



# Real Time Water Quality Report Humber River at Humber Village

Deployment Period  
2022-02-03 to 2022-04-08



Government of Newfoundland & Labrador  
Department of Environment and Climate Change  
Water Resources Management Division



## General

The following public report is a presentation and interpretation of qualitative and quantitative data taken in real-time at the Humber River in Humber Village station. The deployment period took place between February 3, and April 8, 2022.

This station is a year-round operation as part of the Provincial Real Time Water Quality (RTWQ) network. A multi-parameter sonde device is deployed and tracks variables of interest including: temperature (°C), pH, dissolved oxygen (mg/L), specific conductivity (µS/cm), and turbidity (NTU). The sondes are linked to the monitoring network with staff at the Department of Environment and Climate Change (Water Resources Management Division-WRMD) monitoring the data remotely on a regular basis.

In the event of anomalous activity, staff can travel to the location and investigate any inquiries that could arise from internal or external disruptions. This site in particular is easy to access. Typically, the instrument is removed on monthly to bi-monthly intervals in order to conduct routine maintenance/calibration, after which the instrument is redeployed within 48 hours.

## Quality Assurance/Quality Control (QA/QC)

During the beginning and end of deployment periods, a routine QA/QC performance test is administered on both the instrument that is being removed and the new one to be deployed. The methodology of this protocol can be found in Appendix A.

The purpose is to determine the accuracy of the instrument’s sensors by cross-examining its initial readings against a control sonde which is deployed at the same time to compare parameters. Depending on these readings, the sensors of each parameter receive a qualitative rank (See Table 1) based on whether or not readings fall within a specified threshold. This will further ensure the integrity of the data’s accuracy, so that WRMD scientists deliver reliable results to the public.

Table 1: QA/QC protocol for deployment performance testing of sonde equipment for ranking of data accuracy.

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
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

With the exception of water quantity data (i.e. stage height), all other data used in the preparation of graphs and subsequent discussion below adhere to the stringent QA/QC protocol. The stage data is raw data that is transmitted via satellite and published on WRMD’s webpage. It has not been corrected for backwater effect. Water Survey of Canada is responsible of QA/QC of water quantity data. Corrected data can be obtained upon request.

Table 2: QA/QC water quality performance results for the beginning and end of deployment period.

<b>Station: Humber River at Humber Village</b>		
Stage of Deployment (Date)	Deployment (February 3, 2022)	Removal (April 8, 2022)
<i>Parameter (Unit)</i>	<i>Rank</i>	<i>Rank</i>
Temperature (°C)	Excellent	Excellent
pH (dimensionless unit)	Marginal	Fair
Specific Conductivity (µS/cm)	Good	Good
Dissolved Oxygen (mg/L)	Excellent	Good
Turbidity (NTU)	Excellent	Excellent
<b>Deployment Note:</b> “pH from field instrument was given 15 minutes to stabilize, however pH was still not comparable to QAQC instrument. A later check of ADRS indicated that pH was comparable to grab sample result and QAQC instrument.”		

### Deployment Notes

This deployment took place over the course of 65 days (February 3, 2022, to April 8, 2022), during which there were no significant interruptions or data loss.

### Data Interpretation

The following interpretations for the Humber River stations will cover the following six parameters: (1) Stage (m); (2) Temperature (°C); (3) pH; (4) Specific Conductivity (µS/cm); (5) Dissolved Oxygen (mg/L); (6) Turbidity (NTU).

### 1) Stage

- Stage ranged between 1.81 m and 3.32 m with an average stage height of 2.37 m
- Flow ranged from 191.45 m<sup>3</sup>/s to 465.72 m<sup>3</sup>/s with an average speed of 286.21 m<sup>3</sup>/s.
- Fluctuations of stage height were frequent throughout this deployment period with most peaks correlating to events of high precipitation very near or on the same day the stage and flow values rose.
- The winter notable winter conditions (based on climate data in Appendix B) show that the stage and flow seem less impacted by changes in temperature and more so by the precipitation during this deployment.

