

Real Time Water Quality Report Humber River at Humber Village

Deployment Period
2020-05-26 to 2020-09-02



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.
- The station was not deployed between November 2018 and May 2020 due to Issues with station instrumentation and staffing vacancies.
- 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 May 26 to September 2, 2020. It should be noted that this deployment period was much longer than normal.

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	2020-05-26	2020-09-02
Temperature	Good	Good
pH	Fair	Good
Specific Conductivity	Fair	Excellent
Dissolved Oxygen	Fair	Poor
Turbidity	NA	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 May 26, 2020 and continued without any significant operational issues until September 2, 2020, when the instrument was removed for routine calibration and maintenance. It should be noted that this deployment period was much longer than normal.

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 ($\mu\text{S}/\text{cm}$)
 - (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 1.40 m to 4.89 m at Humber River at Humber Village, with corresponding flow ranging from 134.21 m³/sec to 843.60 m³/sec (Figure 1).
- Flows over the deployment period were typical for the Humber River with the most significant peak during spring runoff (see climate data located in Appendix B).

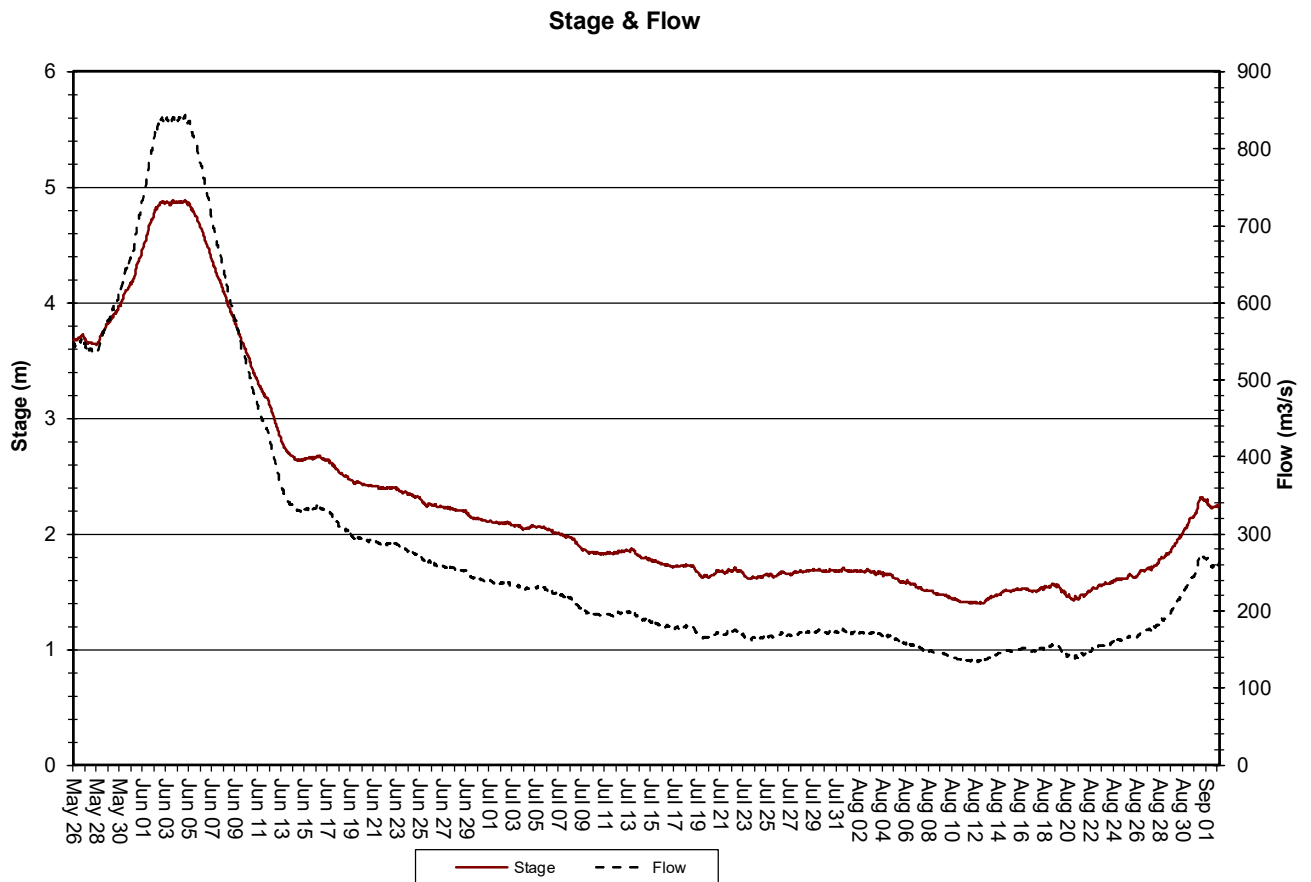


Figure 1: Stage & Flow at Humber River from May 26 to September 2, 2020

Temperature

- During this deployment period the water temperature at Humber River ranged from 3.74°C to 19.68°C (Figure 2).
- Water temperature shows a steady increase from spring into summer, as expected, following the ambient air temperatures.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

