



Real Time Water Quality Report Humber River at Humber Village

Deployment Period
2022-06-03 to 2022-07-13



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 June 3, and July 13, 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.

Station: Humber River at Humber Village		
Stage of Deployment (Date)	Deployment (June 3, 2022)	Removal (July 13, 2022)
<i>Parameter (Unit)</i>	<i>Rank</i>	<i>Rank</i>
Temperature (°C)	Excellent	Fair
pH (dimensionless unit)	Good	Excellent
Specific Conductivity (µS/cm)	Good	Marginal
Dissolved Oxygen (mg/L)	Excellent	Excellent
Turbidity (NTU)	Excellent	Excellent

Deployment Notes

This deployment took place over the course of 41 days (June 3, 2022, to July 13, 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 1.93 m and 3.37 m with an average stage height of 2.58 m
- Flow ranged from 209.69 m³/s to 476.37 m³/s with an average speed of 320.60 m³/s.
- Stage/Flow decreased overall throughout the deployment, with a notable increase towards the end. As the remainder of the spring runoff from the upper watershed snowpack melted, water level naturally decreased.
- Levels periodically increased due to episodes of precipitation (see Appendix B).

Stage & Flow

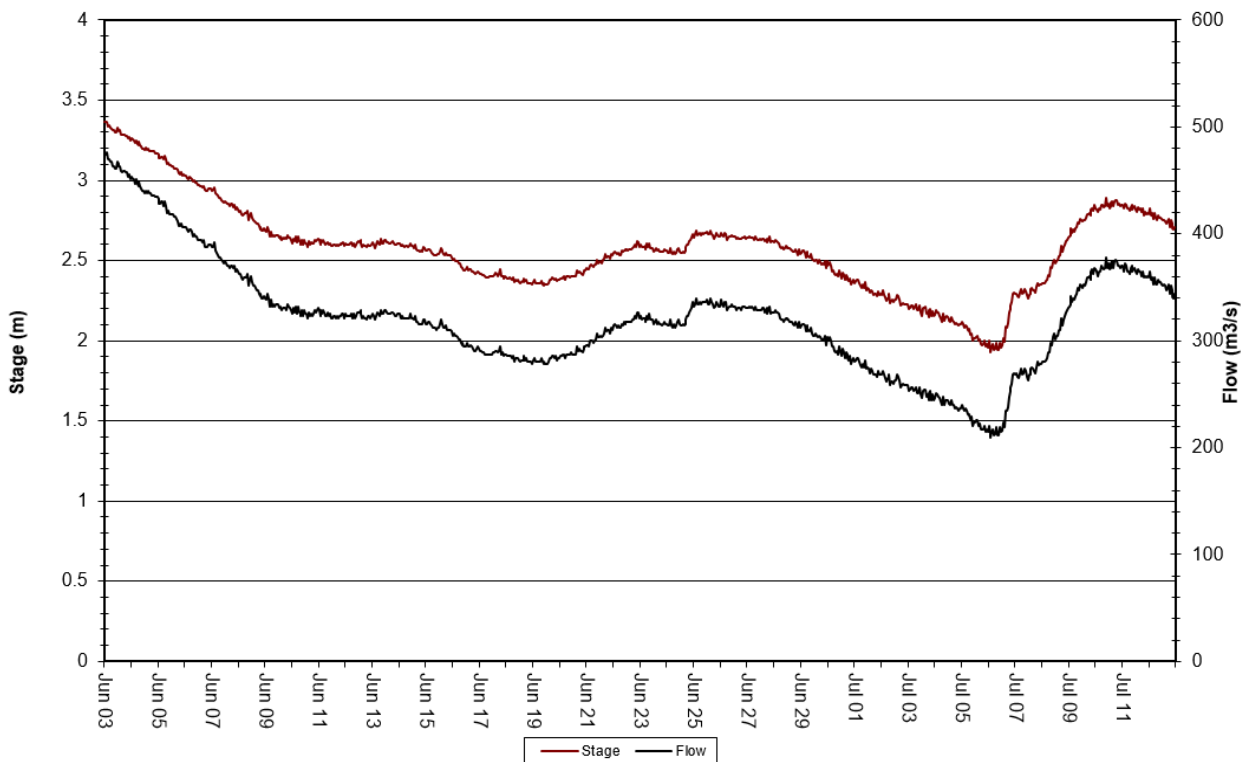


Figure 1: Stage & Flow at Humber River from June 3, 2022, to July 13, 2022

2) Temperature

- Throughout the deployment period, the water temperature ranged between 6.12 °C and 18.65 °C, with an average temperature of 11.67 °C.
- Temperatures gradually increased throughout the deployment, typical of the late-spring and summer seasons.
- The combination of air temperatures and precipitation caused some frequent fluctuations in water temperatures; the data is otherwise normal.

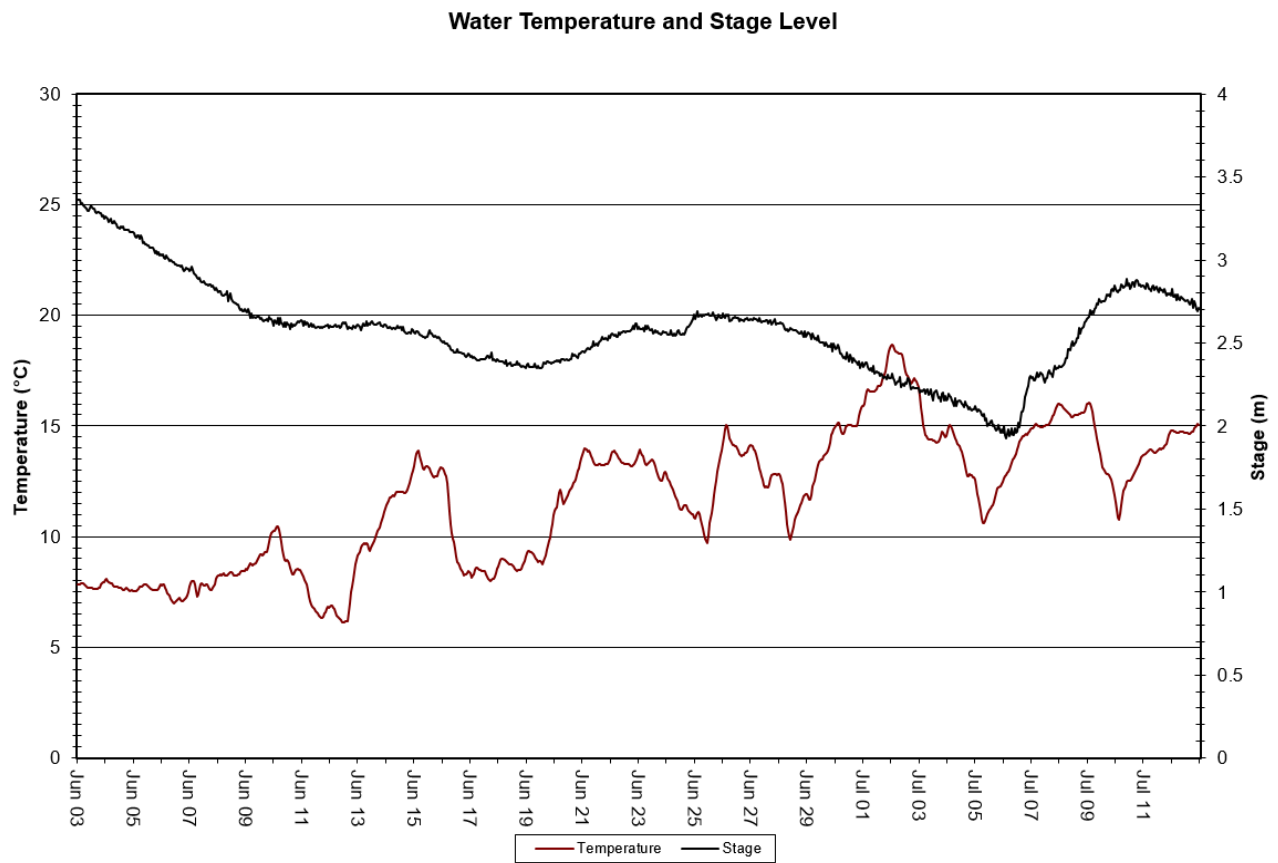


Figure 2: Water Temperature at Humber River from June 3, 2022, to July 13, 2022

3) pH

- pH ranged between 6.71 and 6.99 during the deployment period, with an average of 6.81 pH units.
- 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).

