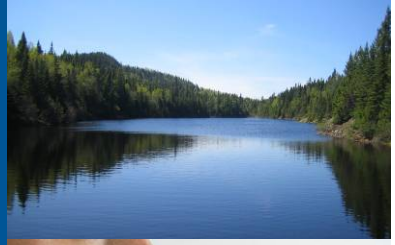




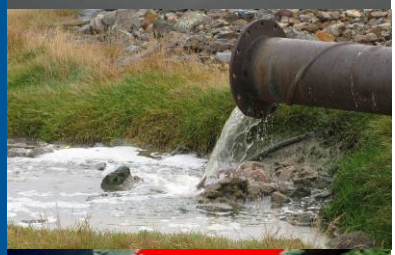


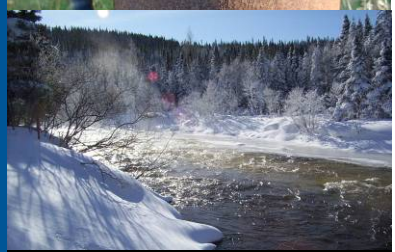

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2020-10-21 to 2020-12-17

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

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) monitor 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 October 21 to December 17, 2020.

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.

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

Humber River		
Stage of deployment	**Beginning**	**End**
Date	2020-10-21	2020-12-17
Temperature	Excellent	Excellent
pH	Good	Good
Specific Conductivity	Excellent	Good
Dissolved Oxygen	Excellent	Good
Turbidity	Excellent	Excellent

- 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.

Deployment Notes

- Water quality monitoring for this deployment period started on October 21, 2020 and continued without any significant operational issues until December 17, 2020, 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

- 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 1.93 m to 2.42 m at Humber River at Humber Village, with corresponding flow ranging from 209.69 m^3/sec to 290.80 m^3/sec (Figure 1).
- Flows over the deployment period were typical for the Humber River. Levels were lowest in November, but showed several increases in October and December. The Humber has a large catchment area and stage levels are influenced by precipitation falling within this area (see climate data located in Appendix B).