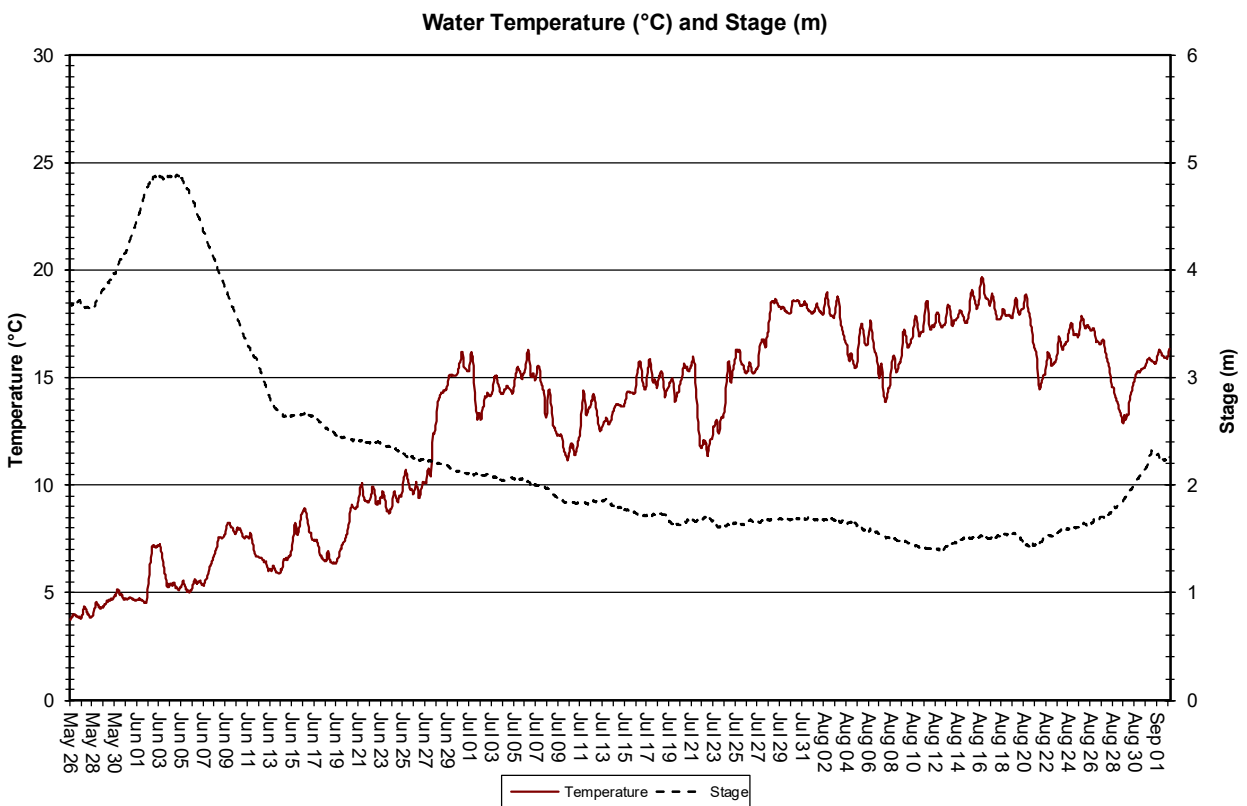


Figure 2: Temperature (°C) at Humber River from May 26 to September 2, 2020

pH

- During this deployment period pH values at Humber River ranged from 7.08 units to 7.54 units (Figure 3).
- pH was stable throughout the deployment period, with a slight rise in levels during the latter half of the deployment.
- With a median value of 7.25, 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).