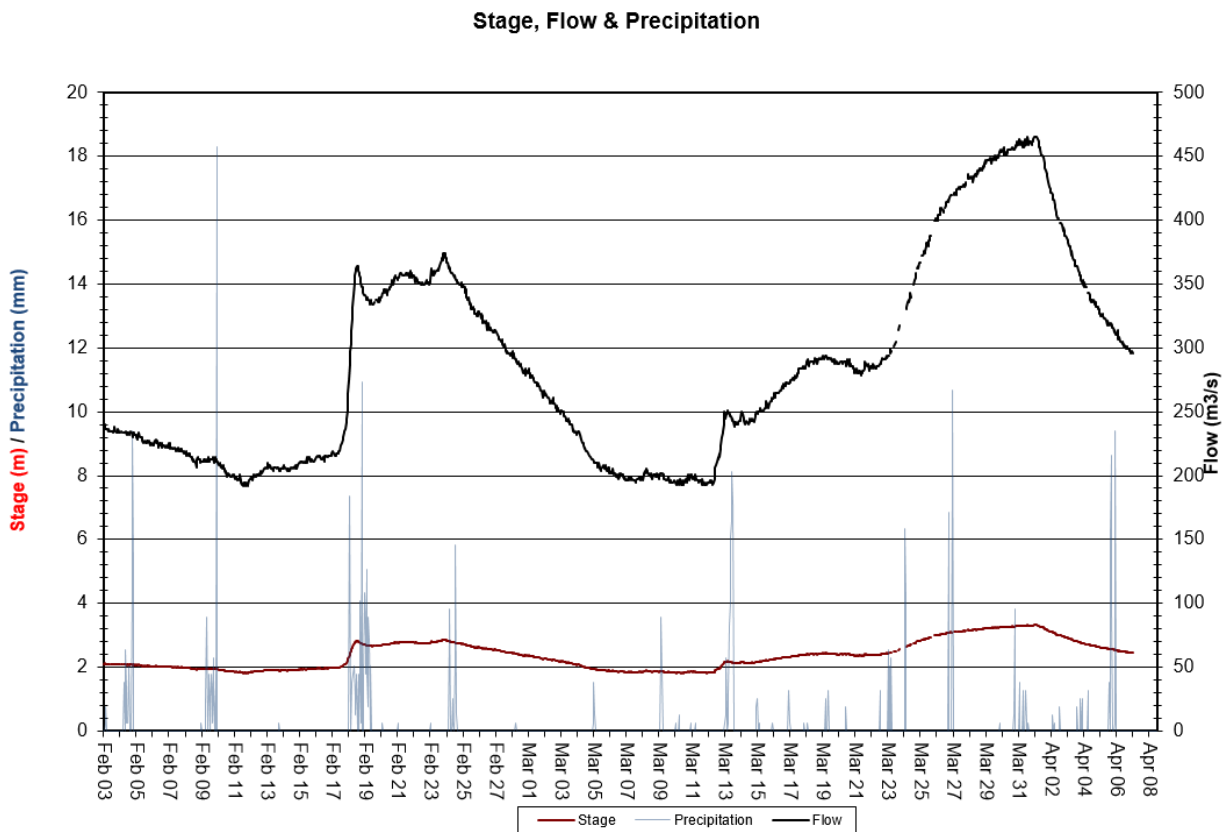


Figure 1: Stage, Flow & Precipitation at Humber River from February 3, 2022, to April 8, 2022

## 2) Temperature

- Throughout the deployment period, the water temperature ranged between 0.33 °C and 1.89 °C, with an average temperature of 0.88 °C.
- Temperatures were steady throughout the entire deployment period; the winter climate kept the range of this data in a narrow window.