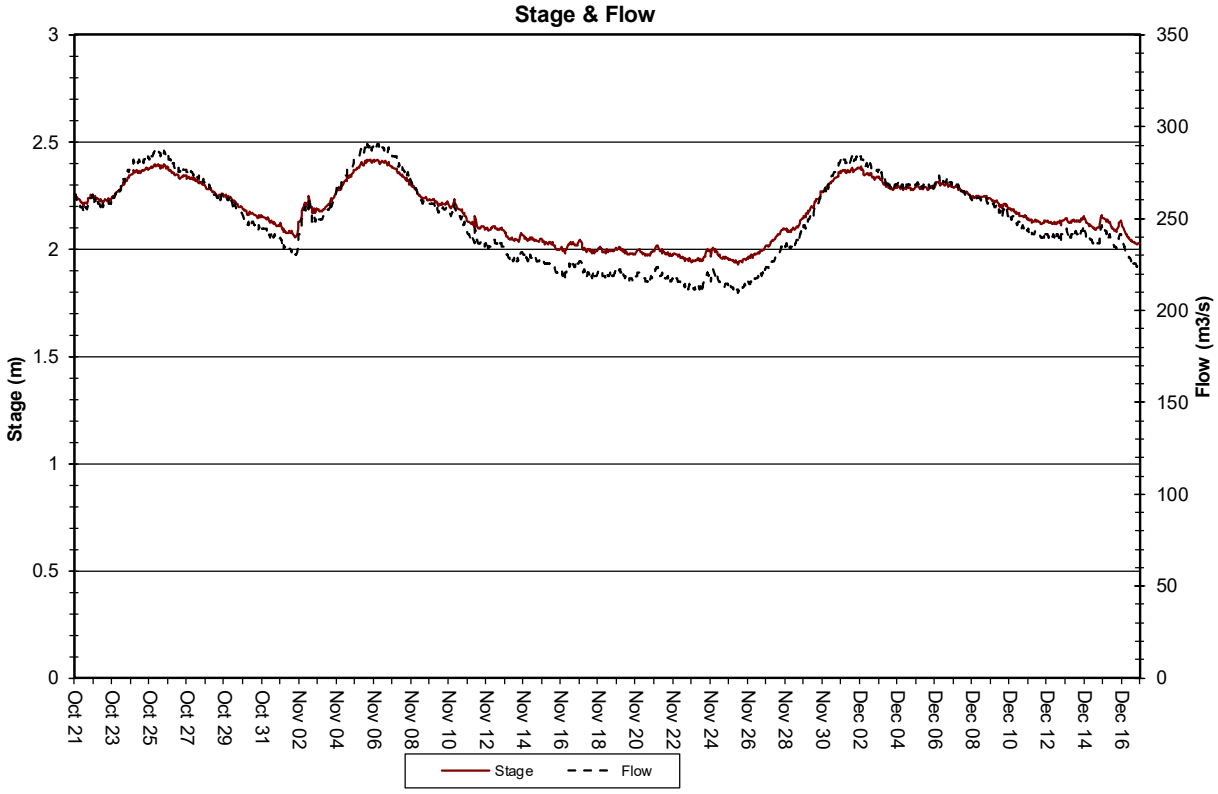

Figure 1: Stage & Flow at Humber River from October 21 to December 17, 2020

Temperature

- During this deployment period the water temperature at Humber River ranged from 4.84˚C to 11.40˚C (Figure 2).
- Water temperature shows a steady decline from fall into winter, as expected, following the pattern of ambient air temperatures. On November 4th, a noticeable drop in water temperature occurs at the same time as an increase in stage. This is likely due to cooler weather systems moving through the area at this time.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

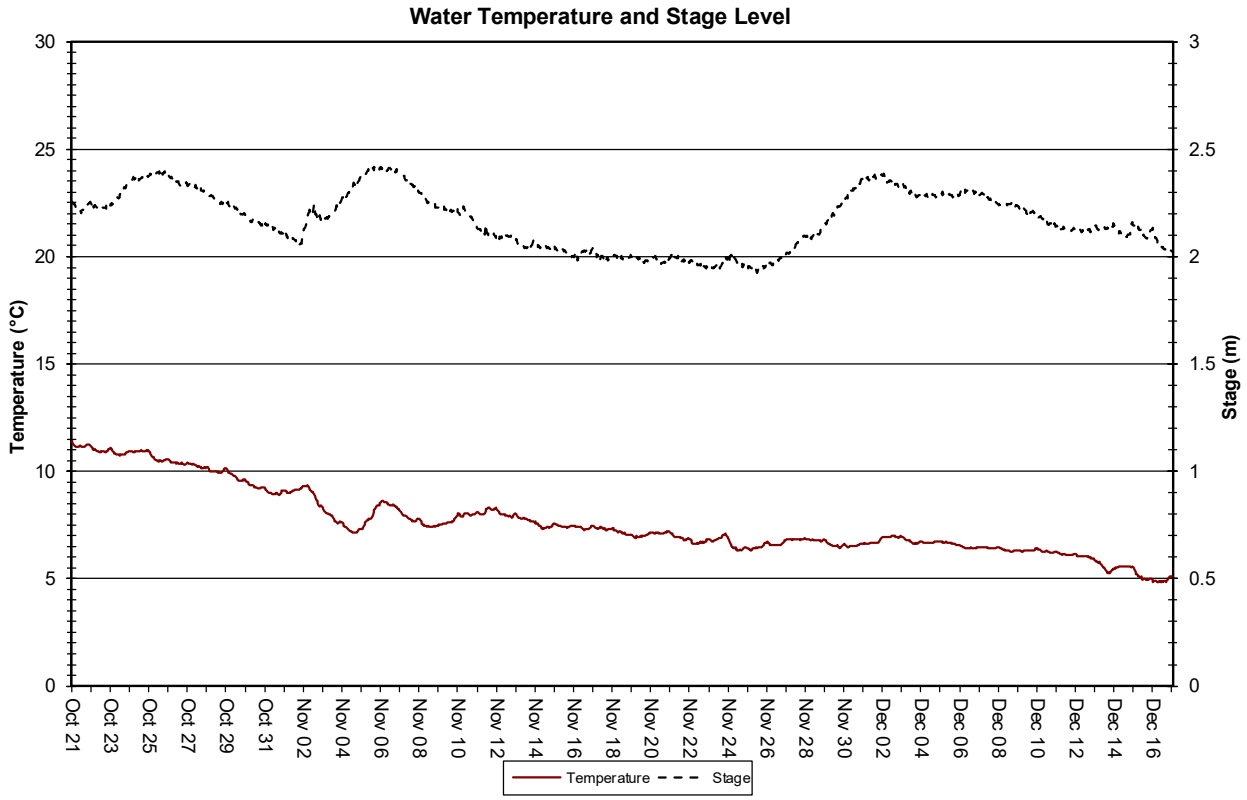

Figure 2: Water Temperature (°C) at Humber River from October 21 to December 17, 2020

