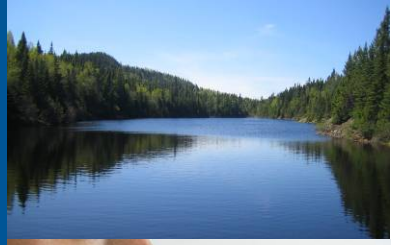




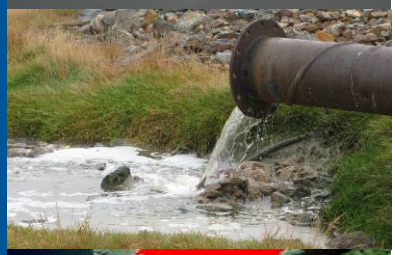


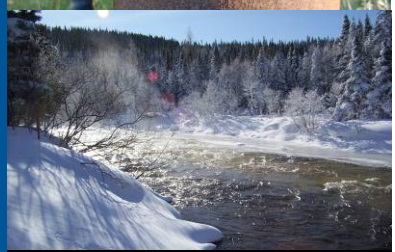

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2015-03-31 to 2015-06-08

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

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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 March 31, 2015, to June 8, 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 the deployed instrument.
- Due to technical issues with the QA/QC sonde at the time of the deployment, it was not possible to make any measurements for comparison with the field sonde. At the end of the deployment the performances of three of the sensors was excellent while dissolved oxygen was rated fair and specific conductivity rated marginal (Table 1). At the time of the removal, the flow in the Humber River at Humber Village was relatively high due to spring runoff. During high flow the specific conductivity is more variable than usual making it more difficult to get a good comparison between the field instrument deployed from the bridge and the QA/QC instrument located at the shoreline near the bridge.
- **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	2015-03-31	2015-06-08
Temperature	Not Available	Excellent
pH	Not Available	Excellent
Specific Conductivity	Not Available	**Marginal**
Dissolved Oxygen	Not Available	Fair
Turbidity	Not Available	Excellent

Deployment Notes

Water quality monitoring for this deployment period started on March 31, 2015 and continued without any significant operational issues until June 8, 2015, 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 1.68 m to 4.17 m at Humber River at Humber Village, with corresponding flow ranging from 172.44 m^3/sec to 659.41 m^3/sec (Figure 1).

- From approximately April 25th to May 5th there is a period of significant increase in stage height and flow (See inside red oval) which corresponds with the onset of warmer weather and some rainfall for the same period (See climate data located in Appendix B).

- Flows over the deployment period were typical for the season with the onset of higher stage and flow due to spring runoff. Over the last week of the deployment stage and flow are beginning to decline from the peak levels of spring runoff.