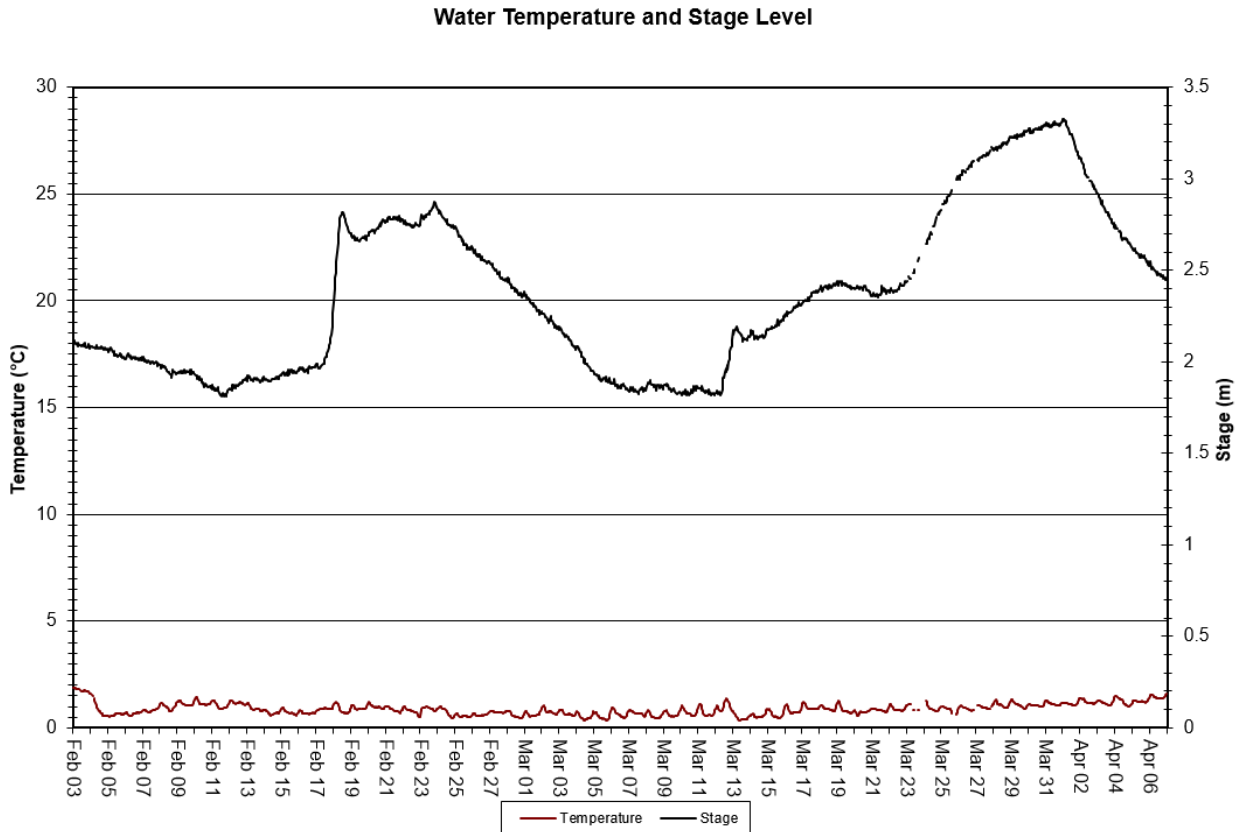


Figure 2: Water Temperature at Humber River from February 3, 2022, to April 8, 2022

### 3) pH

- pH ranged between 6.29 and 6.96 during the deployment period, with an average of 6.88 pH units.
- QA/QC to field sonde comparison during deployment showed that this sensor was showing an abnormal pH reading; however, grab sample results revealed a usual pH level for this station, supporting the possibility that the issue was the sensor itself as it was taking longer to acclimate to the water. The sensor later stabilized and was reporting typical readings.
- Following the sensor’s extended acclimation, the pH data remained within the threshold of acceptance for the protection of aquatic life as outlined by the Canadian Council of Ministers of the Environment (CCME) (2007).

