Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2013-11-06 to 2014-01-16

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and 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 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 6, 2013, to January 16, 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 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	2013-11-06	2014-01-16
Temperature	Excellent	Excellent
pH	Good	Fair
Specific Conductivity	Excellent	Fair
Dissolved Oxygen	Marginal	Fair
Turbidity	Excellent	Excellent

The performances of all sensors were rated marginal to excellent at the beginning and fair to excellent at the end of the deployment period (Table 1). The marginal rating for the oxygen sensor at deployment may be indicative of technical issues as the oxygen readings took an excessively long time to stabilize to a reasonable level.

Deployment Notes

- Water quality monitoring for this deployment period started on November 6, 2013 at 11:00 am and continued without any significant operational issues until January 16, 2014, at 10:55 am 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 (°C)
(iii.) pH
(iv.) Specific conductivity (µS/cm)
(v.) Dissolved oxygen (mg/l)
(vi.) Turbidity (NTU)

Stage

- During this deployment period stage values ranged from 1.86 m to 3.68 m at Humber River, with corresponding flow ranging from 200.00 m^3/sec to 550.0 m^3/sec (Figure 1).

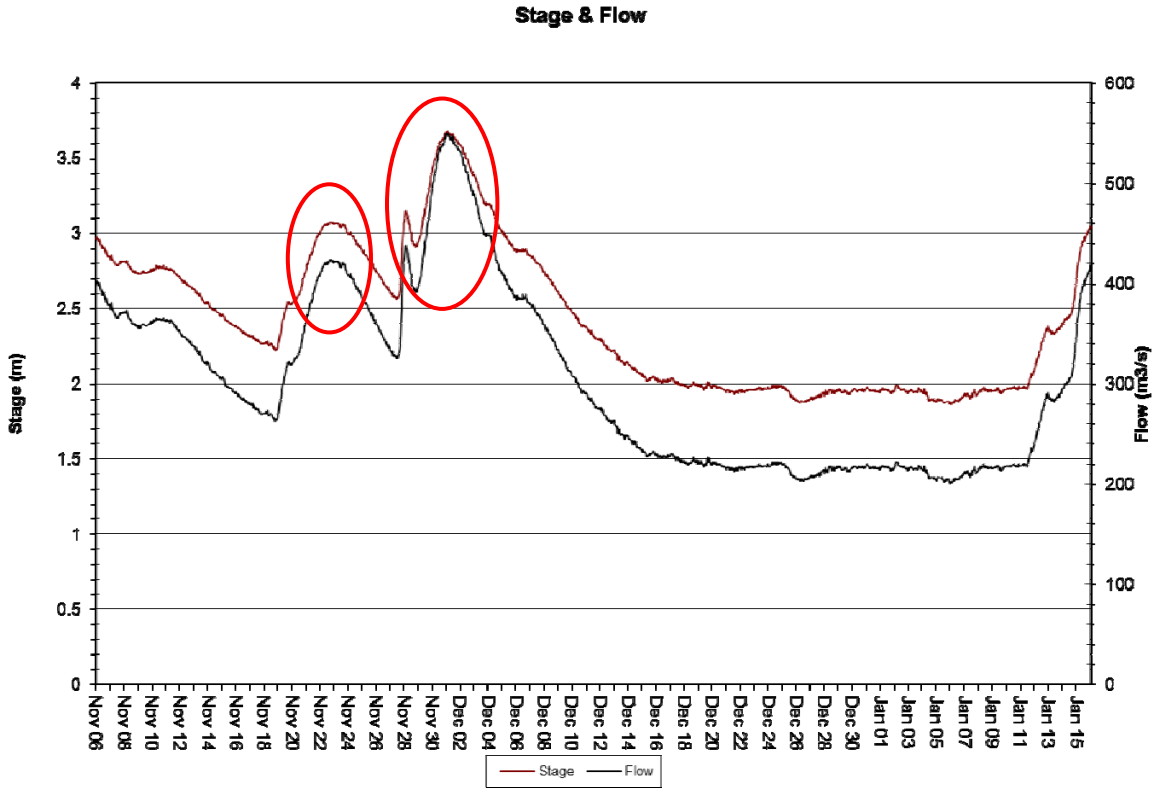

Figure 1: Stage Height (m) at Humber River from November 6, 2013, to January 16, 2014

- During the deployment period there are two significant spikes in flow (See inside red ovals – Figure 1). The first spike is related to a period of significant rainfall from November 18th to 20th and the second is related to a period of heavy rain from November 27th to 28th. At

the end of the deployment period stage and flow show a sharp rise as well, which is related to a period of significant rainfall from January 11th to 16th.