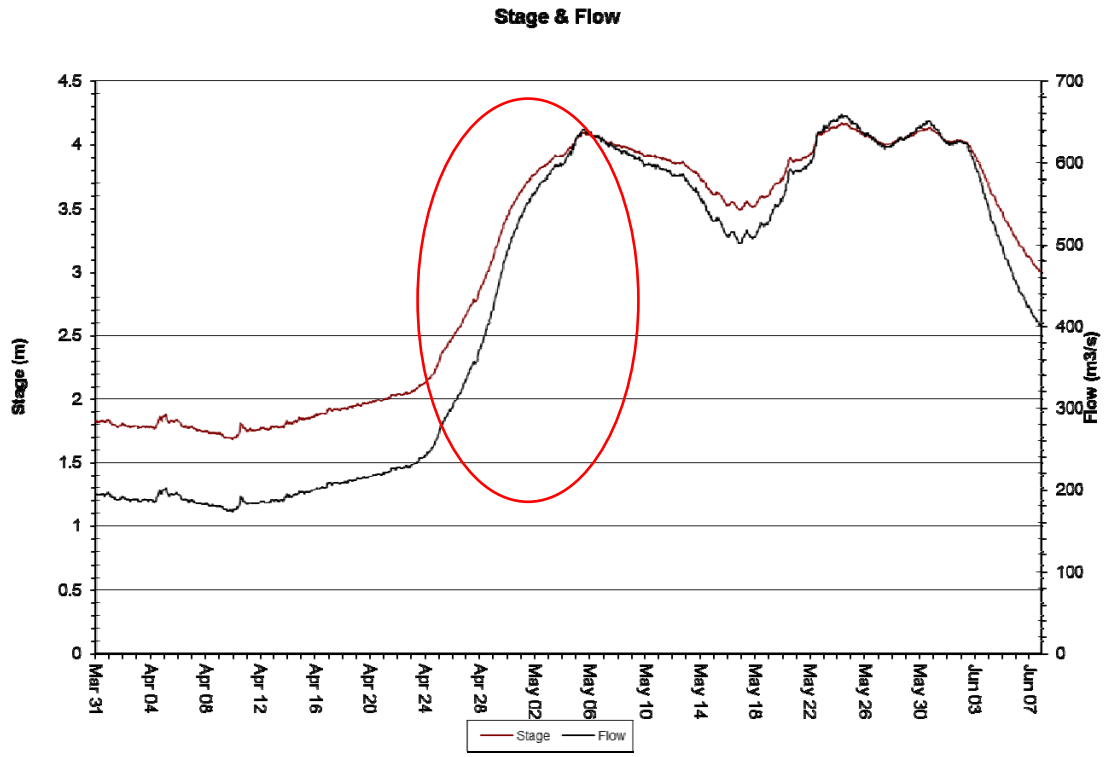

Figure 1: Stage Height (m) at Humber River from March 31, 2015, to June 8, 2015

Temperature

- During this deployment period the water temperature at Humber River ranged from 0.20˚C to 8.33˚C (Figure 2).
- Water temperature shows an increasing trend over the deployment period which is consistent with the spring season.
- From approximately June 4th to 6th there is a noticeable spike in water temperature of about 3 degrees (see inside red oval) which corresponds with a period of warmer daytime and nighttime air temperatures for several days (See climate data located in Appendix B).
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