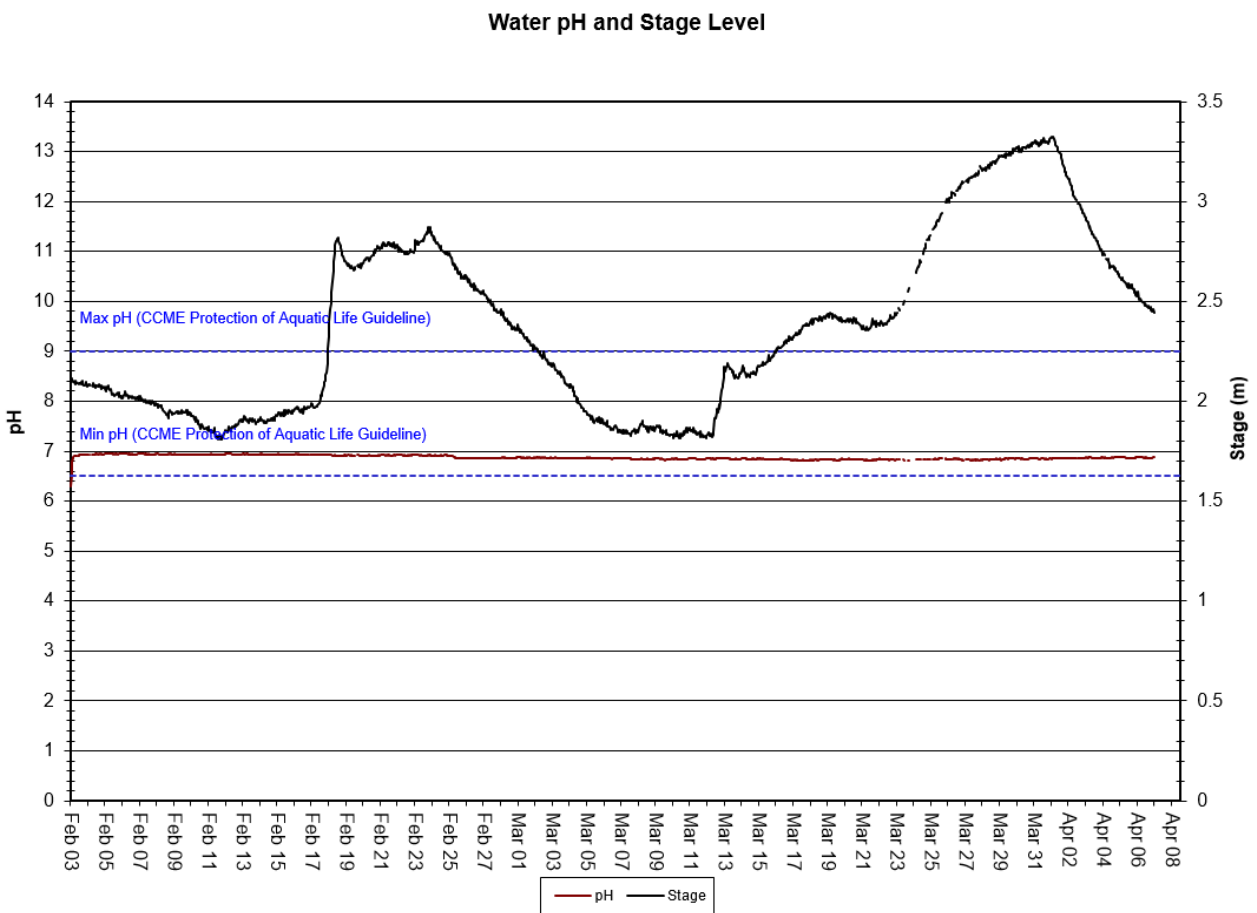


Figure 3: pH values recorded at Humber River from February 3, 2022, to April 8, 2022

#### 4) Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 43.2  $\mu\text{S}/\text{cm}$  and 51.7  $\mu\text{S}/\text{cm}$ , with an average of 45.0  $\mu\text{S}/\text{cm}$ .
- Data was generally stable throughout the deployment with a slight increasing trend overall, with occasional spikes correlating to changes in stage level and precipitation events.

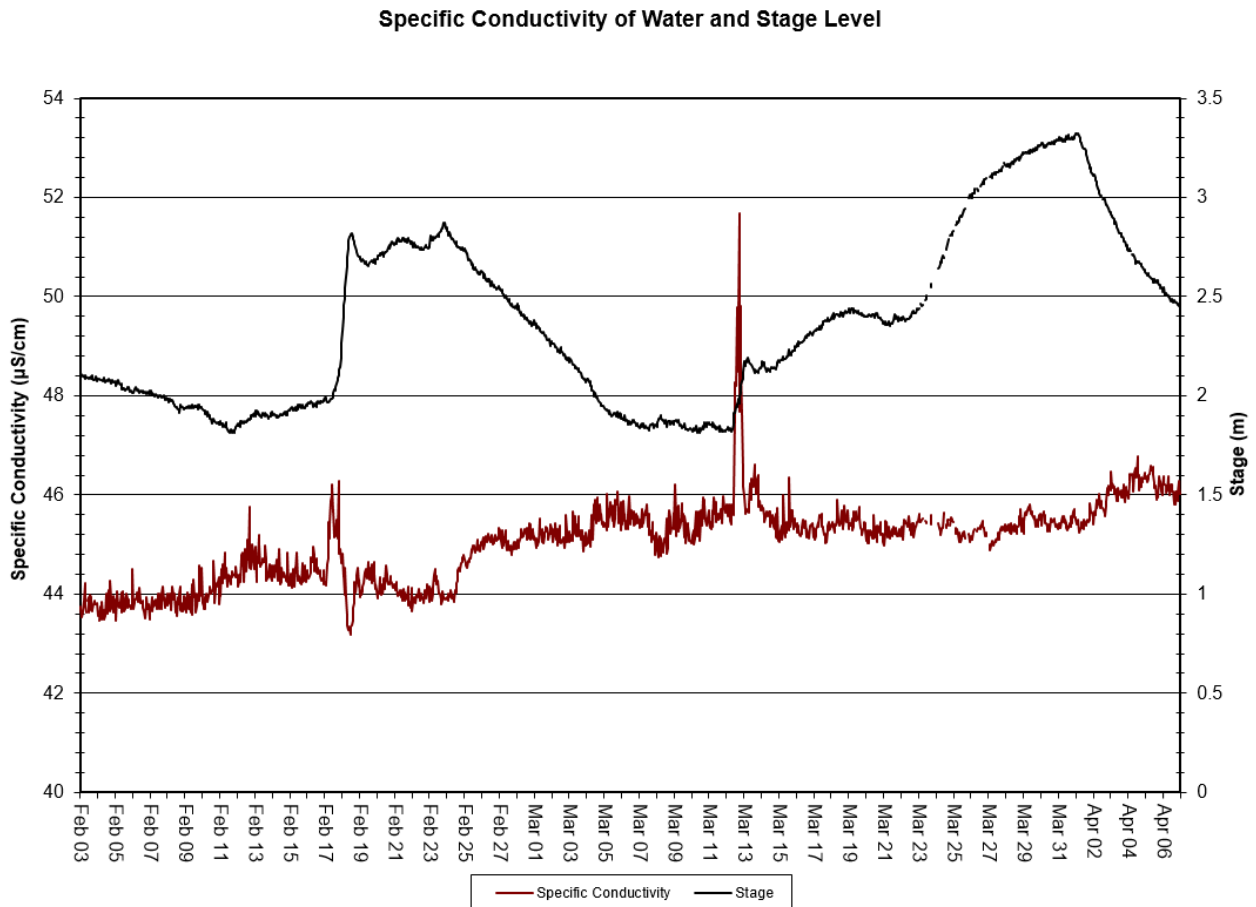


Figure 4: Specific conductivity at Humber River from February 3, 2022, to April 8, 2022