Temperature

- During this deployment period water temperature at Humber River ranged from 0.60˚C to 8.68˚C (Figure 2).
- There is a gentle decreasing temperature trend over the deployment period which is consistent with the transition from late fall to winter.

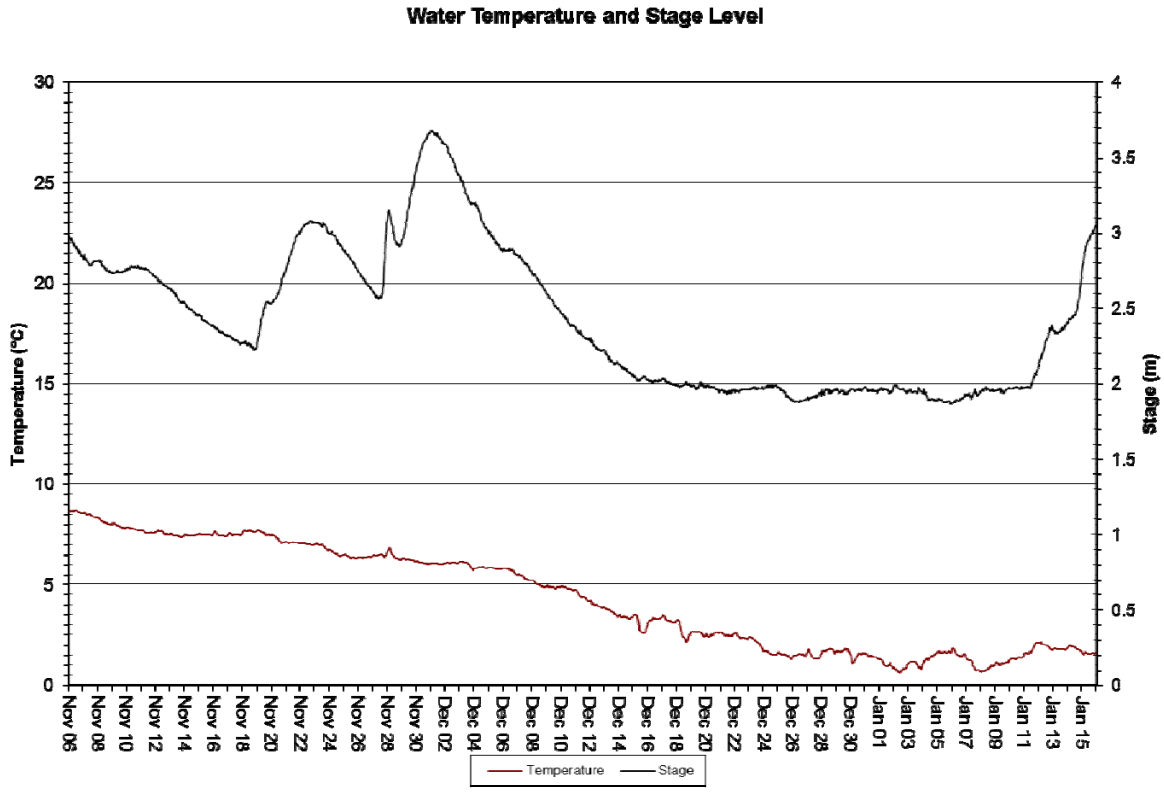

Figure 2: Temperature (°C) at Humber River from November 6, 2013, to January 16, 2014

pH

- During this deployment period pH values at Humber River ranged from 5.80 units to 7.23 units (Figure 3).
- pH was very stable throughout the deployment period.
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.

- With a mean value of 6.37, the majority of pH values recorded at Humber River during this deployment period were below the minimum guidelines for pH for the protection of aquatic life (i.e., 6.5 units), as defined by the Canadian Council of Ministers of the Environment (2007). It should be noted that acidic waters are quite common in Canada, particularly in boreal and northern ecoregions, and pH is often naturally below this 6.5 unit guideline.

