

5) Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 10.70 mg/L to 13.53 mg/L, with an average of 12.06 mg/L. Dissolved oxygen percent-saturation ranged from 92.1% to 95.6%, with an average of 94.2%.
- Dissolved oxygen has a tendency to increase when water temperature decreases (and vice versa). This can be seen in Figure 5 as oxygen concentrations increased throughout the course of the deployment.
- This is a normal trend as fall transitions into the winter months, bringing with it a cooler climate.
- 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, and Water Temperature

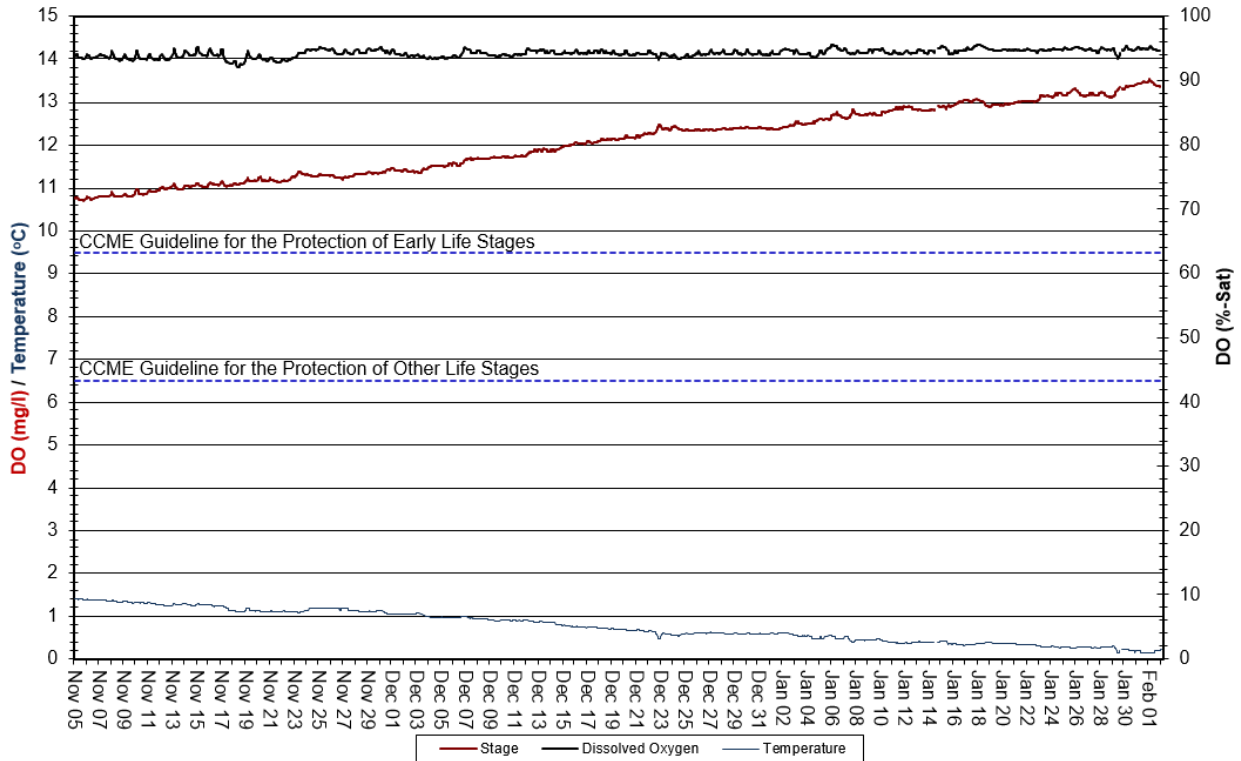


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River November 5, 2021, to February 2, 2022

6) Turbidity

- Throughout the deployment period, turbidity ranged from 1.2 NTU to 6.9 NTU, with an average turbidity of 1.5 NTU.
- Turbidity was relatively stable throughout deployment, with several spikes corresponding to precipitative events and subsequent stage increases. High volumes of rain over a few hours likely disturbed the water column and stirred the sediments.