### 5) Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 13.29 mg/L to 13.84 mg/L, with an average of 13.63 mg/L. Dissolved oxygen percent-saturation ranged from 94.5% to 97.2%, with an average of 95.5%.
- Dissolved oxygen has a tendency to have an inverted response to changes in water temperature, meaning that oxygen level increases in lower temperatures, and decreases with higher temperatures.
- This data shows a normal trend as winter progresses, with cold water as well as stable, oxygenated water.
- Values remained above the thresholds of the CCME guidelines for the protection of both early and other life stages (CCME, 2007).

**Dissolved Oxygen Concentration, Saturation & Water Temperature**

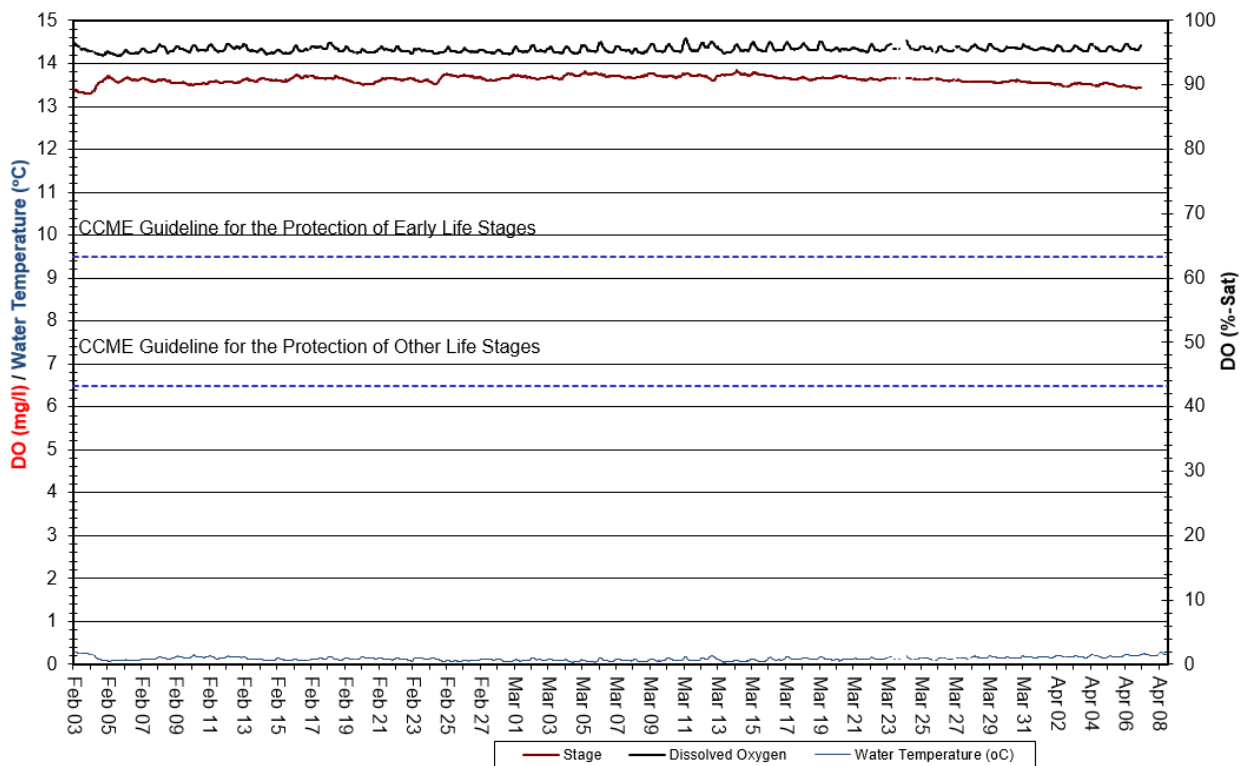


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River February 3, 2022, to April 8, 2022

## 6) Turbidity

- Throughout the deployment period, turbidity ranged from 1.4 NTU to 14.2 NTU, with an average turbidity of 1.7 NTU.
- Turbidity was relatively stable throughout deployment, with some spikes corresponding to precipitation events and subsequent stage increases.