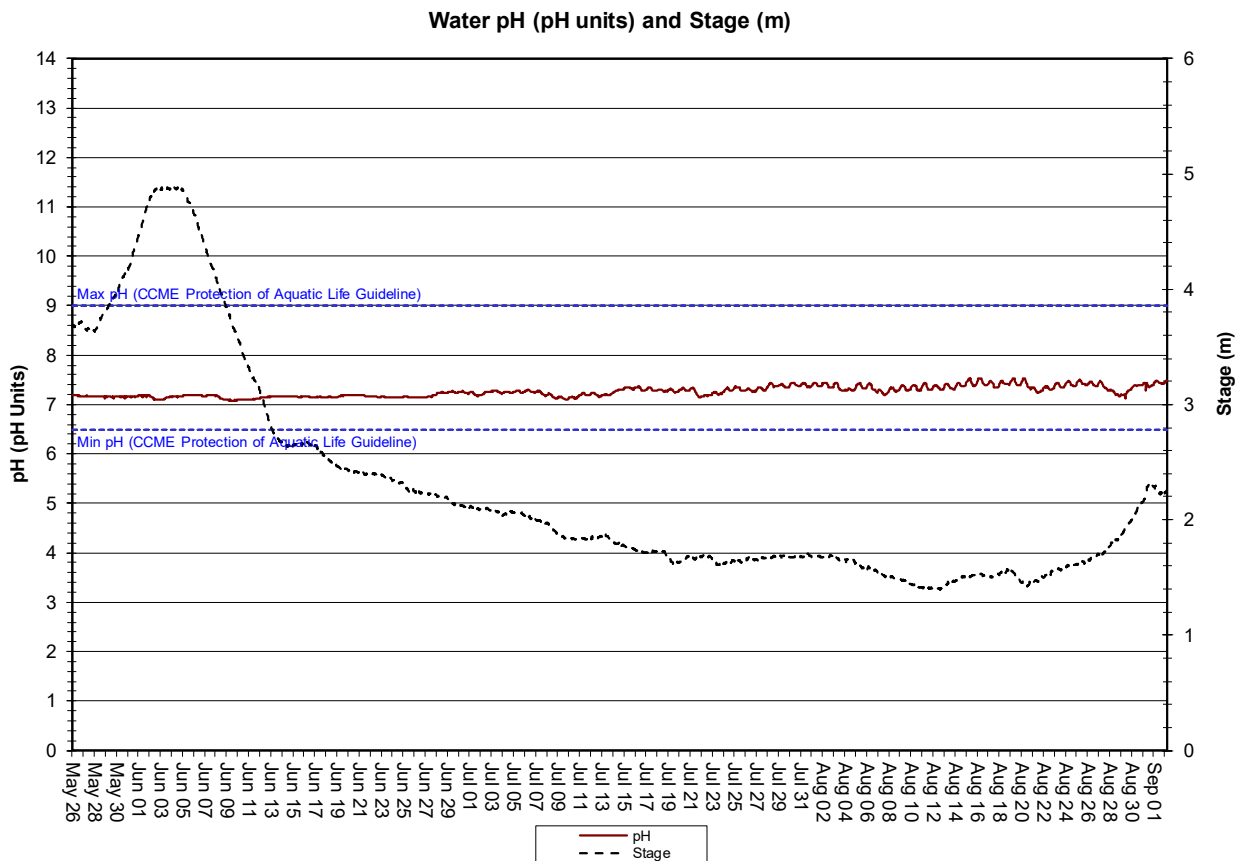


Figure 3: pH values recorded at Humber River from May 26 to September 2, 2020

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 34.6 $\mu\text{S}/\text{cm}$ to 44.1 $\mu\text{S}/\text{cm}$ (Figure 4).
- Specific conductivity recorded some drops early in June, but was relatively stable for the remainder of