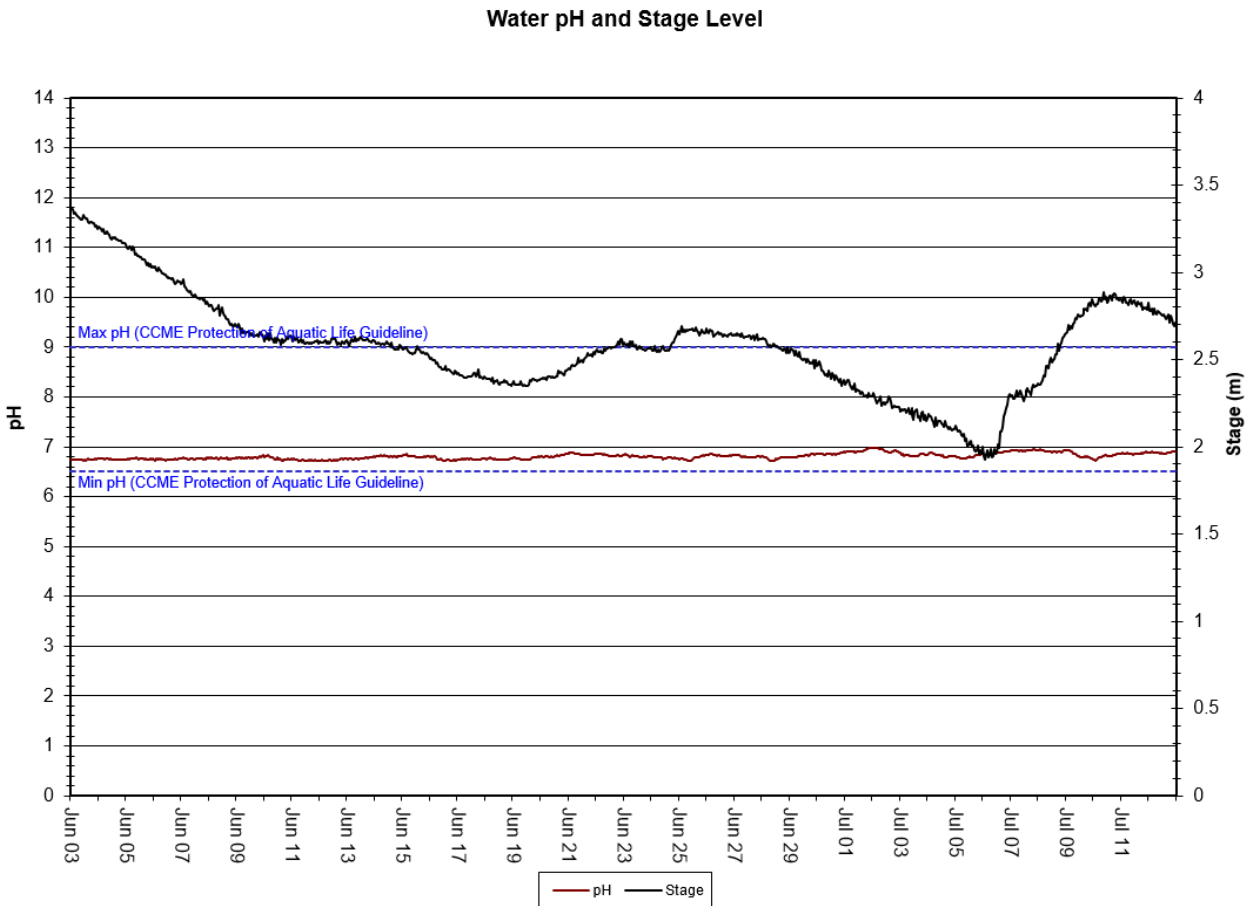


Figure 3: pH values recorded at Humber River from June 3, 2022, to July 13, 2022

4) Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 33.7 $\mu\text{S}/\text{cm}$ and 38.8 $\mu\text{S}/\text{cm}$, with an average of 36.0 $\mu\text{S}/\text{cm}$.
- Fluctuations during the early half of this deployment were likely the cause of the spring runoff from the higher elevations in the area and precipitation events. Levels would stabilize in the later half for the rest of the deployment.
- This is a normal occurrence at the start of the summer for this station.