Water Turbidity, Stage Level, and Precipitation

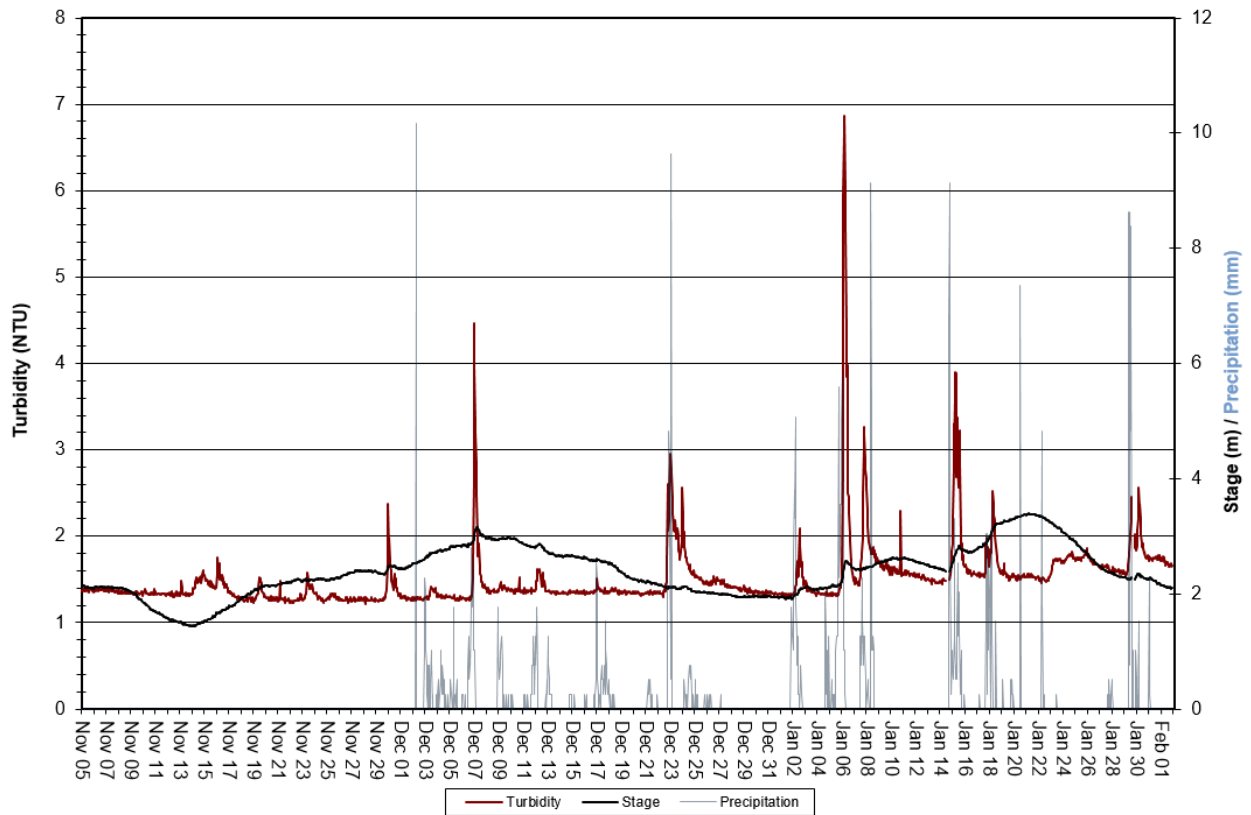


Figure 6: Turbidity (NTU) at Humber River from November 5, 2021, to February 2, 2022