pH

- During this deployment period pH values at Humber River ranged from 6.75 units to 7.18 units (Figure 3).
- pH was very stable throughout the deployment period, with little fluctuations. One noticeable drop occurred on November 4th, the same time as a stage increase, and is likely related to weather patterns in the area at that time. pH levels quickly recover and climb to background levels.
- With a median value of 7.06, 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).

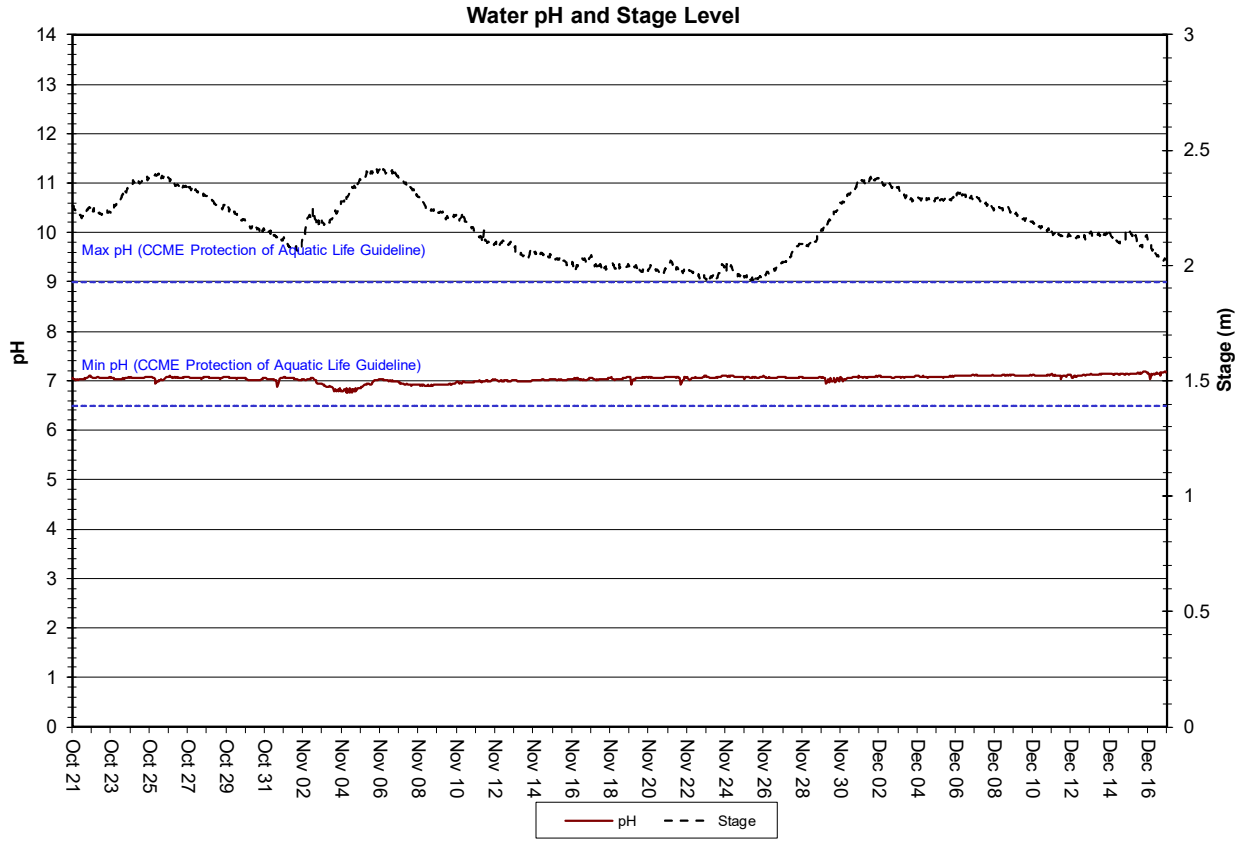

Figure 3: pH values recorded at Humber River from October 21 to December 17, 2020