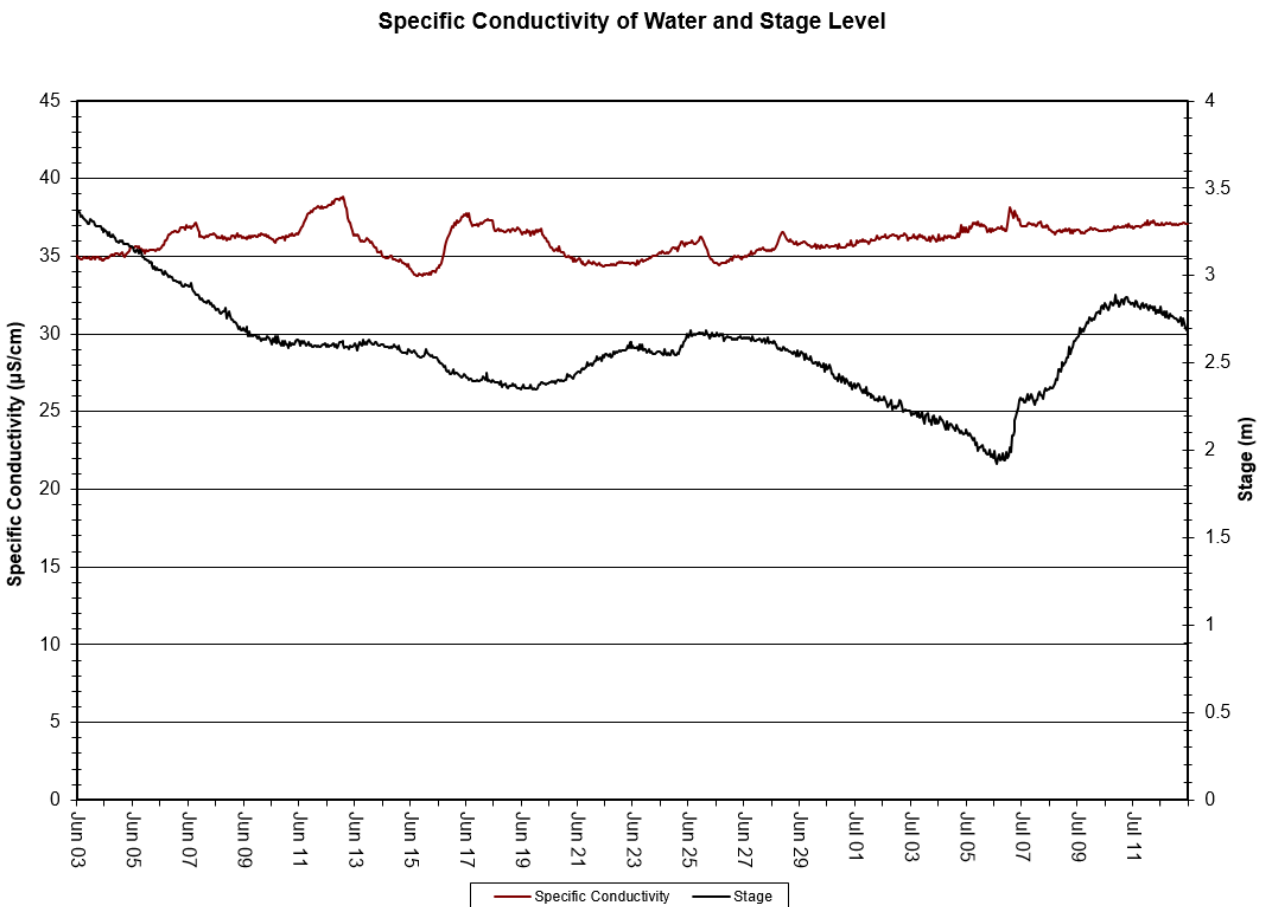


Figure 4: Specific conductivity at Humber River from June 3, 2022, to July 13, 2022

5) Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 9.76 mg/L to 12.46 mg/L, with an average of 11.13 mg/L. Dissolved oxygen percent-saturation ranged from 99.0% to 105.9%, with an average of 102.1%.
- Dissolved oxygen is inversely related to water temperature, meaning that oxygen level increases in lower temperatures, and decrease in higher temperatures.
- This data shows a normal trend as spring transitions into summer onward, with warming water bringing lower levels of concentrated oxygen.
- Values remained above the thresholds of the CCME guidelines for the protection of both early and other life stages (CCME, 2007).

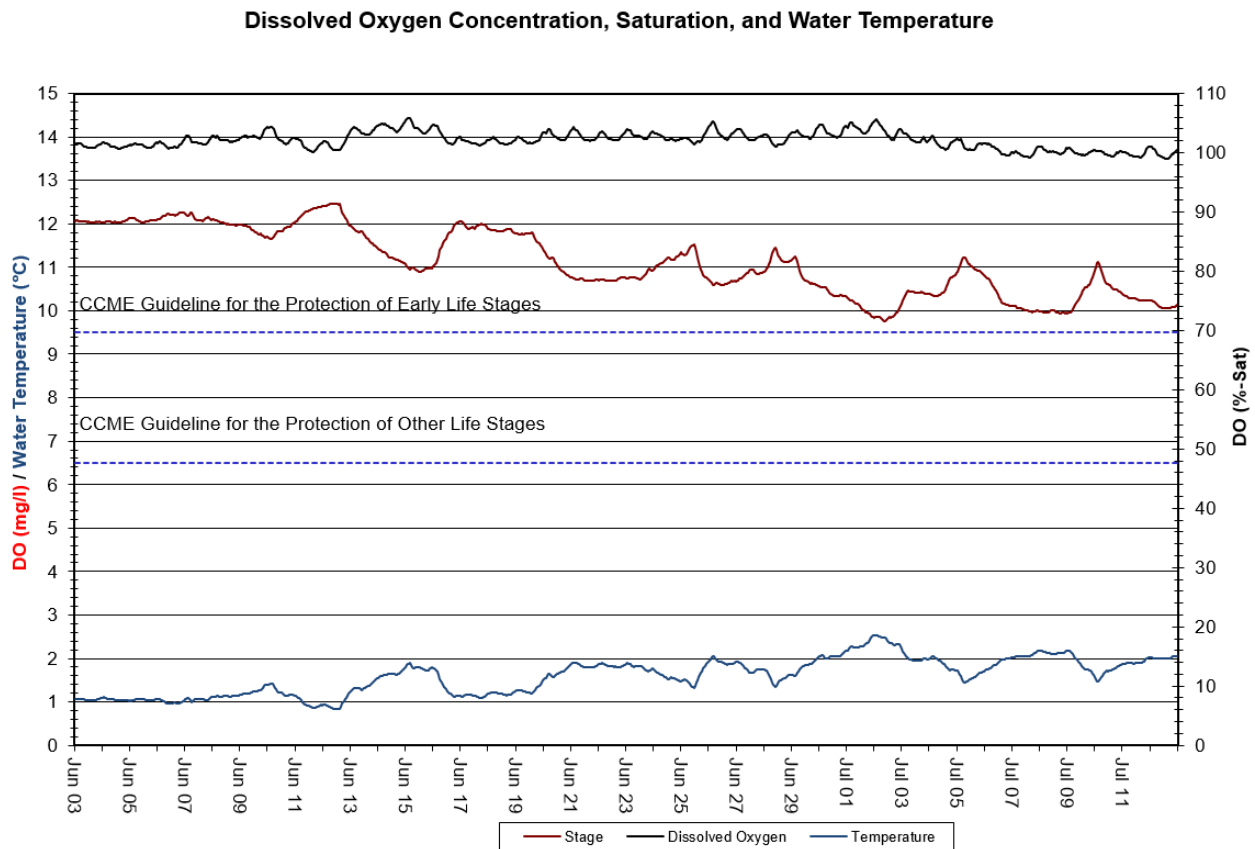


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River June 3, 2022, to July 13, 2022