Conclusions

- This deployment report outlines the findings of water quality and water quantity data recorded over a period of 90 days at the Humber River at Humber Village November 5, 2021, to February 2, 2022.
- QA/QC rankings at the start of the deployment duration were satisfactory, with 3/5 sensors ranking “Excellent”, and 2/5 sensors ranking “Good”. At removal, the QA/QC ranking for specific conductivity was the only sensor that fell to a “Fair” ranking. There were no QA/QC changes among the other sensors.
- The following are summarized statements regarding the findings at Humber River:
 - o Stage & Flow: Stage ranged from 1.43 m to 3.39 m, averaging at 2.38 m. Flow ranged from 138.121 m³/s to 480.660 m³/s, averaging 287.709 m³/s. The increases in the data are likely attributed to precipitative events that occurred throughout the deployment period.
 - o Water Temperature: Ranged from 0.97 °C to 9.39 °C, averaging 5.06 °C, steadily decreased throughout in response to the cooling climate of fall then winter.
 - o pH: Ranged from 6.27 to 7.00, averaging 6.91 pH units. Remained mostly stable, only notable decrease occurred during an increase in stage between November 14 and 17. Data was within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
 - o Specific Conductivity: Ranged from 41.75 µS/cm to 46.01 µS/cm, averaging at 43.26 µS/cm. Stable overall with occasional responses corresponding to stage decreases (peaked) and precipitation causing stage increases (spiked due to initial precipitation with gradual dips thereafter as stage rose).
 - o Dissolved Oxygen: Concentration ranged from 10.70 mg/L to 13.53 mg/L, averaging at 12.06 mg/L; percent-saturation ranged from 92.1% to 95.6%, averaging at 94.2%. Concentrations increased steadily in response to consistently cooling temperatures. Data met the acceptance thresholds of the CCME’s guidelines for the protection of both early and other life stages.
 - o Turbidity: Ranged from 1.2 NTU to 6.9 NTU, averaging 1.5 NTU. Was relatively stable throughout deployment, with several spikes corresponding to precipitative events and subsequent 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://cegg-rcqe.cme.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) |
|-------------------|-------------------|-------------------|-------------------|--------------------------|
| November 5, 2021 | 4.286 | 2.869 | 6.150 | 0.00 |
| November 6, 2021 | 4.929 | 2.718 | 8.310 | 0.00 |
| November 7, 2021 | 9.472 | 7.678 | 10.430 | 0.00 |
| November 8, 2021 | 8.180 | 4.041 | 11.660 | 0.00 |
| November 9, 2021 | 7.416 | 2.077 | 11.170 | 0.00 |
| November 10, 2021 | 7.460 | 5.154 | 8.810 | 0.00 |
| November 11, 2021 | 3.308 | 0.932 | 5.013 | 0.00 |
| November 12, 2021 | 0.229 | -2.683 | 1.245 | 0.00 |
| November 13, 2021 | 4.918 | -2.697 | 11.140 | 0.00 |
| November 14, 2021 | 6.187 | 3.973 | 10.170 | 0.00 |
| November 15, 2021 | 5.745 | 3.934 | 7.858 | 0.00 |
| November 16, 2021 | 6.179 | 3.789 | 7.901 | 0.00 |
| November 17, 2021 | 3.266 | 1.763 | 4.334 | 0.00 |
| November 18, 2021 | 2.433 | 1.723 | 5.321 | 0.00 |
| November 19, 2021 | 10.054 | 5.313 | 15.870 | 0.00 |
| November 20, 2021 | 3.049 | 1.590 | 5.341 | 0.00 |
| November 21, 2021 | 2.853 | 0.178 | 5.146 | 0.00 |
| November 22, 2021 | 6.425 | 3.623 | 9.130 | 0.00 |
| November 23, 2021 | 8.998 | 7.770 | 11.190 | 0.00 |
| November 24, 2021 | 13.340 | 11.090 | 14.810 | 0.00 |
| November 25, 2021 | 10.565 | 8.700 | 15.360 | 0.00 |
| November 26, 2021 | 10.211 | 9.020 | 12.230 | 0.00 |
| November 27, 2021 | 9.622 | 7.338 | 13.490 | 0.00 |
| November 28, 2021 | 5.051 | 2.981 | 8.340 | 0.00 |
| November 29, 2021 | 3.949 | 2.213 | 5.864 | 0.00 |
| November 30, 2021 | 8.435 | 1.802 | 13.790 | 0.00 |
| December 1, 2021 | 1.481 | 0.308 | 2.213 | 0.00 |
| December 2, 2021 | 2.860 | 1.186 | 4.592 | 0.87 |
| December 3, 2021 | 8.373 | 2.418 | 12.320 | 0.44 |
| December 4, 2021 | -2.131 | -3.632 | 1.638 | 0.28 |
| December 5, 2021 | -1.236 | -2.922 | 0.574 | 0.21 |
| December 6, 2021 | -0.313 | -1.968 | 3.274 | 0.79 |
| December 7, 2021 | 7.345 | 0.490 | 14.980 | 0.12 |
| December 8, 2021 | -1.074 | -2.291 | 0.556 | 0.13 |
| December 9, 2021 | -3.249 | -4.091 | -1.620 | 0.34 |
| December 10, 2021 | -3.859 | -6.070 | -2.407 | 0.02 |