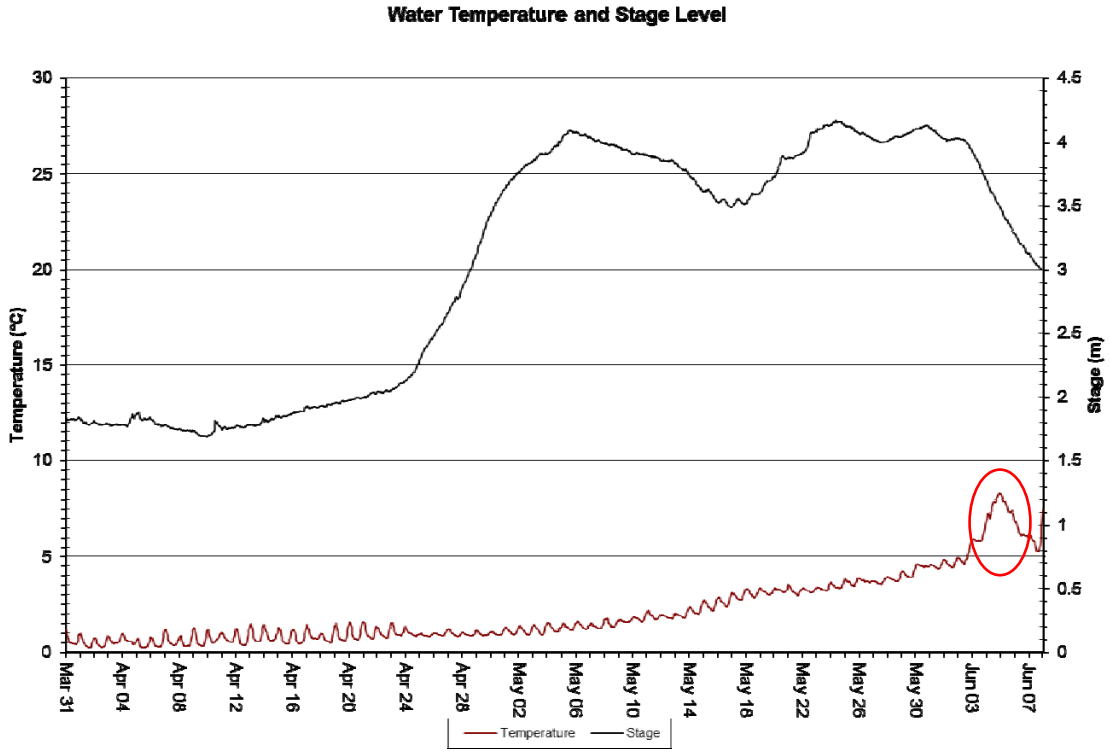

Figure 2: Temperature (°C) at Humber River from March 31, 2015, to June 8, 2015

pH

- During this deployment period pH values at Humber River ranged from 6.34 units to 6.90 units (Figure 3).
- Upon the initial deployment pH was slow to stabilize, which is an indication of an aging pH probe. pH remained stable throughout the remainder of the deployment period.
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 6.80, all but a handful 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).

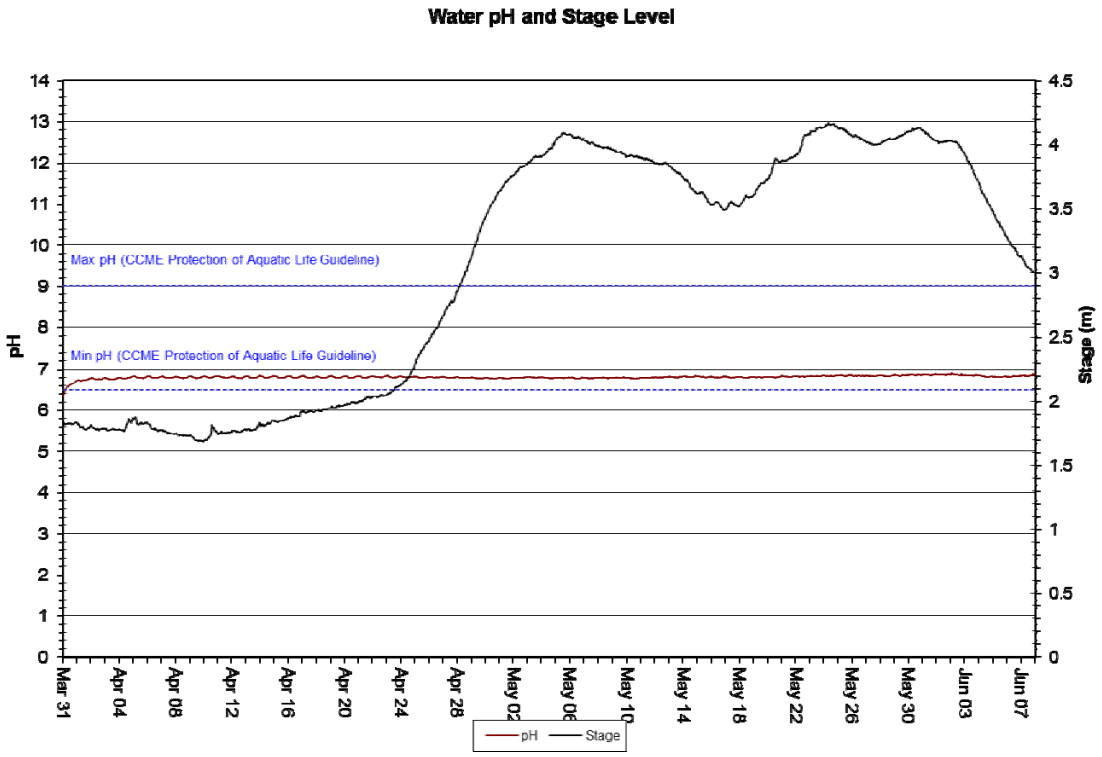

Figure 3: pH values recorded at Humber River from March 31, 2015, to June 8, 2015

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 29.6 µS/cm to 38.9 µS/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent; however there was a significant dip (see inside red oval) from approximately June 2nd to 7th, which corresponds to an increase in temperature for the same period.