6) Turbidity

- Throughout the deployment period, turbidity ranged from 0.2 NTU to 6.6 NTU, with an average turbidity of 0.5 NTU.
- Turbidity was stable throughout deployment, keeping within a < 1.0 NTU range, with the exception of one noteworthy spike corresponding to an episode of high precipitation towards the end of the deployment period.

Water Turbidity, Stage Level, and Precipitation

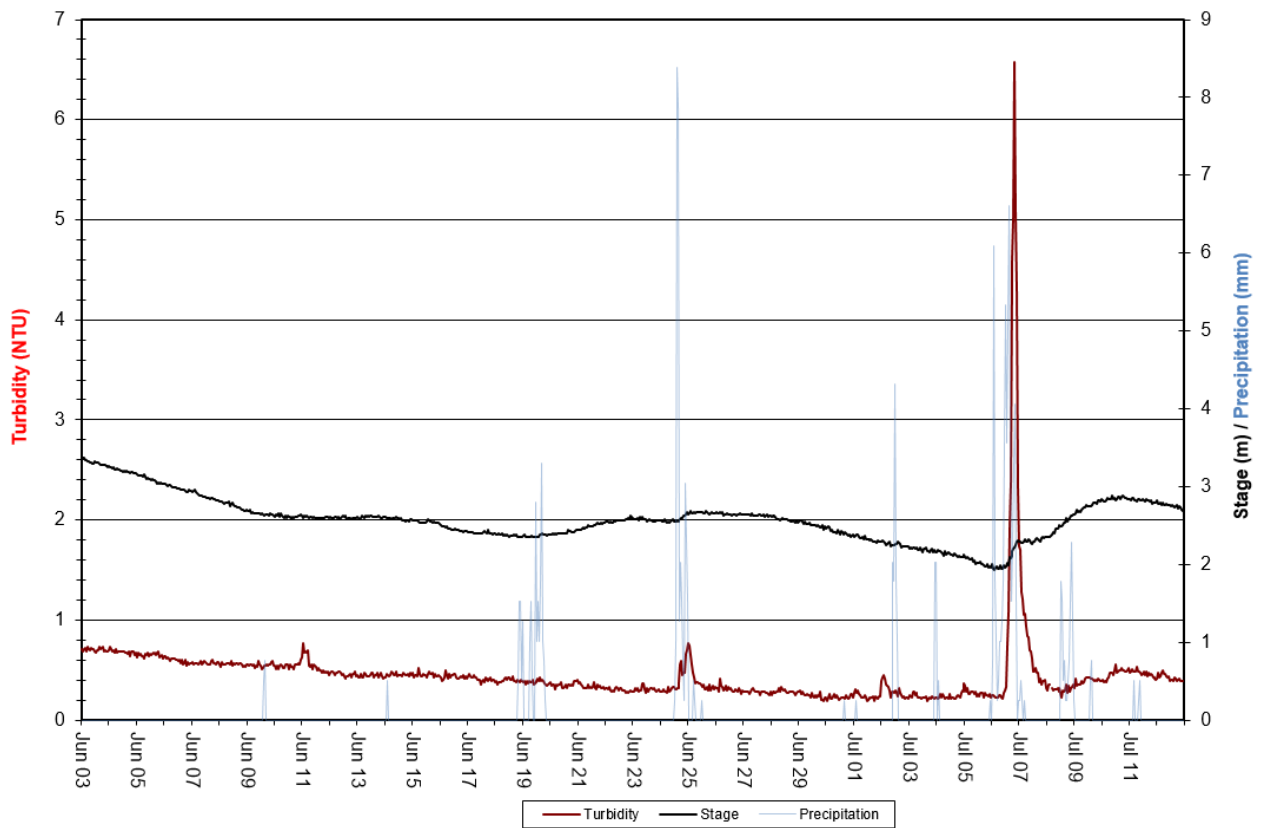


Figure 6: Turbidity, Stage, & Precipitation at Humber River from June 3, 2022, to July 13, 2022