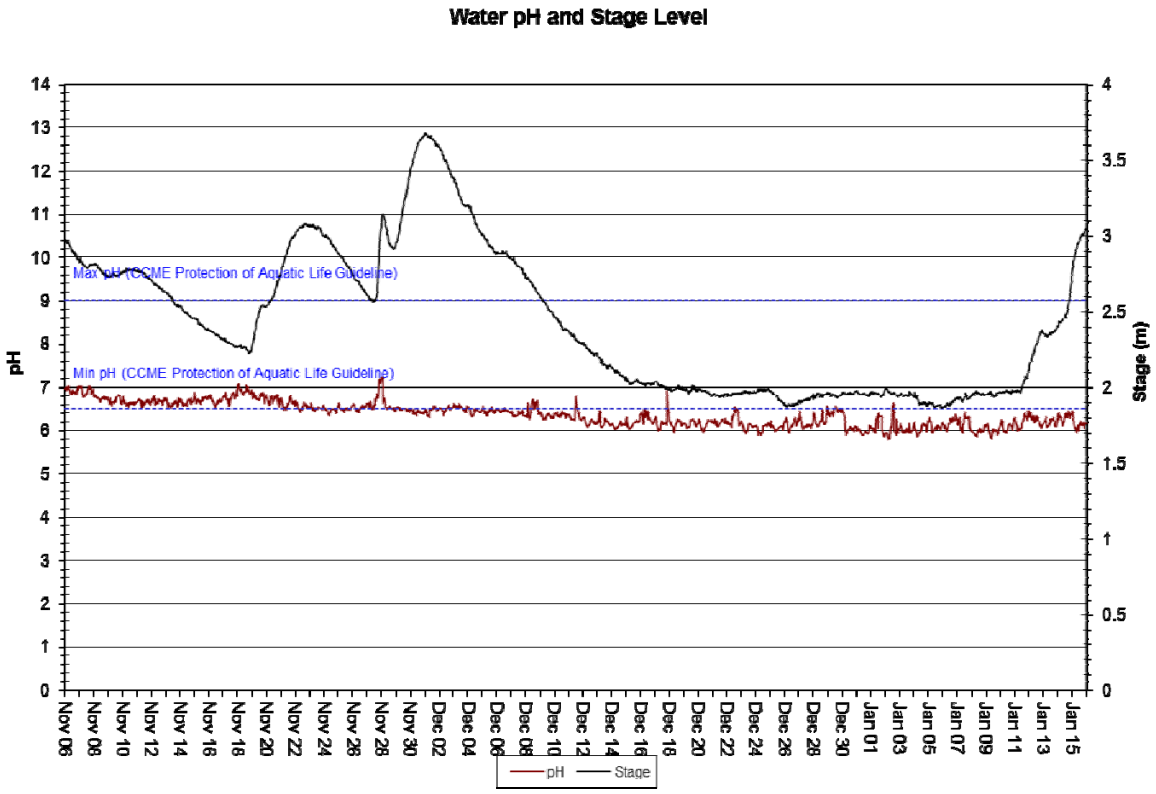

Figure 3: pH values recorded at Humber River from November 6, 2013, to January 16, 2014

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 36.7 µS/cm to 42.3 µS/cm (Figure 4).
- Specific conductivity appears to be relatively stable during the deployment period.
- There are a number of small spikes in specific conductivity visible in the data which correspond very well with significant rainfall events. Several examples are highlighted on the graph.