Water Turbidity, Stage Level & Precipitation

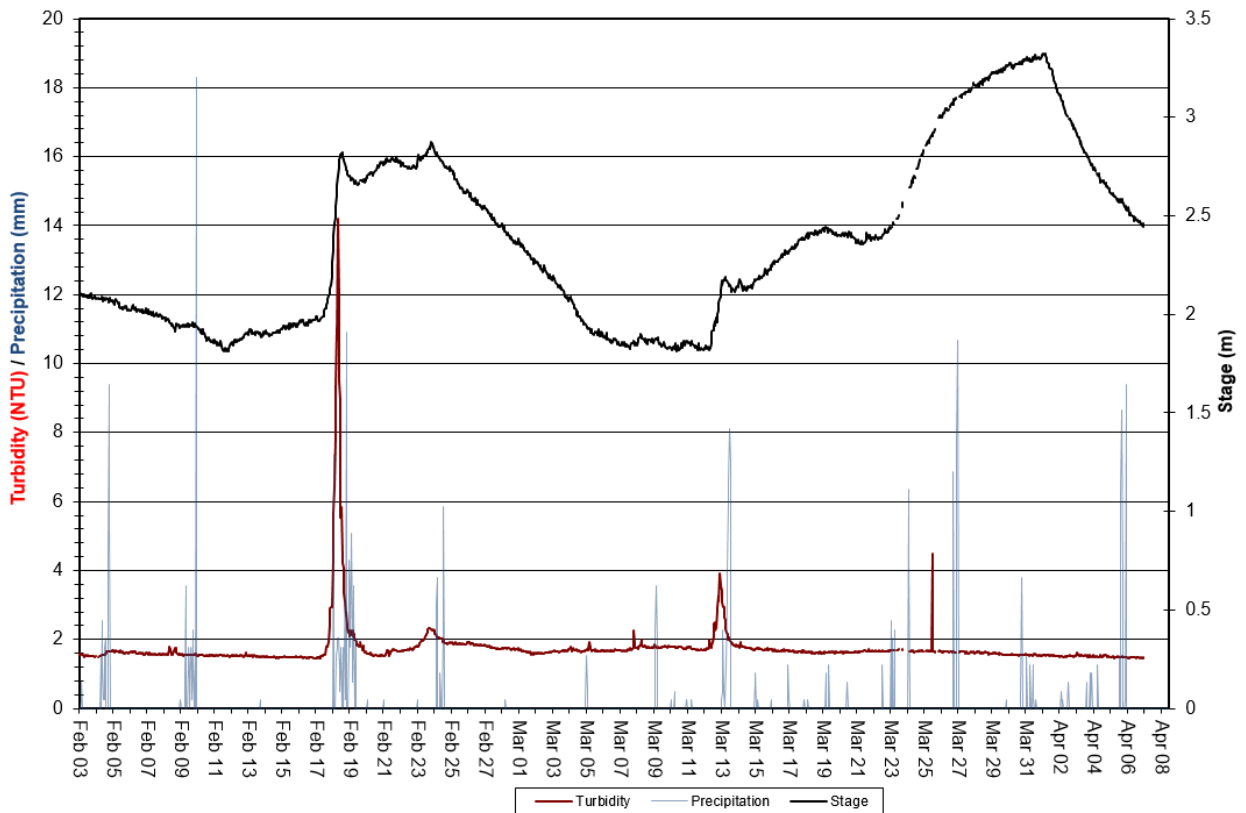


Figure 6: Turbidity, Stage, & Precipitation at Humber River from February 3, 2022, to April 8, 2022

## Conclusions

- This deployment report outlines the findings of water quality and water quantity data recorded over a period of 65 days at the Humber River at Humber Village February 3, 2022, to April 8, 2022.
- QA/CA rankings at the start of the deployment were mostly satisfactory, with 3/5 sensors ranking “Excellent”, one sensor ranking “Good”, and the one outlier ranking “Marginal”, which was the pH sensor (which later acclimated and delivered typical data). At removal, the QA/QC ranking for dissolved oxygen downgraded from “Excellent” to “Good”, and the pH ranking improved from “Marginal” to “Fair”. There were no other QA/QC rank changes to the other sensors.
- The following are summarized statements regarding the findings at Humber River:
  - o Stage & Flow: Stage ranged from 1.81 m to 3.32 m, averaging at 2.37 m. Flow ranged from 191.45 m<sup>3</sup>/s to 465.72 m<sup>3</sup>/s, averaging 286.21 m<sup>3</sup>/s. The increases in the data are attributed to precipitation events that occurred throughout the deployment period.
  - o Water Temperature: Ranged from 0.33 °C to 1.89 °C, averaging 0.88 °C. remained steady throughout due to the winter climate.
  - o pH: Ranged from 6.29 to 6.96, averaging 6.88 pH units. pH remained stable, with the only notable issue occurring at deployment where readings were at their lowest. This was attributed to a sensor issue which later corrected itself and reported normal levels. Data was within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
  - o Specific Conductivity: Ranged from 43.2 µS/cm to 51.7 µS/cm, averaging at 45.0 µS/cm. Conductance steadily increased overall with occasional responses corresponding to stage decreases (peaks) and precipitation causing stage increases (spiked due to initial precipitation with gradual dips thereafter as stage rose and the system diluted).
  - o Dissolved Oxygen: Concentration ranged from 13.29 mg/L to 13.84 mg/L, averaging at 13.63 mg/L; percent-saturation ranged from 94.5% to 97.2%, averaging at 95.5%. Concentrations remained steady and high during the winter months. Data met the acceptance thresholds of the CCME’s guidelines for the protection of both early and other life stages.
  - o Turbidity: Ranged from 1.4 NTU to 14.2 NTU, averaging 1.7 NTU. Turbidity was relatively stable throughout deployment, with spikes corresponding to precipitation events and subsequent stage increases.