| | | | | |
|-------------------|--------|---------|--------|------|
| December 11, 2021 | -0.657 | -4.416 | 1.886 | 0.28 |
| December 12, 2021 | 5.002 | 1.005 | 13.910 | 0.26 |
| December 13, 2021 | 2.034 | 0.546 | 2.918 | 0.20 |
| December 14, 2021 | -0.738 | -3.796 | 0.514 | 0.04 |
| December 15, 2021 | -5.171 | -6.030 | -4.169 | 0.01 |
| December 16, 2021 | -4.884 | -6.222 | -2.155 | 0.17 |
| December 17, 2021 | 1.532 | -4.959 | 4.241 | 0.61 |
| December 18, 2021 | 0.461 | -2.930 | 3.397 | 0.06 |
| December 19, 2021 | -4.162 | -4.832 | -3.287 | 0.00 |
| December 20, 2021 | -5.713 | -10.120 | -2.542 | 0.00 |
| December 21, 2021 | -2.299 | -4.768 | 0.673 | 0.13 |
| December 22, 2021 | -3.114 | -4.532 | -0.904 | 0.87 |
| December 23, 2021 | -1.602 | -4.922 | 1.840 | 0.49 |
| December 24, 2021 | -4.888 | -6.299 | -3.595 | 0.26 |
| December 25, 2021 | -1.494 | -3.731 | 0.088 | 0.06 |
| December 26, 2021 | 2.266 | -0.434 | 3.767 | 0.04 |
| December 27, 2021 | 2.971 | -0.323 | 4.696 | 0.01 |
| December 28, 2021 | 1.033 | -2.806 | 3.141 | 0.00 |
| December 29, 2021 | -0.422 | -3.037 | 2.880 | 0.00 |
| December 30, 2021 | -2.214 | -5.583 | 1.726 | 0.00 |
| December 31, 2021 | -2.693 | -5.481 | -0.263 | 0.00 |
| January 1, 2022 | 0.713 | -1.662 | 4.453 | 0.23 |
| January 2, 2022 | 4.988 | 2.974 | 7.143 | 1.15 |
| January 3, 2022 | -3.428 | -6.358 | 1.814 | 0.00 |
| January 4, 2022 | -8.489 | -9.890 | -6.551 | 0.26 |
| January 5, 2022 | -3.069 | -8.130 | 3.023 | 1.40 |
| January 6, 2022 | 4.614 | -4.159 | 9.740 | 0.80 |
| January 7, 2022 | -4.361 | -5.681 | -3.168 | 0.59 |
| January 8, 2022 | -3.631 | -6.978 | -1.312 | 0.90 |
| January 9, 2022 | -3.587 | -7.353 | 2.502 | 0.00 |
| January 10, 2022 | -1.350 | -8.200 | 3.022 | 0.00 |
| January 11, 2022 | -9.653 | -11.260 | -8.340 | 0.00 |
| January 12, 2022 | -7.783 | -10.300 | -4.366 | 0.00 |
| January 13, 2022 | -0.700 | -3.097 | 0.552 | 0.00 |
| January 14, 2022 | -2.387 | -6.631 | 0.597 | 1.24 |
| January 15, 2022 | 3.336 | -2.929 | 8.170 | 0.91 |
| January 16, 2022 | -6.799 | -7.848 | -4.847 | 0.00 |
| January 17, 2022 | -3.424 | -6.013 | 0.017 | 0.61 |
| January 18, 2022 | 5.068 | 0.640 | 8.640 | 0.62 |
| January 19, 2022 | -3.477 | -6.910 | 2.598 | 0.11 |
| January 20, 2022 | -2.521 | -7.539 | 3.088 | 0.44 |

| | | | | |
|------------------|---------|---------|--------|------|
| January 21, 2022 | -7.039 | -10.050 | -4.252 | 0.00 |
| January 22, 2022 | -6.293 | -9.970 | -3.440 | 0.29 |
| January 23, 2022 | -5.529 | -10.050 | -2.030 | 0.01 |
| January 24, 2022 | -1.523 | -4.558 | -0.221 | 0.00 |
| January 25, 2022 | -3.358 | -5.475 | -2.141 | 0.00 |
| January 26, 2022 | -1.568 | -6.369 | 4.081 | 0.00 |
| January 27, 2022 | -9.586 | -13.560 | -6.437 | 0.05 |
| January 28, 2022 | -4.681 | -12.680 | -0.903 | 0.03 |
| January 29, 2022 | -1.685 | -2.913 | 1.160 | 1.69 |
| January 30, 2022 | 1.091 | -2.789 | 6.925 | 0.10 |
| January 31, 2022 | -3.427 | -5.175 | -2.432 | 0.12 |
| February 1, 2022 | -7.218 | -8.920 | -4.925 | 0.00 |
| February 2, 2022 | -10.824 | -13.500 | -3.486 | 0.00 |

Note: Precipitation data from November to the start of December was unavailable due to a loose connection with the monitoring equipment. Appropriate repairs were made on December 2 and precipitation monitoring was re-established.