the deployment. These drops correspond with spring freshet in this area: snow and ice in the higher elevations melts, it adds freshwater to the system, diluting the water and decreasing the conductivity.

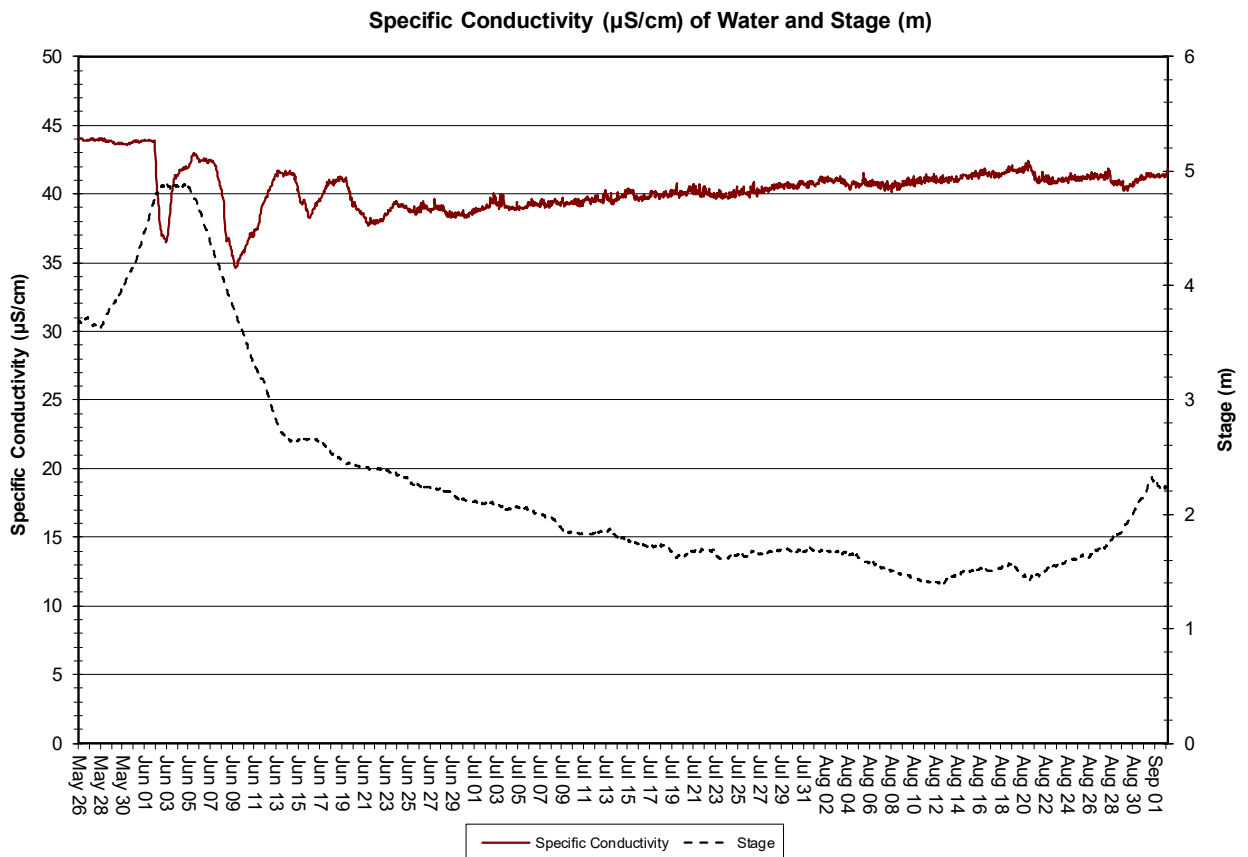


Figure 4: Specific conductivity ($\mu\text{S}/\text{cm}$) at Humber River from May 26 to September 2, 2020