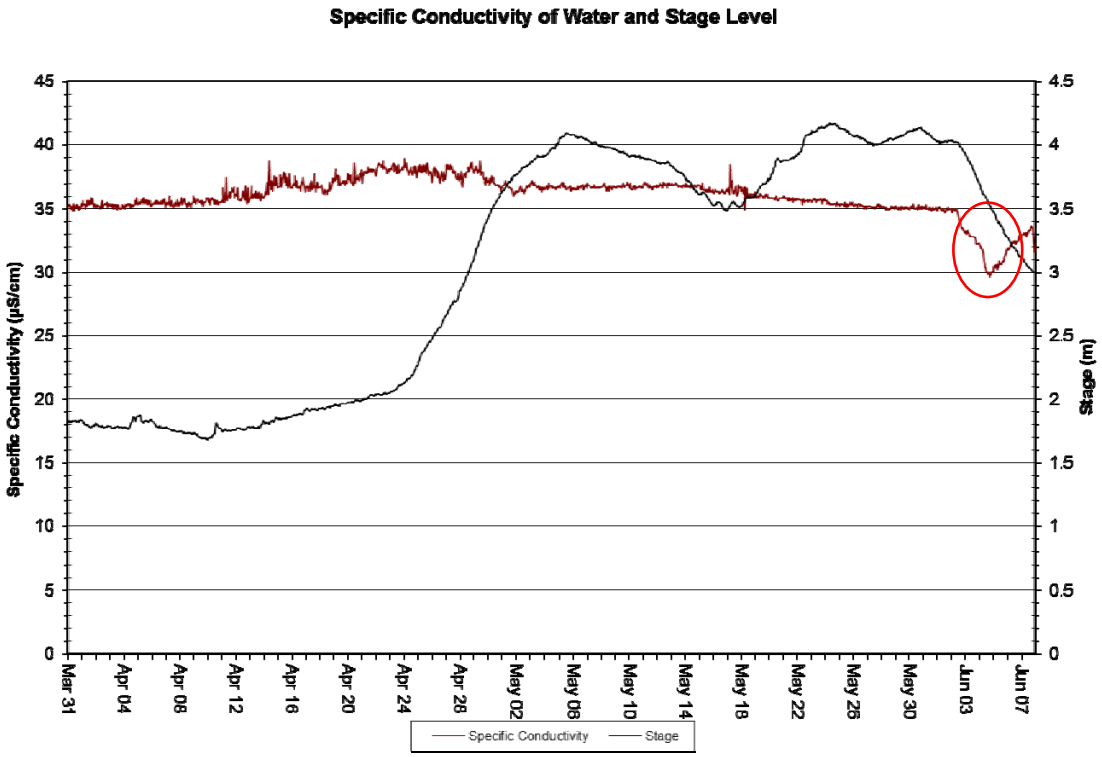

Figure 4: Specific conductivity (µs/cm) at Humber River from March 31, 2015, to June 8, 2015

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 11.91 mg/l (91.8% saturation) to 13.50 mg/l (102.6% saturation) (Figure 5).
- Over the deployment period DO (mg/l)shows a gradual decreasing trend which is due to the increasing temperature trend.
- There is a noticeable dip in DO (mg/l) from approximately June 2nd to the 6th (See inside red oval) which is related to a spike in water temperature for the same period.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- 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).