Conclusions

- This deployment report outlines the findings of water quality and water quantity data recorded over a period of 41 days at the Humber River at Humber Village June 3, 2022, to July 13, 2022.
- QA/CA rankings at the start of the deployment were satisfactory, with 3/5 sensors ranking “Excellent”, 2/5 sensors ranking “Good”. At removal, the QA/QC ranking for temperature downgraded from “Excellent” to “Fair”, while specific conductivity downgraded from “Excellent” to “Marginal”. At removal, QA/QC ranking for pH improved from “Good” to “Excellent”.
- The following are summarized statements regarding the findings at Humber River:
 - o Stage & Flow: Stage ranged from 1.93 m to 3.37 m, averaging at 2.58 m. Flow ranged from 209.69 m³/s to 476.37 m³/s, averaging 320.60 m³/s. Stage decreased overall as the remainder of the spring runoff from snowpack melted and ran through the system.
 - o Water Temperature: Ranged from 6.12 °C to 18.65 °C, averaging 11.67 °C. Gradually increased throughout the deployment with frequent fluctuation caused by combination of diurnal fluctuations in the air temperature, occasional precipitative episodes and normal seasonal changes.
 - o pH: Ranged from 6.71 to 6.99, averaging 6.81 pH units. Remained stable, and data was within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
 - o Specific Conductivity: Ranged from 33.7 µS/cm to 38.8 µS/cm, averaging at 36.0 µS/cm. Fluctuations occurred due to ice-melt and spring runoff from the land (decreased conductivity). Conductivity later stabilized, reporting normal levels.
 - o Dissolved Oxygen: Concentration ranged from 9.76 mg/L to 12.46 mg/L, averaging at 11.13 mg/L; percent-saturation ranged from 99.0% to 105.9%, averaging at 102.1%. Concentrations decreased overall due to the warming climate over the spring and summer. Data met the acceptance thresholds of the CCME’s guidelines for the protection of both early and other life stages.
 - o Turbidity: Ranged from 0.2 NTU to 6.6 NTU, averaging 0.5 NTU. Turbidity was stable throughout deployment, with one spike corresponding to a high-precipitation event towards the end of the deployment period.

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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.ccmec.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
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

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)
June 3, 2022	10.29	6.98	12.46	0.00
June 4, 2022	9.79	5.16	14.11	0.00
June 5, 2022	9.45	3.80	12.52	0.00
June 6, 2022	11.87	8.53	17.60	0.00
June 7, 2022	12.24	5.62	18.15	0.00
June 8, 2022	13.40	3.34	21.50	0.00
June 9, 2022	13.75	9.26	20.37	0.00
June 10, 2022	18.58	14.06	22.79	1.27
June 11, 2022	17.22	10.66	23.25	0.00
June 12, 2022	18.46	12.49	24.54	0.00
June 13, 2022	16.50	10.24	24.76	0.00
June 14, 2022	16.84	9.66	23.67	0.51
June 15, 2022	16.71	10.17	24.41	0.00
June 16, 2022	19.31	9.85	28.04	0.00
June 17, 2022	18.91	13.38	25.09	0.00
June 18, 2022	18.74	15.29	22.99	0.00
June 19, 2022	18.31	16.33	21.02	8.38
June 20, 2022	18.10	13.02	24.06	13.46
June 21, 2022	14.37	9.98	20.71	0.00
June 22, 2022	14.61	10.88	20.50	0.00
June 23, 2022	18.34	9.46	26.35	0.00
June 24, 2022	21.06	16.48	25.04	0.00
June 25, 2022	19.57	17.58	21.64	30.99
June 26, 2022	19.88	13.63	28.11	0.25
June 27, 2022	20.25	13.16	26.15	0.00
June 28, 2022	19.77	16.58	21.86	0.00
June 29, 2022	20.01	12.90	25.12	0.00
June 30, 2022	18.52	11.03	26.83	0.00
July 1, 2022	19.38	14.91	25.90	0.51
July 2, 2022	20.92	12.46	29.35	2.03
July 3, 2022	21.03	16.72	26.20	8.89
July 4, 2022	15.70	11.20	20.01	4.57
July 5, 2022	16.89	13.21	20.13	0.00
July 6, 2022	15.49	10.78	19.60	15.75