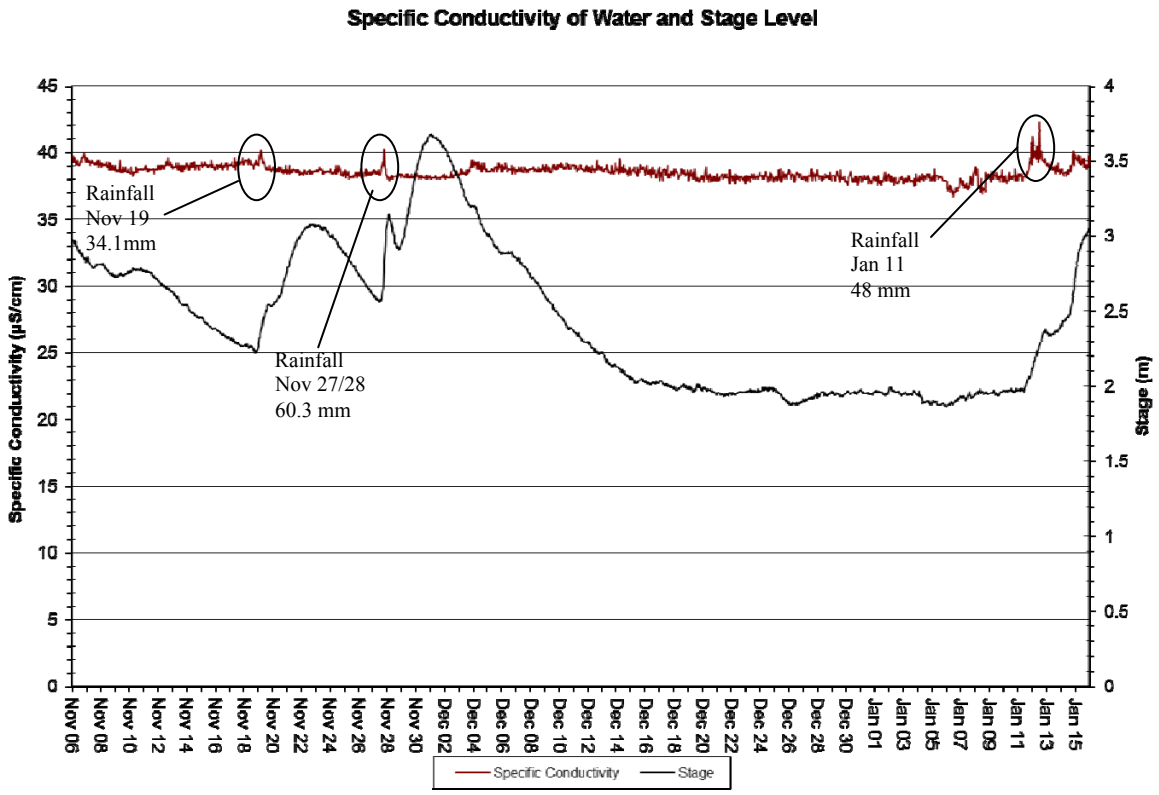

Figure 4: Specific conductivity (µs/cm) at Humber River from November 6, 2013, to January 16, 2014

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 10.66 mg/l (85.2% saturation) to 12.54 mg/l (99.1% saturation) (Figure 5).
- Upon initial deployment DO values appear to be relatively high and over a 24 hour period they stabilize to a reasonable level (see inside red oval – Figure 5). This has led to a marginal performance rating on initial deployment and may be indicative of technical issues with the oxygen sensor.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- DO (mg/l) shows a gentle increasing trend over the deployment period which is related to the decreasing temperature trend (i.e. cooler water holds more oxygen).
- 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).