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 40.3 µS/cm to 42.4 µS/cm (Figure 4). This shows there is little variability in conductivity data during the deployment, and is consistent with previous deployments.
- In Figure 4, the relationship between specific conductivity and stage level is obvious: as stage increases, conductivity decreases. As precipitation enters a water system, it increases the volume of water, raising the stage level and in turn, diluting the system, causing drops in conductivity. This relationship is evident around November 6th and 30th.
- Specific conductivity was relatively stable throughout the deployment, showing a slight increasing trend. Despite the low variability, conductivity levels were affected by stage increases from associated precipitation.

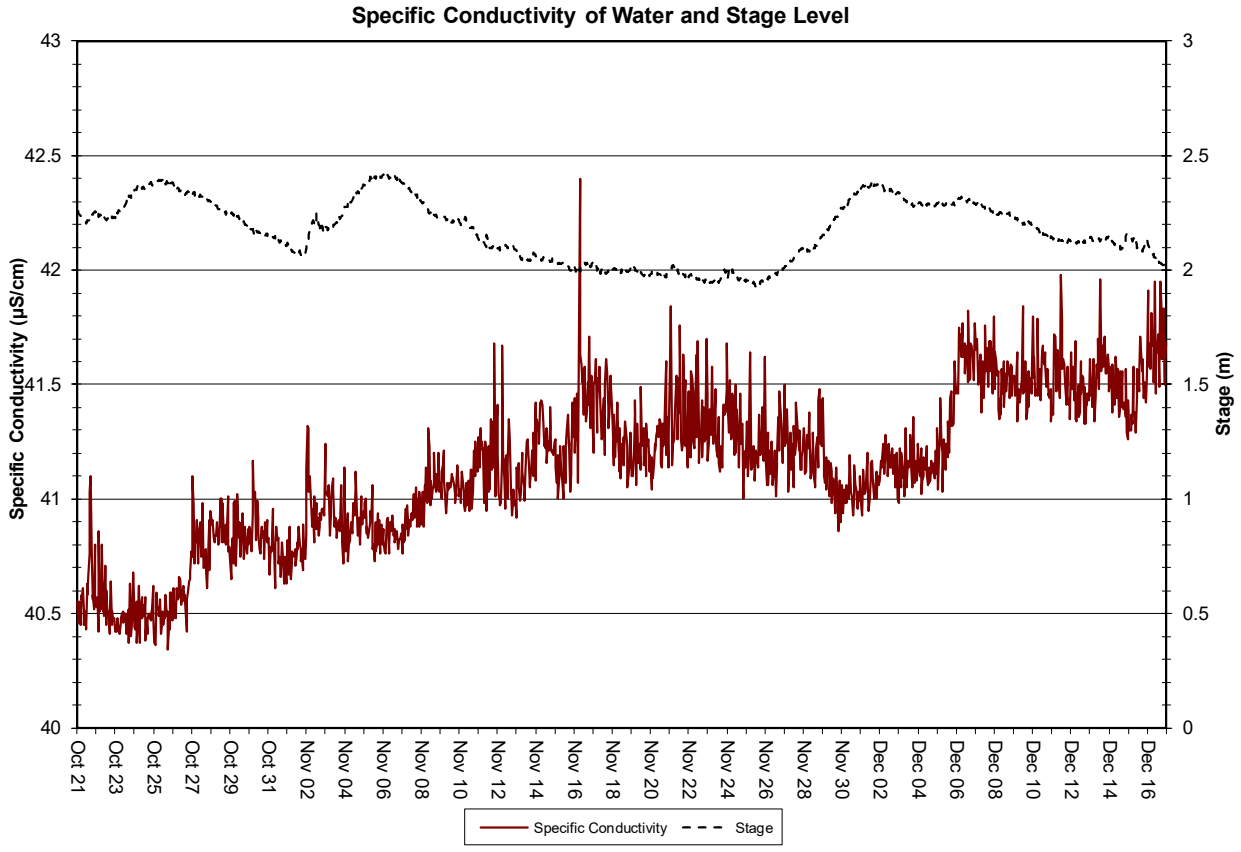

Figure 4: Specific conductivity (µs/cm) at Humber River from October 21 to December 17, 2020