Dissolved Oxygen

- During this deployment period dissolved oxygen (DO) values at Humber River ranged from 9.56 mg/l (98.8% saturation) to 13.14 mg/l (108.8% saturation) (Figure 5).
- DO saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a gradual decrease into the warmer months of summer. This dip is related to the corresponding increasing temperature trend as warmer water can hold less oxygen than during colder 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).

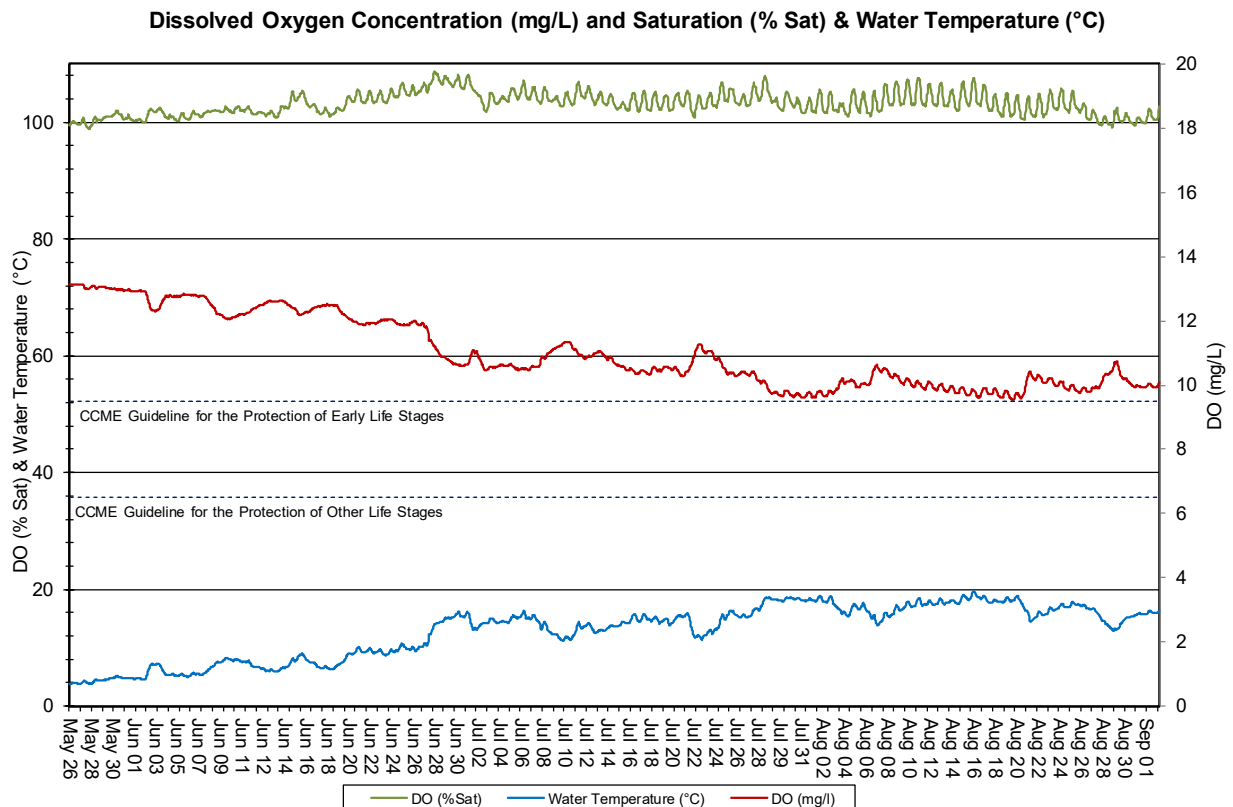


Figure 5: DO (mg/l & % saturation) at Humber River from May 26 to September 2, 2020