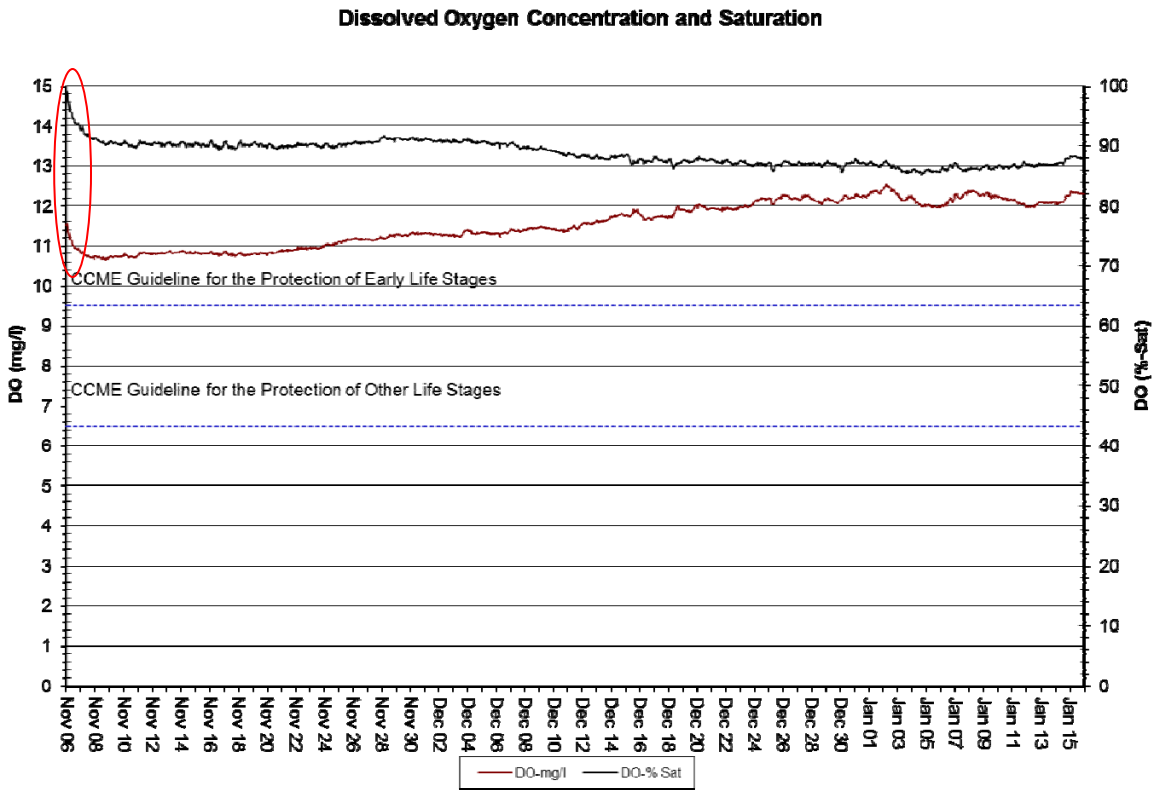

Figure 5: DO (mg/l & % saturation) at Humber River from November 6, 2013, to January 16, 2014

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 527.0 NTU (Figure 6).
- From about November 9th to December 4th there are a number of extremely high turbidity readings ranging from 0 NTU up to 527.0 NTU (see inside red oval). While heavy rainfall events may have contributed to some degree to these high readings, they are most likely false readings related to biofouling and/or organic matter trapped around the sensor. These high readings are unreliable and do not reflect the actual turbidity readings at the station.

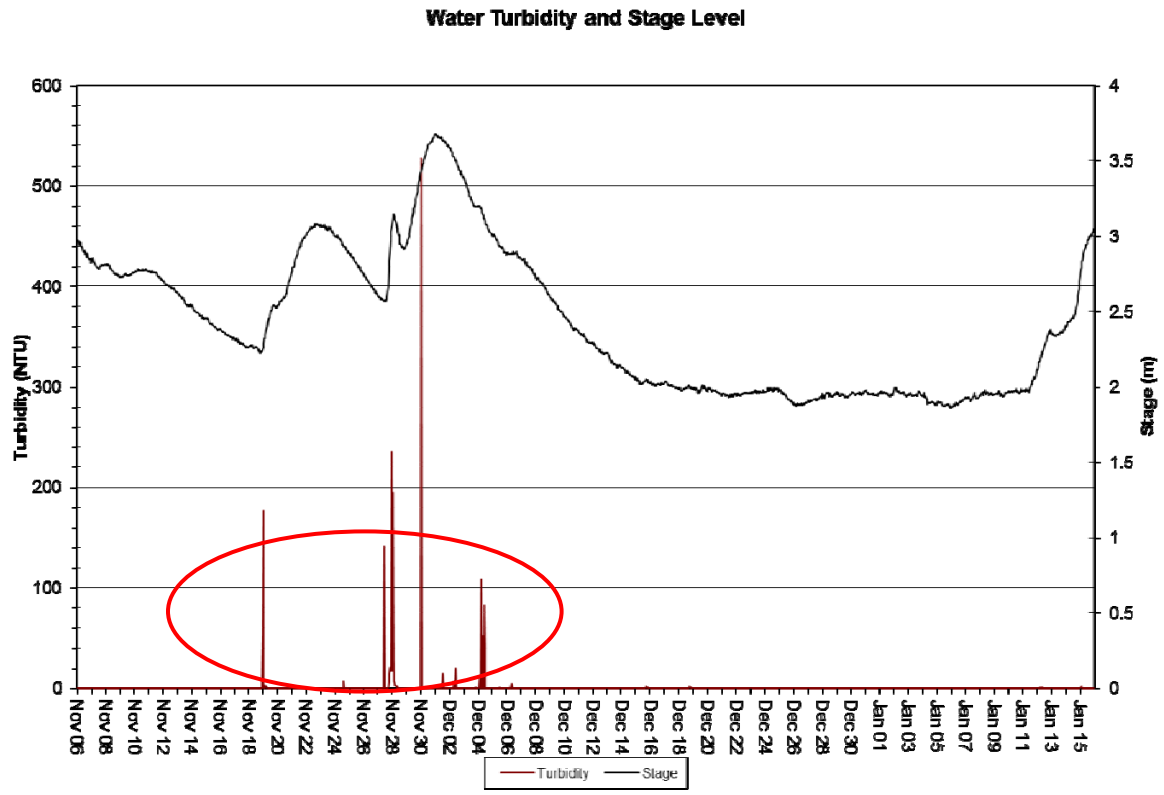

Figure 6: Turbidity (NTU) at Humber River from November 6, 2013, to January 16, 2014