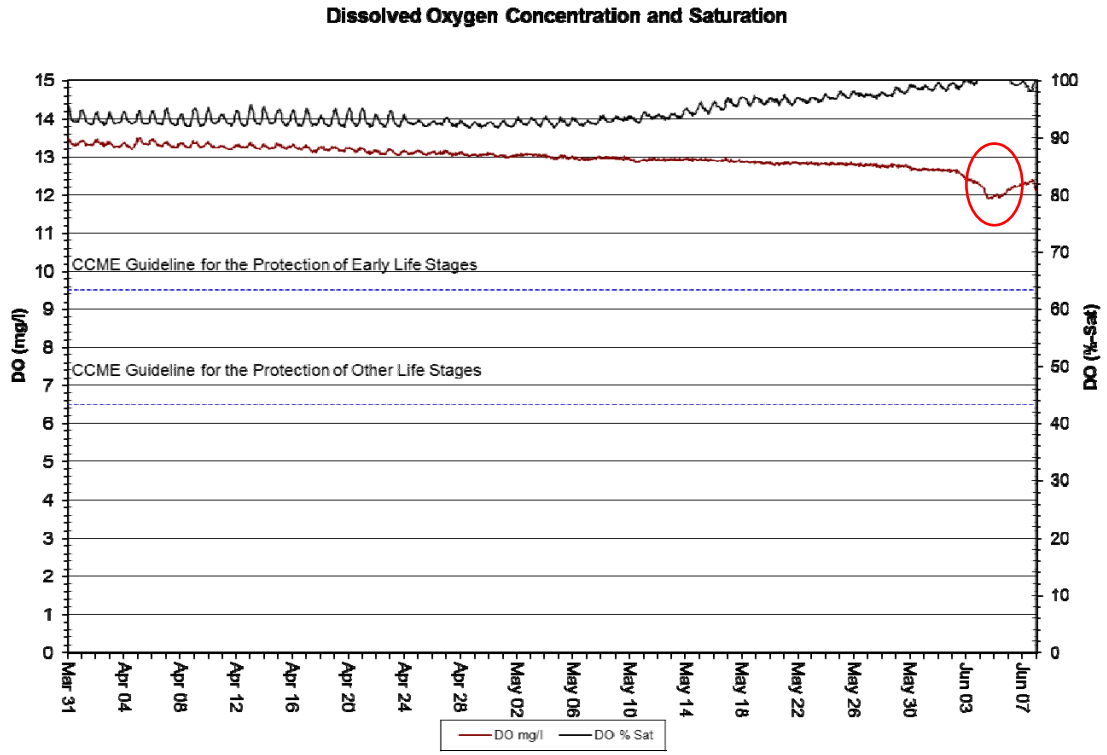

Figure 5: DO (mg/l & % saturation) at Humber River from March 31, 2015, to June 8, 2015

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 0.1 NTU (Figure 6)

