42.2 µS/cm at Humber River from November 28, 2012 to January 31, 2013 (Figure 4).
- Specific conductivity readings were fairly stable at Humber River during the deployment period.

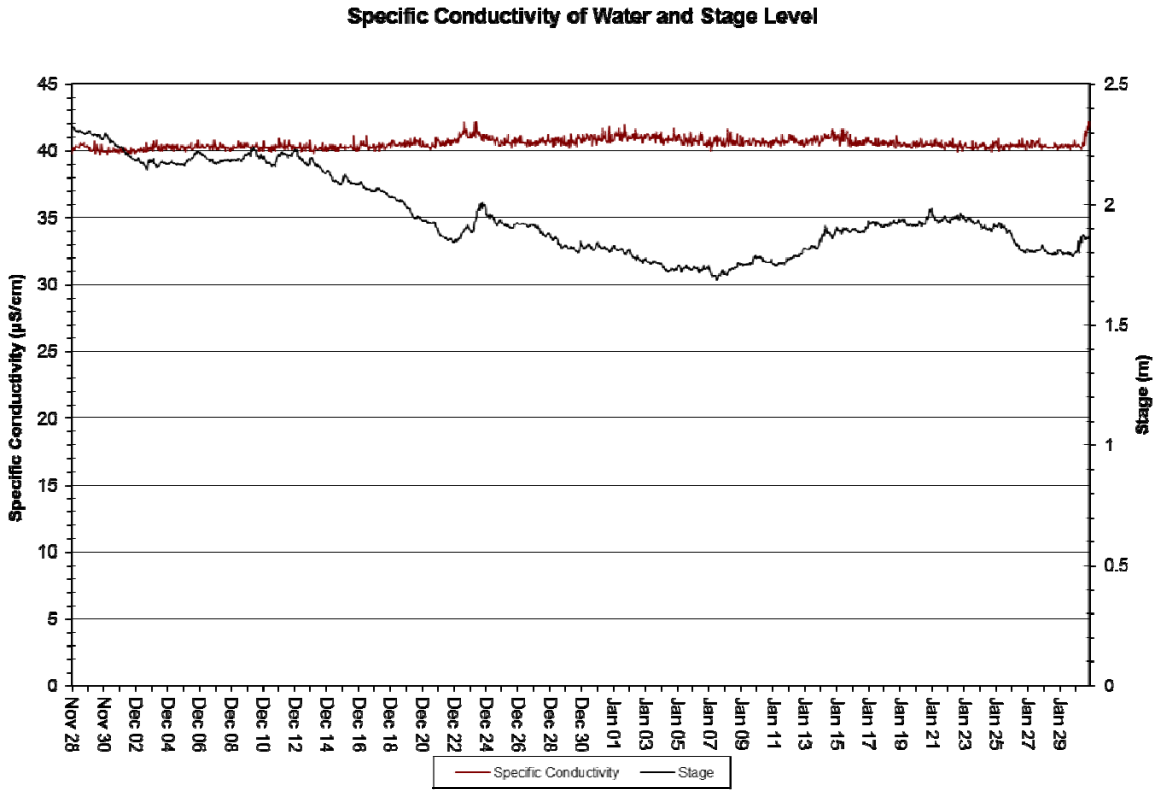

Figure 4: Specific conductivity (µs/cm) at Humber River from November 28, 2012 to January 31, 2013

Dissolved Oxygen

- Dissolved Oxygen [DO] values ranged from 11.27 mg/l (84.7% saturation) to 12.45 mg/l (94.3% saturation) at Humber River from November 28, 2012 to January 31, 2013 (Figure 5).
- DO (mg/l & % saturation) shows a clear diurnal fluctuation which can be attributed to the diurnal temperature fluctuations.
- The DO values at Humber River were above the cold water minimum guideline set for aquatic life during early life stages (9.5 mg/l), and above minimum guideline set for other life stages (6.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