Conclusion

- This monthly deployment report presents water quality and water quantity data recorded at Humber River from November 6, 2013, to January 16, 2014.
- The performances of all sensors were rated marginal to excellent at the beginning and end of the deployment period. The marginal rating for the oxygen sensor at deployment may be indicative of technical issues as the oxygen readings took an excessively long time to stabilize to a reasonable level.
- Variations in water quality/quantity values recorded at each station are summarized below:
    - During this deployment period stage values ranged from 1.86 m to 3.68 m at Humber River, with corresponding flow ranging from 200.00 m^3/sec to 550.0 m^3/sec.
    - During the deployment period there are two significant spikes in flow which are related to significant rainfall events.
    - During this deployment period water temperature at Humber River ranged from 0.60˚C to 8.68˚C.

- There is a gentle decreasing temperature trend over the deployment period which is consistent with the transition from late fall to winter.
- During this deployment period pH values at Humber River ranged from 5.80 units to 7.23 units.
- pH was very stable throughout the deployment period, however there were diurnal fluctuations which are related to a number of variables including diurnal temperature fluctuations.
- The majority of pH values during this deployment period were below the minimum guidelines for pH for the protection of aquatic life (i.e., 6.5 units), as defined by the Canadian Council of Ministers of the Environment (2007). It should be noted that acidic waters are quite common in Canada, particularly in boreal and northern ecoregions, and pH is often naturally below this 6.5 unit guideline.
- During this deployment period specific conductivity at Humber River ranged from 36.7 µS/cm to 42.3 µS/cm.
- Specific conductivity appears to be relatively stable during the deployment period, however there were a number of small spikes in the data which correspond very well with significant rainfall events.
- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 10.66 mg/l (85.2% saturation) to 12.54 mg/l (99.1% saturation).
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- DO (mg/l) shows a gentle increasing trend over the deployment period which is related to the decreasing temperature trend (i.e. cooler water holds more oxygen).
- All of the DO values 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.
- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 527.0 NTU.
- From about November 9th to December 4th there are a number of extremely high turbidity readings ranging from 0 NTU up to 527.0 NTU. While heavy rainfall events may have contributed to some degree to these high readings, they are most likely false readings related to biofouling and/or organic matter trapped around the sensor.

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 (Nov. 6, 2013, to Dec. 5, 2013)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain (mm)	Total Snow (mm)	Total Precip (mm)
11/6/2013	5.5	1	3.3	14.7	0	0	0	0
11/7/2013	13.5	2	7.8	10.2	0	20	0	20
11/8/2013	5.5	3.5	4.5	13.5	0	2.8	0	2.8
11/9/2013	5	0.5	2.8	15.2	0	0	0.4	0.4
11/10/2013	2	-0.5	0.8	17.2	0	0	0	0
11/11/2013	2.5	-0.5	1	17	0	0	0	0
11/12/2013	6	-4	1	17	0	13.6	3	16.6
11/13/2013	2	-1	0.5	17.5	0	0	3	3
11/14/2013	1	-2	-0.5	18.5	0	0	1.4	1.4
11/15/2013	4	-1	1.5	16.5	0	0.4	0	0.4
11/16/2013	9	2	5.5	12.5	0	0	0	0
11/17/2013	10	0	5	13	0	0	0	0
11/18/2013	12.5	5	8.8	9.2	0	19.1	0	19.1
11/19/2013	12	9	10.5	7.5	0	34.1	0	34.1
11/20/2013	2.5	1	1.8	16.2	0	2.1	10	12.1
11/21/2013	2	-1.5	0.3	17.7	0	2	0.6	2.6
11/22/2013	2.5	0	1.3	16.7	0	0.6	0	0.6
11/23/2013	3.5	0	1.8	16.2	0	2.2	5.2	7.4
11/24/2013	0	-2.5	-1.3	19.3	0	0	13.6	13.6
11/25/2013	-2	-5	-3.5	21.5	0	0	3	3
11/26/2013	-0.5	-3.5	-2	20	0	0	4	4
11/27/2013	15.5	-1.5	7	11	0	45.1	0	45.1
11/28/2013	15.5	5.5	10.5	7.5	0	14.8	0.4	15.2
11/29/2013	-0.5	-2.5	-1.5	19.5	0	0	1.8	1.8
11/30/2013	-2.5	-6	-4.3	22.3	0	0	1.2	1.2
12/1/2013	1	-5.5	-2.3	20.3	0	0	6	6
12/2/2013	3	-2.5	0.3	17.7	0	3.5	0.4	3.9
12/3/2013	5	1	3	15	0	3.4	0	3.4
12/4/2013	3.5	0	1.8	16.2	0	3	2.2	5.2
12/5/2013	1	-1	0	18	0	2.4	1	3.4
12/6/2013	6	-2	2	16	0	10.8	0	10.8
12/7/2013	0	-2	-1	19	0	0	4.8	4.8
12/8/2013	-3	-6	-4.5	22.5	0	0	4	4
12/9/2013	-5	-7	-6	24	0	0	1.8	1.8
12/10/2013	0	-7	-3.5	21.5	0	0	3.4	3.4
12/11/2013	-5	-9	-7	25	0	0	7	7
12/12/2013	-11	-12	-11.5	29.5	0	0	3.8	3.8