Turbidity

- During this deployment period turbidity values at Humber River ranged from -0.2 NTU to 1.3 NTU (Figure 6), indicating very low turbidity during this deployment.
- While turbidity remained very low throughout the deployment, there were some fluctuations throughout June as stage levels fluctuated during spring freshet.

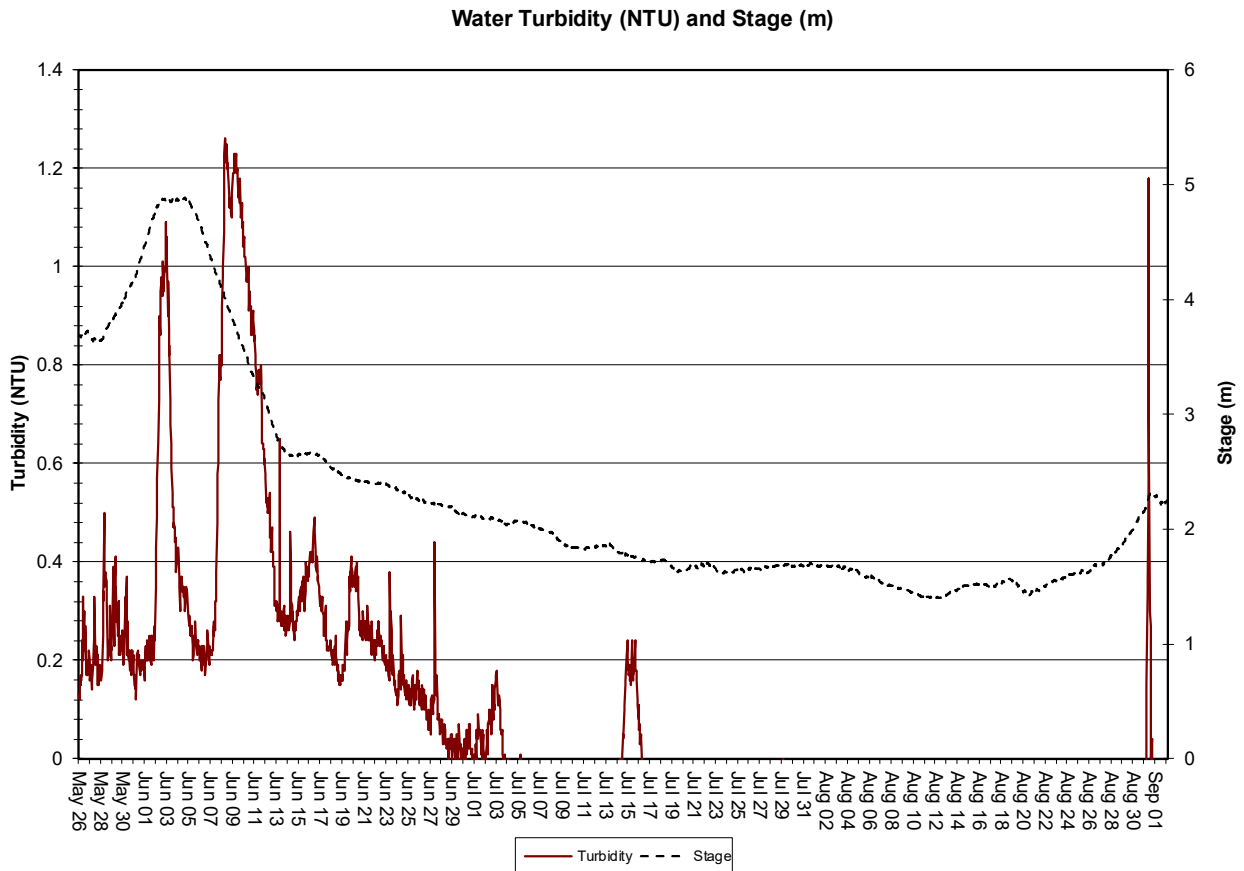


Figure 6: Turbidity (NTU) at Humber River from May 26 to September 2, 2020

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from May 26 to September 2, 2020.
- While sensor performance rankings at the start of the deployment were not ideal, rating ‘Good’ to ‘Fair’, this was likely related acclimation time. Upon removal, all performance ratings were ‘Good’ to ‘Excellent’, with the exception of dissolved oxygen which ranked ‘Poor’. This rating was likely due to the extended length of the deployment period (96 days) which may have caused sensor drift.
- Variations in water quality/quantity values recorded at each station are summarized below:
 - During this deployment period stage values ranged from 1.40 m to 4.89 m at Humber River at Humber Village, with corresponding flow ranging from 134.21 m³/sec to 843.60 m³/sec. These flows were typical for the Humber River with the most significant peak occurring during spring freshet.
 - During this deployment period the water temperature at Humber River ranged from 3.74 °C to 19.68 °C. Water temperature shows a steady increase from spring to summer and had already begun a decline in late August as Fall approached.
 - During this deployment period pH values at Humber River ranged from 7.08 units to 7.54 units. pH was stable throughout the deployment period, with a slight rise in levels during the latter half of the deployment. 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 34.6 µS/cm to 44.1 µS/cm and was relatively stable over the deployment period.