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## 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)<sup>1</sup>.

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
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

<sup>1</sup> 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

### WRMD Climate Station – Humber Village at Humber Village Bridge

Date	Air Temp (Avg) °C	Air Temp (Min) °C	Air Temp (Max) °C	Total Precipitation (mm)
February 3, 2022	2.61	-3.19	5.50	5.84
February 4, 2022	-5.67	-9.56	0.03	22.86
February 5, 2022	-7.52	-9.15	-5.95	0.00
February 6, 2022	-10.16	-11.57	-8.25	0.00
February 7, 2022	-6.77	-11.86	-2.77	0.00
February 8, 2022	-0.60	-3.78	2.78	7.87
February 9, 2022	0.96	-1.62	3.52	27.43
February 10, 2022	0.58	-1.25	2.41	0.00
February 11, 2022	1.48	-1.42	3.95	0.00
February 12, 2022	3.57	-4.00	10.21	0.00
February 13, 2022	-1.55	-8.73	5.86	0.25
February 14, 2022	-10.52	-12.21	-9.05	0.00
February 15, 2022	-10.91	-13.08	-8.67	0.00
February 16, 2022	-10.08	-12.59	-6.64	0.00
February 17, 2022	1.61	-6.91	6.11	19.81
February 18, 2022	5.46	-4.51	11.05	47.24
February 19, 2022	-6.13	-7.67	-4.05	0.25
February 20, 2022	-5.08	-7.64	-0.60	0.25
February 21, 2022	-2.36	-5.93	1.24	0.00
February 22, 2022	-9.30	-11.83	-3.85	0.25
February 23, 2022	-2.26	-11.98	9.16	8.13
February 24, 2022	-6.09	-9.55	0.72	8.64
February 25, 2022	-10.37	-11.90	-7.57	0.00
February 26, 2022	-10.28	-13.72	-7.79	0.00
February 27, 2022	-5.68	-8.17	-3.86	0.25
February 28, 2022	-7.00	-9.60	-4.63	0.00
March 1, 2022	-10.62	-12.53	-7.98	0.00
March 2, 2022	-3.52	-8.78	1.50	0.00
March 3, 2022	-4.44	-8.69	0.19	0.00
March 4, 2022	-8.72	-10.65	-6.84	2.29
March 5, 2022	-6.64	-9.54	-3.80	0.00
March 6, 2022	-5.23	-8.56	-2.35	0.00
March 7, 2022	-3.28	-6.03	-0.35	0.00
March 8, 2022	-0.10	-2.43	2.69	7.62
March 9, 2022	-3.12	-4.63	-1.80	0.76
March 10, 2022	-2.10	-6.23	0.72	0.51

March 11, 2022	-1.14	-3.38	0.38	0.00
March 12, 2022	-0.77	-8.08	12.15	33.28
March 13, 2022	1.07	-6.96	13.17	7.11
March 14, 2022	-5.13	-6.22	-2.47	2.03
March 15, 2022	-2.04	-4.93	1.04	0.25
March 16, 2022	-6.37	-11.88	-2.21	1.78
March 17, 2022	-1.71	-7.71	4.33	0.51
March 18, 2022	3.32	1.16	6.21	2.29
March 19, 2022	-0.67	-5.60	1.23	0.76
March 20, 2022	-3.20	-7.44	0.72	0.00
March 21, 2022	0.30	-1.12	1.56	0.00
March 22, 2022	0.43	-0.48	1.74	8.13
March 23, 2022	1.55	-0.24	4.04	10.41
March 24, 2022	0.64	-3.33	4.46	0.00
March 25, 2022	0.25	-4.63	4.65	0.00
March 26, 2022	1.28	-0.78	3.91	25.40
March 27, 2022	2.81	-1.87	9.44	0.00
March 28, 2022	6.33	2.34	13.11	0.00
March 29, 2022	3.67	0.75	7.46	0.25
March 30, 2022	1.80	0.24	3.22	8.64
March 31, 2022	2.41	-0.75	3.99	0.25
April 1, 2022	2.39	-0.85	4.80	0.76
April 2, 2022	4.12	2.24	9.49	0.76
April 3, 2022	1.99	1.12	2.87	4.06
April 4, 2022	3.18	0.22	6.77	0.00
April 5, 2022	0.47	-0.64	1.52	29.72
April 6, 2022	2.35	0.92	3.79	0.00
April 7, 2022	4.12	1.81	7.48	0.00
April 8, 2022	4.03	0.49	7.97	0.00