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain (mm)	Total Snow (mm)	Total Precip (mm)
12/14/2013	-9.5	-12.5	-11	29	0	0	3.8	3.8
12/15/2013	-5.5	-10	-7.8	25.8	0	0	25.2	25.2
12/16/2013	-3.5	-9.5	-6.5	24.5	0	0	11.2	11.2
12/17/2013	-8	-11	-9.5	27.5	0	0	3	3
12/18/2013	-4.5	-15.5	-10	28	0	0	29.6	29.6
12/19/2013	-6	-10.5	-8.3	26.3	0	0	6	6
12/20/2013	-8.5	-11.5	-10	28	0	0	2.6	0.8
12/21/2013	-6	-10.5	-8.3	26.3	0	0	2.4	2.4
12/22/2013	-8	-13.5	-10.8	28.8	0	0	1.4	1.4
12/23/2013	-11.5	-16	-13.8	31.8	0	0	1.6	1.6
12/24/2013	-9.5	-12	-10.8	28.8	0	0	0.8	0.8
12/25/2013	-10.5	-13	-11.8	29.8	0	0	0.4	0.4
12/26/2013	-5.5	-16	-10.8	28.8	0	0	3.6	3.6
12/27/2013	-4	-7.5	-5.8	23.8	0	0	3.8	3.8
12/28/2013	-6	-7.5	-6.8	24.8	0	0	7	7
12/29/2013	-6	-14.5	-10.3	28.3	0	0	3.2	3.2
12/30/2013	-4.5	-15.5	-10	28	0	0	5.6	5.6
12/31/2013	-7.5	-11.5	-9.5	27.5	0	0	1	1
1/1/2014	-13	-15.5	-14.3	32.3	0	0	4.2	4.2
1/2/2014	-13	-18.5	-15.8	33.8	0	0	0	0
1/3/2014	-13	-19.5	-16.3	34.3	0	0	4	4
1/4/2014	-8.5	-16	-12.3	30.3	0	0	0	0
1/5/2014	-5.5	-11	-8.3	26.3	0	0	0	0
1/6/2014	9.5	-10	-0.3	18.3	0	25.4	0	25.4
1/7/2014	2.5	-2	0.3	17.7	0	1	0	1
1/8/2014	-9	-13	-11	29	0	0	22.6	22.6
1/9/2014	-8.5	-11.5	-10	28	0	0	1.6	1.6
1/10/2014	-4.5	-12	-8.3	26.3	0	0	0	0
1/11/2014	10.5	-7	1.8	16.2	0	46	2	48
1/12/2014	9.5	-2	3.8	14.2	0	4.2	0	4.2
1/13/2014	1.5	-2.5	-0.5	18.5	0	2	0	2
1/14/2014	6.3	-1.8	2.3	15.7	0	M	M	6.7
1/15/2014	9.6	-0.2	4.7	13.3	0	M	M	19.1
1/16/2014	4	-2.5	0.8	17.2	0	6	1	7