 - During this deployment period dissolved oxygen (DO) values at Humber River ranged from 9.56 mg/l (98.8% saturation) to 13.14 mg/l (108.8% saturation) (Figure 5). DO saturation, was relatively stable over the duration of the deployment period, while DO (mg/L) shows a gradual decrease into the warmer months of summer. 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 -0.2 NTU to 1.3 NTU. This indicates very low turbidity during this timeframe.

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://cegg-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.

Parameter	Rating				
	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)	$\leq \pm 0.3$	$> \pm 0.3$ 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	$> \pm 20$

APPENDIX B

WRMD Climate Station – Humber Village at Humber Village Bridge

YMD	Air Temp (Avg) C	Air Temp (Min) C	Air Temp (Max) C	Total Precip (mm)
2020/05/26	12.8	10.07	14.47	0
2020/05/27	13	8.9	19.23	0.51
2020/05/28	12.76	5.23	18.59	0.25
2020/05/29	17.74	14.87	20.49	0
2020/05/30	18.75	16.45	21.44	2.03
2020/05/31	15.58	13.49	17.97	7.11
2020/06/01	11.53	10.66	13.43	7.11
2020/06/02	15.58	11	19.51	3.81
2020/06/03	10.88	8.07	15.07	2.03
2020/06/04	13.46	7.92	20.05	1.27
2020/06/05	16.56	7.21	24.13	1.02
2020/06/06	14.62	11.44	18.91	1.27
2020/06/07	11.88	8.92	16.2	0
2020/06/08	6.45	5.27	8.19	4.57
2020/06/09	7.33	5.3	10.45	0.76
2020/06/10	8.89	1.29	15.23	0.25
2020/06/11	11.3	3.99	17.83	0
2020/06/12	17.88	13.44	20.85	0
2020/06/13	17.63	13.64	20.71	0.25
2020/06/14	12.81	7.68	18.63	0
2020/06/15	13.41	8.38	20.82	0.25
2020/06/16	16.16	6.96	24.64	0
2020/06/17	18.51	12.69	21.94	0
2020/06/18	17.07	13.05	23.37	2.29
2020/06/19	11.9	7.74	17.58	0
2020/06/20	11.59	6.62	18.74	4.57
2020/06/21	13.74	6.82	20.47	0
2020/06/22	18.88	11.72	27.24	0.51
2020/06/23	23.33	18.64	29.05	0.25
2020/06/24	23.21	15.49	30.35	0
2020/06/25	24.36	16.17	31.98	0.25
2020/06/26	22.1	17.95	27.51	18.8
2020/06/27	18.7	13.99	25.42	3.56
2020/06/28	16.26	12.71	21.39	0.51
2020/06/29	17.02	13.15	21.53	0
2020/06/30	20.15	15.74	25.37	0
2020/07/01	22.38	18.04	27.45	1.52