Dissolved Oxygen

- During this deployment period dissolved oxygen (DO) values at Humber River ranged from 10.63 mg/l (92.6% saturation) to 12.33 mg/l (98.1% saturation) (Figure 5).
- DO saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a gradual increase into the cooler winter months. This is related to the corresponding decreasing temperature trend as cooler water can hold more oxygen than during warmer 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 guidelines set for the protection of other life stages (6.5 mg/l) and early life stages (9.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

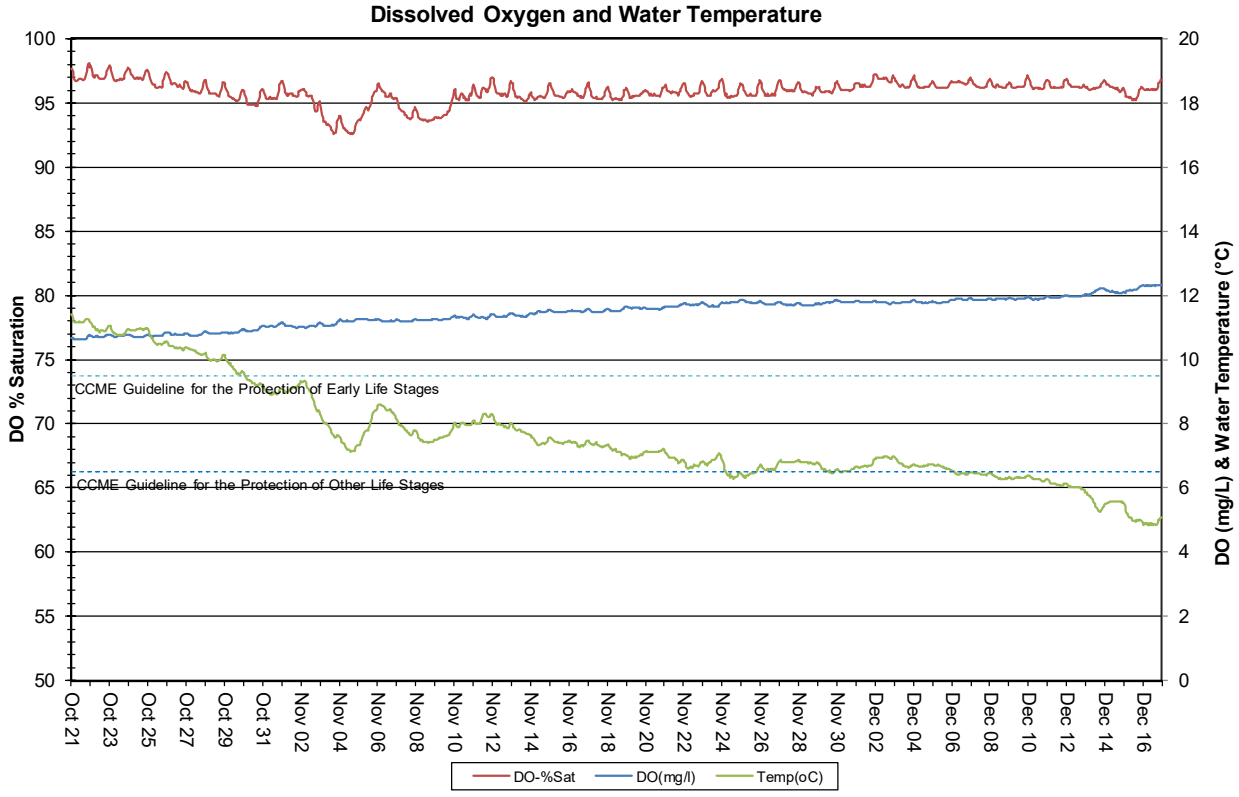

Figure 5: DO (mg/l & % saturation) and Water Temperature at Humber River from October 21 to December 17, 2020

Turbidity

- During this deployment period, turbidity values at Humber River ranged from 1.93 NTU to 2.42 NTU (Figure 6), with a median of 2.18 NTU. This indicates low background turbidity.
- While turbidity remained very low throughout the deployment, there were some fluctuations associated with increasing stage level, such as October 25th and November 4th. Other turbidity spikes do not appear to correspond to stage increases, such as on November 14th and December 14th. In these cases, turbidity gradually increased and decreased, indicating whatever caused the increase was present in the water system for a period of time.