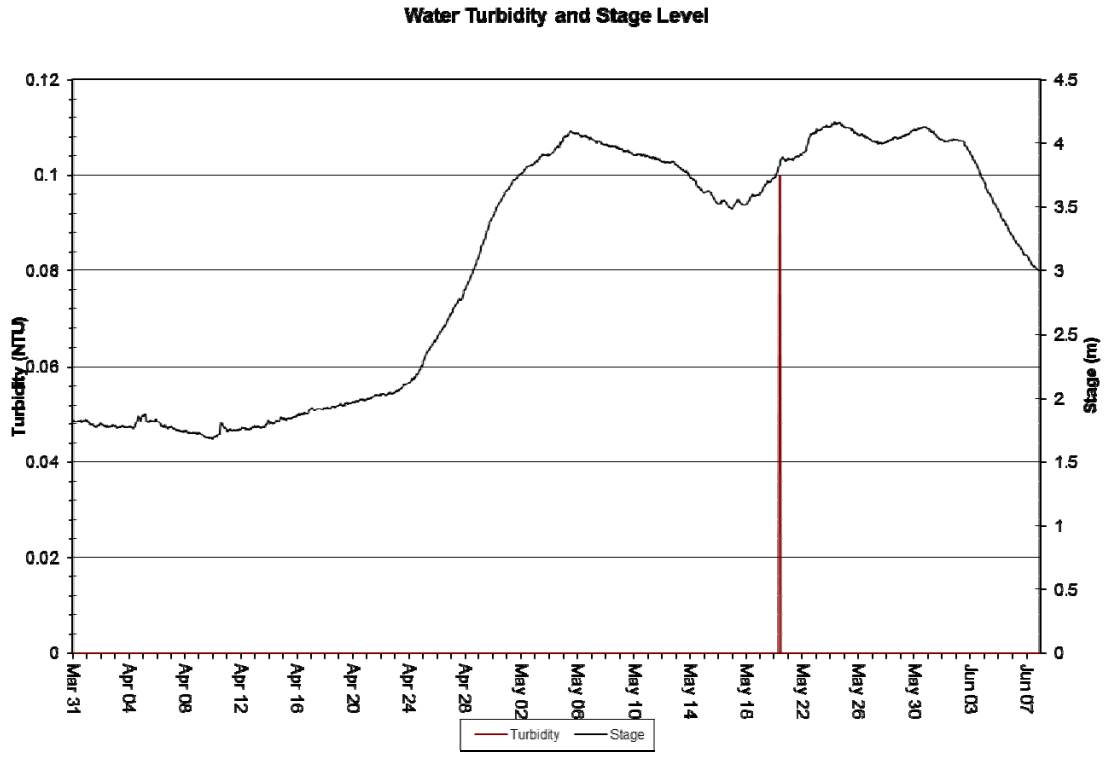

Figure 6: Turbidity (NTU) at Humber River from March 31, 2015, to June 8, 2015

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from March 31, 2015, to June 8, 2015.
- Due to technical issues with the QA/QC sonde at the time of the deployment, it was not possible to make any measurements for comparison with the field sonde. At the end of the deployment the performances of three of the sensors was excellent while dissolved oxygen was rated fair and specific conductivity rated marginal. At the time of the removal, the flow in the Humber River at Humber Village was relatively high due to spring runoff. During high flow the specific conductivity is more variable than usual making it more difficult to get a good comparison between the field instrument deployed from the bridge and the QA/QC instrument located at the shoreline near the bridge.
- 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 4.17 m at Humber River at Humber Village, with corresponding flow ranging from 172.44 m^3/sec to 659.41 m^3/sec. Flows over the deployment period were typical for the season with the onset of higher stage and flow due to spring runoff.
    - During this deployment period the water temperature at Humber River ranged from 0.20˚C to 8.33˚C and showed an increasing trend which is consistent with the spring season.
    - During this deployment period pH values at Humber River ranged from 6.34 units to 6.90 units. With a median value of 6.80, all but a handful 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 29.6 µS/cm to 38.9 µS/cm.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 11.91 mg/l (91.8% saturation) to 13.50 mg/l (102.6% saturation). Over the deployment period DO (mg/l) shows a gradual decreasing trend which is due to the increasing 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 0.1 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)[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 (03-31-2015 to 06-08-2015)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
3/31/2015	4	-6.5	-1.3	19.3	0	2.6
4/1/2015	3	-3	0	18	0	1.6
4/2/2015	-1.5	-8	-4.8	22.8	0	1
4/3/2015	2	-6.5	-2.3	20.3	0	2
4/4/2015	7	-2	2.5	15.5	0	8.4
4/5/2015	-3	-4.5	-3.8	21.8	0	3
4/6/2015	-3.5	-8	-5.8	23.8	0	5
4/7/2015	-3	-8	-5.5	23.5	0	1
4/8/2015	-4	-10.5	-7.3	25.3	0	1.8
4/9/2015	-3.5	-13	-8.3	26.3	0	0
4/10/2015	2	-15	-6.5	24.5	0	5
4/11/2015	8	-2.5	2.8	15.2	0	1.2
4/12/2015	1	-1.5	-0.3	18.3	0	0
4/13/2015	7.5	-8	-0.3	18.3	0	0
4/14/2015	14	1.5	7.8	10.2	0	5.1
4/15/2015	3.5	-1	1.3	16.7	0	0
4/16/2015	-2.5	-7	-4.8	22.8	0	0
4/17/2015	7	-6.5	0.3	17.7	0	0
4/18/2015	-0.5	-2	-1.3	19.3	0	1.6
4/19/2015	2.5	-8	-2.8	20.8	0	0
4/20/2015	5	-7	-1	19	0	0
4/21/2015	10	-5	2.5	15.5	0	0
4/22/2015	8	-3	2.5	15.5	0	0
4/23/2015	9	-1.5	3.8	14.2	0	0
4/24/2015	7.5	0	3.8	14.2	0	2.2
4/25/2015	4.5	1.5	3	15	0	16.2
4/26/2015	5.5	0	2.8	15.2	0	1.7
4/27/2015	8	2.5	5.3	12.7	0	5.4
4/28/2015	5	1	3	15	0	3.6
4/29/2015	6.5	2	4.3	13.7	0	1.9
4/30/2015	4.5	1.5	3	15	0	0.4
5/1/2015	7.5	1.5	4.5	13.5	0	0
5/2/2015	10.5	-0.5	5	13	0	0
5/3/2015	9	-2	3.5	14.5	0	0
5/4/2015	14	-2	6	12	0	0
5/5/2015	14.5	5.5	10	8	0	1
5/6/2015	7	2	4.5	13.5	0	0