## **APPENDIX C**

**Grab Sample Results (next page)**





BUREAU  
VERITAS

Bureau Veritas Job #: C235322  
Report Date: 2022/02/19

NL Department of Environment, Climate Change and  
Municipalities  
Your P.O. #: 220028978-5

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RUZ605 HUMBER VILLAGE BRIDGE								
Sampling Date		2022/02/03 12:25						
Matrix		W						
Sample #		2022-5000-00-SI-SP						
Registration #		WS-S-0000						
<b>RESULTS OF ANALYSES OF WATER</b>								
<b>Calculated Parameters</b>								
Hardness (CaCO3)	-	16	1.0	mg/L	N/A	2022/02/15		7826286
Nitrate (N)	-	0.12	0.050	mg/L	N/A	2022/02/15		7826289
Total dissolved solids (calc., EC)	-	23	1.0	mg/L	N/A	2022/02/15		7826342
<b>Inorganics</b>								
Conductivity	-	41	1.0	uS/cm	N/A	2022/02/15	SHW	7833800
Chloride (Cl-)	-	4.6	1.0	mg/L	N/A	2022/02/15	FD	7831016
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/02/15	FD	7831016
Sulphate (SO4)	-	1.3	1.0	mg/L	N/A	2022/02/15	FD	7831016
Total Alkalinity (Total as CaCO3)	-	15	5.0	mg/L	N/A	2022/02/15	MCN	7832045
Colour	-	60	25	TCU	N/A	2022/02/15	MCN	7833780
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/02/15	SHW	7833802
Total Kjeldahl Nitrogen (TKN)	-	0.19	0.10	mg/L	2022/02/11	2022/02/15	RTY	7829882
Nitrate + Nitrite (N)	-	0.12	0.050	mg/L	N/A	2022/02/15	MCN	7833784
Nitrite (N)	-	ND	0.010	mg/L	N/A	2022/02/15	MCN	7833785
Nitrogen (Ammonia Nitrogen)	-	0.11	0.050	mg/L	N/A	2022/02/14	MCN	7831953
Dissolved Organic Carbon (C)	-	5.9	0.50	mg/L	N/A	2022/02/15	NGI	7828960
Total Organic Carbon (C)	-	6.0	0.50	mg/L	N/A	2022/02/15	NGI	7833834
pH	-	7.05		pH	N/A	2022/02/15	SHW	7833801
Total Phosphorus	-	0.006	0.004	mg/L	2022/02/11	2022/02/14	SSV	7829630
Total Suspended Solids	-	1.2	1.0	mg/L	2022/02/10	2022/02/11	MKX	7826398
Turbidity	-	1.0	0.10	NTU	N/A	2022/02/11	SHW	7828587
<b>ELEMENTS BY ICP/MS (WATER)</b>								
<b>Metals</b>								
Total Aluminum (Al)	-	0.099	0.0050	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Barium (Ba)	-	0.0092	0.0010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Boron (B)	-	ND	0.050	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Calcium (Ca)	-	4.7	0.10	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Copper (Cu)	-	0.00058	0.00050	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Iron (Fe)	-	0.13	0.050	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Magnesium (Mg)	-	0.93	0.10	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Manganese (Mn)	-	0.0074	0.0020	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Potassium (K)	-	0.27	0.10	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/02/10	2022/02/14	BAN	7826945



BUREAU  
VERITAS

Bureau Veritas Job #: C235322  
Report Date: 2022/02/19

NL Department of Environment, Climate Change and  
Municipalities  
Your P.O. #: 220028978-5

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RUZ605 HUMBER VILLAGE BRIDGE								
Sampling Date		2022/02/03 12:25						
Matrix		W						
Sample #		2022-5000-00-SI-SP						
Registration #		WS-S-0000						
<b>ELEMENTS BY ICP/MS (WATER)</b>								
<b>Metals</b>								
Total Sodium (Na)	-	2.9	0.10	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Strontium (Sr)	-	0.021	0.0020	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Uranium (U)	-	ND	0.00010	mg/L	2022/02/10	2022/02/14	BAN	7826945
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/02/10	2022/02/14	BAN	7826945
<b>ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)</b>								
<b>Metals</b>								
Mercury (Hg)	-	ND	0.00001	mg/L	2022/02/15	2022/02/15	PBA	7834656