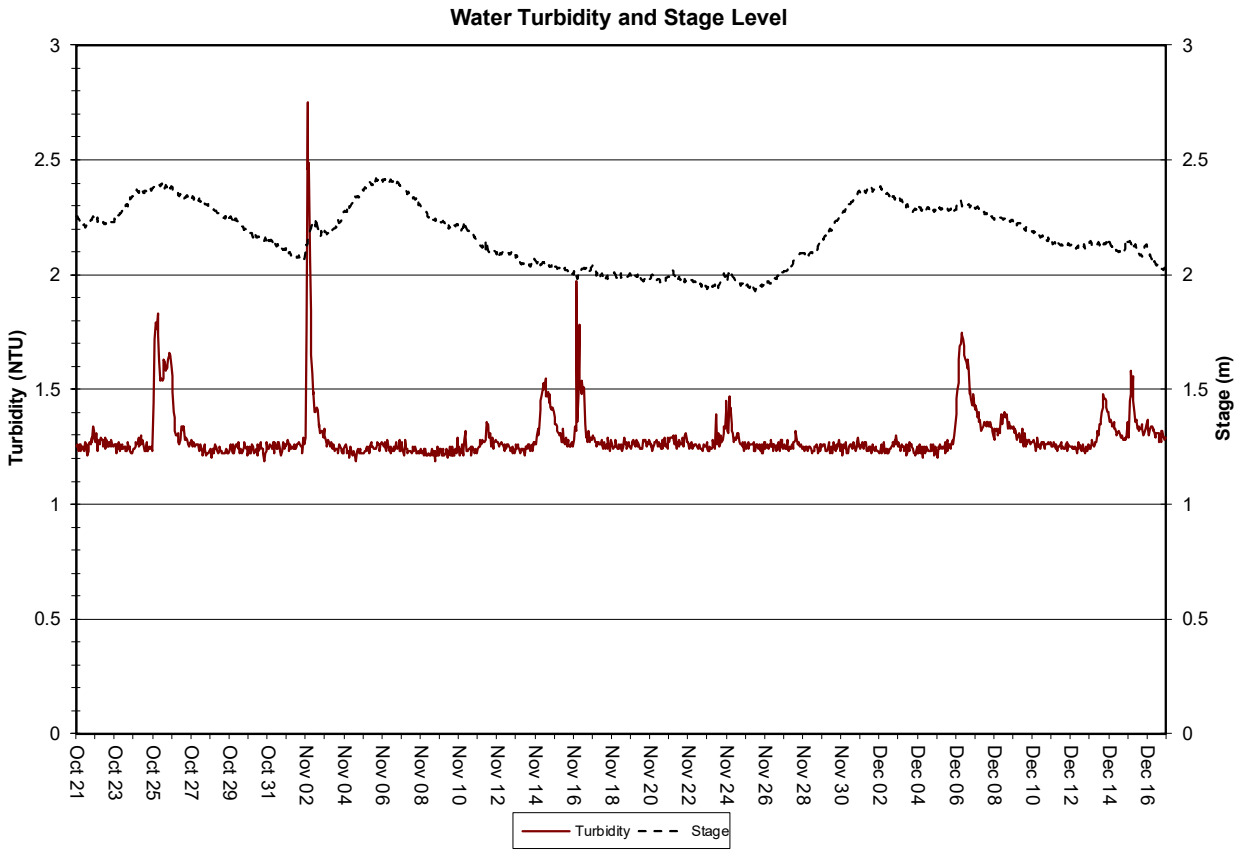

Figure 6: Turbidity (NTU) at Humber River from October 21 to December 17, 2020

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from October 21 to December 17, 2020.
- Sensor performance rankings at the start and end of the deployment were all 'excellent' or 'good', indicating good performance by the instrument.
- Variations in water quality/quantity values recorded at each station are summarized below:
    - During this deployment period stage values ranged from 1.93 m to 2.42m at Humber River at Humber Village, with corresponding flow ranging from 209.69 m^3/sec to 290.80 m^3/sec. These flows were typical for the Humber River at this time of year.
    - During this deployment period the water temperature at Humber River ranged from 4.84˚C to 11.40 ˚C. Water temperature shows a steady decrease from fall into winter.
    - During this deployment period pH values at Humber River ranged from 6.75 units to 7.18 units. pH was stable throughout the deployment period, with a minor drop noticeable when stage levels rose on November 4th. 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 40.3 µS/cm to 42.4 µS/cm and was relatively stable over the deployment period, fluctuating with stage level and showing a slight increasing trend.
    - During this deployment period dissolved oxygen (DO) values at Humber River ranged from 10.63 mg/l (92.6% saturation) to 12.33 mg/l (98.1% saturation) (Figure 5). DO saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a gradual increase into the cooler winter months. During this deployment period all of the DO values at Humber River were above the minimum guidelines set for the protection of other life stages (6.5 mg/l) and 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 1.2 NTU to 2.8 NTU, with fluctuations during stage increases.

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

[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*