July 7, 2022	15.75	13.57	17.38	42.42
July 8, 2022	17.53	11.43	22.85	0.00
July 9, 2022	16.26	13.05	20.28	11.68
July 10, 2022	15.68	13.17	18.20	1.27
July 11, 2022	17.12	11.64	22.32	1.27
July 12, 2022	20.02	14.55	26.54	0.00
July 13, 2022	19.78	16.35	21.97	0.00

APPENDIX C

Grab Sample Results (next page)



BUREAU
VERITAS

Bureau Veritas Job #: C2F8141
Report Date: 2022/06/23

NL Department of Environment, Climate Change and
Municipalities
Site Location: HUMBER RIVER @ HUMBER VILLAGE BRIDGE
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SVU986 HUMBER RIVER @ HUMBER VILLAGE BRIDGE								
Sampling Date		2022/06/03 14:25						
Matrix		W						
Sample #		2022-5004-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	11	1.0	mg/L	N/A	2022/06/14		8043091
Nitrate (N)	-	0.084	0.050	mg/L	N/A	2022/06/16		8043093
Total dissolved solids (calc., EC)	-	20	1.0	mg/L	N/A	2022/06/19		8043094
Inorganics								
Conductivity	-	35	1.0	uS/cm	N/A	2022/06/19	KMC	8061387
Chloride (Cl-)	-	3.5	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Total Alkalinity (Total as CaCO3)	-	10	2.0	mg/L	N/A	2022/06/19	KMC	8061390
Colour	-	48	5.0	TCU	N/A	2022/06/16	MCN	8056021
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/06/19	KMC	8061393
Total Kjeldahl Nitrogen (TKN)	-	0.22	0.10	mg/L	2022/06/15	2022/06/16	RTY	8055574
Nitrate + Nitrite (N)	-	0.084	0.050	mg/L	N/A	2022/06/16	MCN	8056023
Nitrite (N)	-	ND	0.010	mg/L	N/A	2022/06/16	MCN	8056025
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/06/16	MCN	8057202
Dissolved Organic Carbon (C)	-	5.2	0.50	mg/L	N/A	2022/06/22	JHH	8067096
Total Organic Carbon (C)	-	4.9	0.50	mg/L	N/A	2022/06/22	JHH	8064903
pH	-	6.98		pH	N/A	2022/06/19	KMC	8061383
Total Phosphorus	-	ND	0.008	mg/L	2022/06/19	2022/06/19	SSV	8061962
Total Suspended Solids	-	1.4	1.0	mg/L	2022/06/10	2022/06/15	RMK	8044791
Turbidity	-	1.3	0.10	NTU	N/A	2022/06/17	KMC	8056780
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	N/A	2022/06/17	FJO	8056852
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.095	0.0050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Barium (Ba)	-	0.0071	0.0010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Boron (B)	-	ND	0.050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Calcium (Ca)	-	3.3	0.10	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Copper (Cu)	-	0.00059	0.00050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Iron (Fe)	-	0.15	0.050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Magnesium (Mg)	-	0.71	0.10	mg/L	2022/06/13	2022/06/14	JHY	8048291



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Bureau Veritas Job #: C2F8141
Report Date: 2022/06/23

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Site Location: HUMBER RIVER @ HUMBER VILLAGE BRIDGE
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SVU986 HUMBER RIVER @ HUMBER VILLAGE BRIDGE								
Sampling Date		2022/06/03 14:25						
Matrix		W						
Sample #		2022-5004-00-SI-SP						
Registration #		WS-S-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.0084	0.0020	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Potassium (K)	-	0.23	0.10	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Sodium (Na)	-	2.3	0.10	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Strontium (Sr)	-	0.015	0.0020	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Uranium (U)	-	ND	0.00010	mg/L	2022/06/13	2022/06/14	JHY	8048291
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/06/13	2022/06/14	JHY	8048291