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
5/7/2015	7	0	3.5	14.5	0	0.5
5/8/2015	8.5	-0.5	4	14	0	0
5/9/2015	9	-2.5	3.3	14.7	0	3.7
5/10/2015	9.5	2.5	6	12	0	0
5/11/2015	7	2	4.5	13.5	0	0
5/12/2015	10	-1	4.5	13.5	0	6.6
5/13/2015	4	1	2.5	15.5	0	6.4
5/14/2015	10	-1.5	4.3	13.7	0	0
5/15/2015	19.5	2	10.8	7.2	0	0
5/16/2015	20.5	3.5	12	6	0	0
5/17/2015	22.5	1	11.8	6.2	0	0
5/18/2015	20.5	2	11.3	6.7	0	0
5/19/2015	20	3.5	11.8	6.2	0	0.5
5/20/2015	15	8.5	11.8	6.2	0	12.2
5/21/2015	10	4.5	7.3	10.7	0	0
5/22/2015	17.5	1.5	9.5	8.5	0	15.8
5/23/2015	9.5	3	6.3	11.7	0	1.2
5/24/2015	13	3	8	10	0	1.6
5/25/2015	18	5.5	11.8	6.2	0	0.8
5/26/2015	24	8	16	2	0	0
5/27/2015	17.5	10	13.8	4.2	0	0
5/28/2015	16.5	15	15.8	2.2	0	0
5/29/2015	17	4.5	10.8	7.2	0	0
5/30/2015	22.5	4	13.3	4.7	0	5.6
5/31/2015	13.5	9.5	11.5	6.5	0	2.4
6/1/2015	11	0	5.5	12.5	0	0
6/2/2015	14	0	7	11	0	0
6/3/2015	18	3.5	10.8	7.2	0	0
6/4/2015	18	4.5	11.3	6.7	0	0
6/5/2015	20.5	5	12.8	5.2	0	0
6/6/2015	15.5	9	12.3	5.7	0	5.3
6/7/2015	15	6.5	10.8	7.2	0	0
6/8/2015	17	2	9.5	8.5	0	6.4