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

APPENDIX B

WRMD Climate Station – Humber Village at Humber Village Bridge

YMD	AIR_TEMP_AVG	AIR_TEMP_MIN	AIR_TEMP_MAX	PRECIP_TOT
2020/10/21	10.13	7.54	14.51	2.03
2020/10/22	8.99	6.57	13.08	12.7
2020/10/23	6.11	4.15	9.67	0.76
2020/10/24	9.19	4.06	13.54	0
2020/10/25	7.21	4.38	10.56	0
2020/10/26	3.75	0.39	5.89	0
2020/10/27	2.15	1.4	2.9	24.13
2020/10/28	1.89	-0.13	3.13	0.51
2020/10/29	2.9	0.36	6.23	0.51
2020/10/30	1.05	-1.16	2.98	0
2020/10/31	0.24	-3.37	2.71	0
2020/11/01	3.79	1.71	7.51	0
2020/11/02	11.95	5.2	16.76	18.29
2020/11/03	3.57	0.82	8.11	3.3
2020/11/04	-0.21	-1.98	1.31	0
2020/11/05	2.85	-2.54	8.51	0.76
2020/11/06	11.01	6.52	12.97	0.25
2020/11/07	7.9	1.86	13.91	1.02
2020/11/08	1.36	-0.38	4.35	0
2020/11/09	3.29	-0.03	6.16	0.25
2020/11/10	12.07	6.48	18.92	0
2020/11/11	10.34	6.84	17.56	0
2020/11/12	10.97	3.63	17.4	5.84
2020/11/13	4.63	1.46	6.45	0
2020/11/14	2.38	0.35	3.54	1.52
2020/11/15	0.7	-0.59	2.14	2.29
2020/11/16	3.59	-0.37	8.52	22.35
2020/11/17	4.77	2.47	6.71	1.27
2020/11/18	1.41	-0.53	2.54	1.02
2020/11/19	-1.42	-3.04	-0.31	0
2020/11/20	2.12	-0.81	5.08	5.08
2020/11/21	5.02	3.28	8.56	0.51
2020/11/22	-1.34	-3	2.77	0
2020/11/23	0.84	-1.57	6.8	0
2020/11/24	5.72	-2.8	12.65	5.84
2020/11/25	-2.44	-4.32	-0.71	0
2020/11/26	1.56	-1.31	4.37	3.81

2020/11/27	6.67	0.97	14.28	3.05
2020/11/28	6.96	4.89	10.46	5.08
2020/11/29	3.38	2.39	4.88	3.81
2020/11/30	1.76	0.25	3.29	0
2020/12/01	6.42	0.86	11.35	0
2020/12/02	12.01	9.23	15.3	0
2020/12/03	9.81	6.2	12.53	0.76
2020/12/04	4.78	1.9	7.18	0
2020/12/05	6.27	4.39	9.65	5.08
2020/12/06	4.53	3.71	5.34	16
2020/12/07	4.13	3.35	5.22	1.02
2020/12/08	3.51	2.51	4.34	0.51
2020/12/09	2.99	1.68	3.84	9.4
2020/12/10	2.76	1.51	3.87	3.81
2020/12/11	2.36	1.46	3.5	0.51
2020/12/12	1.74	0.2	3.1	1.02
2020/12/13	-1.04	-1.49	-0.06	0
2020/12/14	-0.73	-2.37	0.74	0
2020/12/15	-0.11	-3.24	1.33	0
2020/12/16	-3.66	-4.1	-3.15	0
2020/12/17	-2.86	-4.28	-1.28	0