2020/07/02	12.18	9.23	18.99	12.19
2020/07/03	12.54	8.47	19.5	1.02
2020/07/04	12.76	8.22	17.66	0
2020/07/05	16.14	8.91	23.23	0.76
2020/07/06	16.55	11.27	23.28	0
2020/07/07	16.53	8.69	23.9	0
2020/07/08	18.74	10.18	25.87	0
2020/07/09	15.55	14.24	17.84	0.51
2020/07/10	17.58	12.62	24.67	0.25
2020/07/11	21.1	12.32	28.94	2.03
2020/07/12	20.79	15.51	24.57	0.25
2020/07/13	22.66	19.89	26.16	0.51
2020/07/14	13.28	11.42	20.63	0
2020/07/15	12.44	10.44	15.29	0
2020/07/16	15.61	9.49	25.32	0
2020/07/17	17.88	8.91	27	0.25
2020/07/18	17.45	10.12	26.81	0
2020/07/19	18.35	12.03	25.05	0
2020/07/20	20.98	13.63	28.8	0.25
2020/07/21	23.23	17.64	30.18	0.51
2020/07/22	19.93	13.91	25.04	0
2020/07/23	19.61	13.78	25.72	0
2020/07/24	18.27	11.01	26.72	0
2020/07/25	20.53	14.35	25.87	0
2020/07/26	19.09	17.08	22.49	17.27
2020/07/27	19.52	15.96	24.45	0
2020/07/28	19.38	15.81	25.63	0.51
2020/07/29	16.06	14.31	17.85	1.27
2020/07/30	18.86	15.28	22.75	0
2020/07/31	17.5	15.71	20.38	1.27
2020/08/01	17.42	15.28	21.14	0
2020/08/02	21.08	15.73	27.87	0
2020/08/03	22.38	16.45	29.72	5.33
2020/08/04	18.24	13.14	23.62	1.27
2020/08/05	18.37	9.84	28.67	0
2020/08/06	21.99	16.58	26.67	0
2020/08/07	21.19	15.5	24.76	0
2020/08/08	21.3	13.38	28.85	0
2020/08/09	22.83	15.58	29.52	0
2020/08/10	22.95	18.45	27.91	0
2020/08/11	23.77	15.5	31.91	0
2020/08/12	26.04	23.03	29.82	0

2020/08/13	24.3	17.53	28.79	6.35
2020/08/14	16.66	13.22	18.64	0
2020/08/15	15.86	7.09	25.36	0
2020/08/16	17.34	9.43	25.93	0
2020/08/17	17.17	8.53	24.83	0
2020/08/18	16.82	12.22	22.41	5.33
2020/08/19	18.08	14.31	23.47	3.56
2020/08/20	17.93	15.76	23.25	2.54
2020/08/21	18.16	14.1	22.92	9.91
2020/08/22	16.21	10.5	22.42	0
2020/08/23	17.19	10.52	23.24	0
2020/08/24	17.43	13	22.31	1.02
2020/08/25	16.96	9.83	24.81	3.56
2020/08/26	16.98	11.94	19.44	13.72
2020/08/27	12.92	9.95	15.89	10.92
2020/08/28	14.18	12.19	18.02	9.4
2020/08/29	15.42	12.51	18.54	0.25
2020/08/30	13.86	12.13	15.9	12.95
2020/08/31	12.92	10.74	14.3	35.31
2020/09/01	13.45	9.23	19.02	0
2020/09/02	14.62	8.06	22.37	0