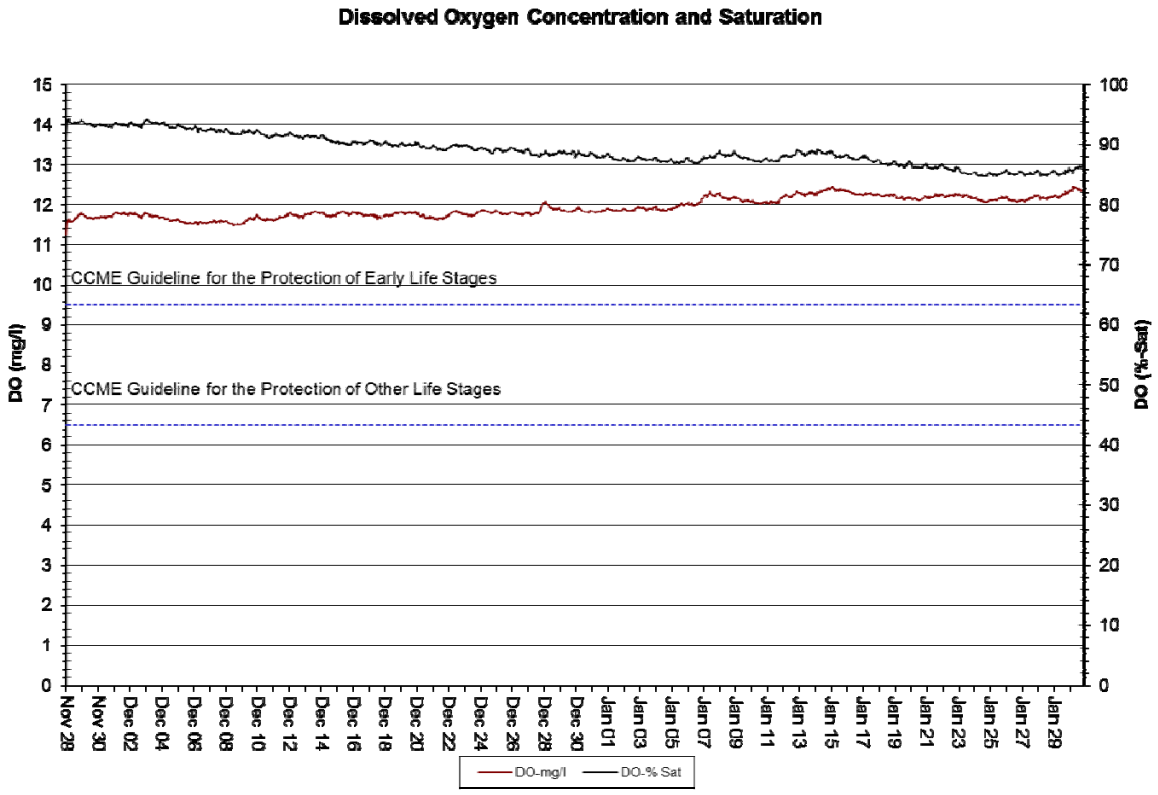

Figure 5: DO (mg/l & % saturation) at Humber River from November 28, 2012 to January 31, 2013

Turbidity

- Turbidity values ranged from 0.0 NTU to 129.8 NTU at Humber River from November 28, 2012 to January 31, 2013 (Figure 6).
- There was a single turbidity event at Humber River (see inside red ovals – Figure 6) around December 7th which is most likely explained by some organic matter or debris temporarily trapped near the turbidity sensor (i.e. it is most likely a false reading).

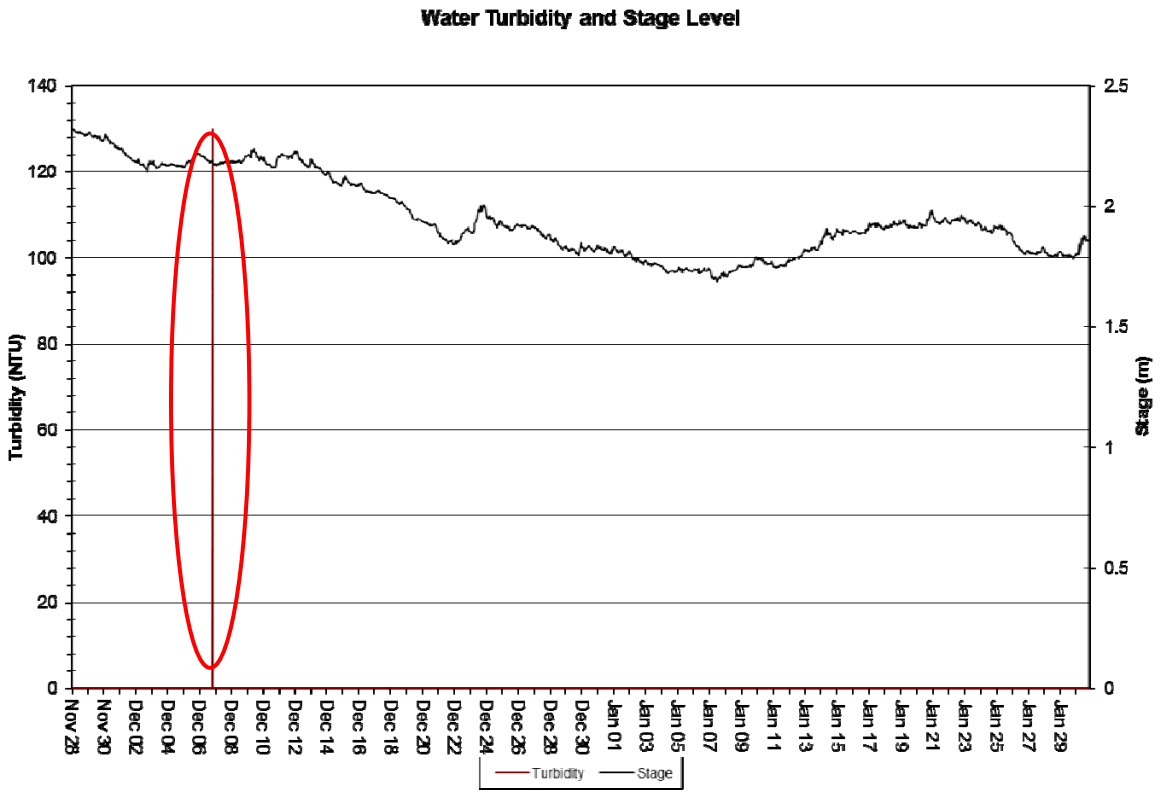

Figure 6: Turbidity (NTU) at Humber River from November 28, 2012 to January 31, 2013

Conclusion

- This monthly deployment report presents water quality and water quantity data recorded at Humber River from November 28, 2012 to January 31, 2013.
- The performances of all sensors were rated good to excellent at the beginning of the deployment period. While temperature and turbidity rated good and excellent respectively upon removal, pH and specific conductivity only ranked fair and dissolved oxygen was rated marginal (Table 1). The fair and marginal ratings at the end are most likely related to the relatively long deployment period of 64 days.

- Variations in water quality/quantity values recorded at each station are summarized below:
  - There appears to be a gentle declining trend in stage height and flow throughout the deployment period.
  - There is a noticeable peak in stage height and flow around December 24 which corresponds with several days of significant precipitation.
  - Water temperature displays diurnal variations which are related to diurnal variations in ambient air temperatures.
  - There is a declining temperatures trend over the deployment period which is consistent with the transition from late fall to winter. There is a significant dip in temperature around December 28th which is related to particularly cold temperatures for the preceding day.
  - pH values show regular diurnal fluctuations which are related to the diurnal temperature fluctuations.
  - pH was relatively stable throughout the deployment period, however around January 7 there was a significant sudden drop in pH. It is difficult to provide a conclusive explanation for this sudden drop in pH, however it does coincide with a slight drop in flow and a noticeable drop in temperature; either of which could affect pH
  - With a mean value of 7.20, pH values recorded at Humber River were almost all 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).
  - Specific conductivity readings were fairly stable at Humber River during the deployment period.
  - DO (mg/l & % saturation) shows a clear diurnal fluctuation which can be attributed to the diurnal temperature fluctuations.
  - The DO values at Humber River were above the cold water minimum guideline set for aquatic life during early life stages (9.5 mg/l), and above minimum guideline set for other life stages (6.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).
  - There was a single turbidity event at Humber River around December 7th which is most likely explained by some organic matter or debris temporarily trapped near the turbidity sensor (i.e. it is most likely a false reading). Other than this spike, turbidity was low and stable during the deployment period.

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(November 28, 2012 to January 31, 2013)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain Flag	Total Snow Flag	Total Precip (mm)
11/28/2012	-2.2	-6.1	-4.2	22.2	0	M	M	0
11/29/2012	-2.8	-4.9	-3.9	21.9	0	M	M	7.9
11/30/2012	-2.9	-6.6	-4.8	22.8	0	M	M	1.9
12/1/2012	-5.6	-7.2	-6.4	24.4	0	M	M	0.6
12/2/2012	1.5	-8.5	-3.5	21.5	0	M	M	0
12/3/2012	6.2	1.5	3.9	14.1	0	M	M	7.9
12/4/2012	2.9	-0.9	1	17	0	M	M	0
12/5/2012	6.1	-0.7	2.7	15.3	0	M	M	6
12/6/2012	5	-1.6	1.7	16.3	0	M	M	1.6
12/7/2012	1.1	-2.9	-0.9	18.9	0	M	M	0
12/8/2012	3.2	-3.2	0	18	0	M	M	0
12/9/2012	6.6	-2.6	2	16	0	M	M	1.3
12/10/2012	-2.3	-4.6	-3.5	21.5	0	M	M	3.7
12/11/2012	6.3	-2.4	2	16	0	M	M	13.3
12/12/2012	-2.2	-4.7	-3.5	21.5	0	M	M	1.3
12/13/2012	-2.6	-6.4	-4.5	22.5	0	M	M	0.7
12/14/2012	-4	-6.5	-5.3	23.3	0	M	M	1.9
12/15/2012	-5.7	-7.7	-6.7	24.7	0	M	M	12.4
12/16/2012	-1.9	-6.4	-4.2	22.2	0	M	M	0
12/17/2012	1	-2.8	-0.9	18.9	0	M	M	0
12/18/2012	-2.1	-6.9	-4.5	22.5	0	M	M	0
12/19/2012	-1.1	-6.8	-4	22	0	M	M	0
12/20/2012	0.5	-4	-1.8	19.8	0	M	M	0
12/21/2012	2.1	-6.8	-2.4	20.4	0	M	M	0
12/22/2012	5.4	-5.7	-0.2	18.2	0	M	M	9.3
12/23/2012	5.4	-2.7	1.4	16.6	0	M	M	11.2
12/24/2012	-2.5	-5.7	-4.1	22.1	0	M	M	2.9
12/25/2012	-1.5	-5.4	-3.5	21.5	0	M	M	2.5
12/26/2012	-1.7	-5.1	-3.4	21.4	0	M	M	0
12/27/2012	-1.5	-10.4	-6	24	0	M	M	0
12/28/2012	-1.3	-6.9	-4.1	22.1	0	M	M	17.7
12/29/2012	0.4	-1.7	-0.7	18.7	0	M	M	5.9
12/30/2012	0.7	-1.8	-0.6	18.6	0	M	M	12.7
12/31/2012	0.9	-3.5	-1.3	19.3	0	M	M	5.8
1/1/2013	-2.6	-6	-4.3	22.3	0	M	M	1.3
1/2/2013	-2	-6.8	-4.4	22.4	0	M	M	3.6

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain Flag	Total Snow Flag	Total Precip (mm
1/3/2013	-3.6	-6.8	-5.2	23.2	0	M	M	0.7
1/4/2013	-6.3	-8.4	-7.4	25.4	0	M	M	1.2
1/5/2013	-5.6	-12.2	-8.9	26.9	0	M	M	5.3
1/6/2013	-6.6	-12.2	-9.4	27.4	0	M	M	2.3
1/7/2013	-8.8	-13.4	-11.1	29.1	0	M	M	1.5
1/8/2013	-1.8	-9.1	-5.5	23.5	0	M	M	3.3
1/9/2013	-2.1	-11.1	-6.6	24.6	0	M	M	0.6
1/10/2013	-4.3	-8.5	-6.4	24.4	0	M	M	2.7
1/11/2013	-3.7	-12	-7.9	25.9	0	M	M	0
1/12/2013	-2	-10.5	-6.3	24.3	0	M	M	0.6
1/13/2013	1.6	-2.5	-0.5	18.5	0	M	M	0
1/14/2013	5.7	0	2.9	15.1	0	M	M	0.8
1/15/2013	0	-7.7	-3.9	21.9	0	M	M	0.7
1/16/2013	-5	-9.2	-7.1	25.1	0	M	M	0
1/17/2013	-0.6	-12.1	-6.4	24.4	0	M	M	2.8
1/18/2013	-12.1	-18.2	-15.2	33.2	0	M	M	1.8
1/19/2013	-6.4	-13.6	-10	28	0	M	M	3.2
1/20/2013	2.5	-17.6	-7.6	25.6	0	M	M	2.6
1/21/2013	1.2	-11.8	-5.3	23.3	0	M	M	2.2
1/22/2013	-8.4	-12.6	-10.5	28.5	0	M	M	0.7
1/23/2013	-10.6	-14.8	-12.7	30.7	0	M	M	
1/24/2013	-12	-14.3	-13.2	31.2	0	M	M	1.4
1/25/2013	-9.3	-13.2	-11.3	29.3	0	M	M	4
1/26/2013	-7.2	-10.3	-8.8	26.8	0	M	M	2
1/27/2013	-7.3	-10.7	-9	27	0	M	M	0.7
1/28/2013	-9.5	-13	-11.3	29.3	0	M	M	2.6
1/29/2013	-7.2	-11.2	-9.2	27.2	0	M	M	0
1/30/2013	3.9	-14.2	-5.2	23.2	0	M	M	21.1
1/31/2013	12.2	3	7.6	10.4	0	M	M	24.3