



# Real-Time Water Quality Deployment Report

## Lower Churchill River Network

September 22/23 to  
October 27/November 4/6, 2020



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

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### Real Time Water Quality Monitoring

- Staff with the Department of Environment, Climate Change and Municipalities monitor real-time water quality data on a regular basis.
- This deployment report discusses water quality related events occurring at four stations on the Lower Churchill River: Churchill River below Metchin River, Churchill River above Grizzle Rapids, Churchill River below Muskrat Falls and Churchill River at English Point.
- Real-time water quality monitoring instruments were deployed at Churchill River above Grizzle Rapids and Churchill River below Muskrat Falls on September 22<sup>nd</sup>. An instrument was deployed at Churchill River at English Point on September 23<sup>rd</sup>.
- The instrument at Churchill River above Grizzle Rapids was removed on November 6<sup>th</sup>, for a deployment period of 45 days. Instruments at Churchill River below Muskrat Falls and Churchill River at English Point were removed on November 4<sup>th</sup>, for deployment periods of 43 days and 42 days, respectively.
- The instrument at Churchill River below Metchin River was not deployed on September 23<sup>rd</sup>; however, for the purposes of this report, data from this station will be reported as if it had been. The instrument at this station was deployed continuously from September 1<sup>st</sup> through October 27<sup>th</sup>. A deployment period of 34 days will be used for reporting purposes.
- The station at Churchill River above Muskrat Falls was not able to be deployed during this deployment period. This station was relocated in October 2016 as it was situated in the flood zone of the Muskrat Falls Reservoir and needed to be moved back to ensure the station did not flood as the reservoir water levels were raised. Even at raised water levels, the above Muskrat Falls station is situated quite far from the water, making it impractical to install monitoring equipment. Additionally, safety requirements with regards to working in and around the reservoir for the Muskrat Falls project further hindered the ability to deploy the instrument at this station.

## Quality Assurance and Quality Control

- As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. This procedure is based on the approach used by the United States Geological Survey.
- At deployment and removal, a QA/QC instrument is temporarily deployed alongside the field instrument. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments. Based on the degree of difference between parameters recorded by the field instrument and QA/QC instrument at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

**Table 1: Instrument Performance Ranking classifications for deployment and removal**

Parameter	Rank				
	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 > 35µS/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

- It should be noted that the temperature sensor on any instrument is the most important. All other parameters can be broken down into three groups: temperature dependent, temperature compensated and temperature independent. Because the temperature sensor is not isolated from the rest of the instrument, the entire instrument must be at the same temperature before the sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

- Deployment and removal comparison rankings for the Lower Churchill River stations deployed from September 22/23 to October 27/November 4/6, 2020 are summarized in Table 2.

**Table 2: Comparison rankings for Lower Churchill River stations September 22/23 to October 27/November 4/6, 2020**

Churchill River Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Below Metchin River	September 23, 2020	Deployment	N/A	N/A	N/A	N/A	N/A
	October 27, 2020	Removal	Good	Fair	Excellent	Poor	Excellent
Above Grizzle Rapids	September 22, 2020	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	November 6, 2020	Removal	Good	Excellent	Excellent	Good	Excellent
Below Muskrat Falls	September 22, 2020	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	November 4, 2020	Removal	Excellent	Good	Excellent	Fair	Good
At English Point	September 23, 2020	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	November 4, 2020	Removal	Good	Excellent	Poor	Poor	Poor
Above Muskrat Falls	Not deployed	Deployment	N/A	N/A	N/A	N/A	N/A
	Not deployed	Removal	N/A	N/A	N/A	N/A	N/A

- Churchill River below Metchin River**

- Comparison rankings are not available for deployment since this instrument wasn't physically deployed on September 23<sup>rd</sup>.
- At removal, conductivity and turbidity were 'excellent', temperature was 'good', pH was 'fair', and dissolved oxygen was 'poor'. This discrepancy with dissolved oxygen may have been due to the QA/QC sonde not being placed close enough to the field sonde; it may also have been due to a calibration error with the field sonde, since a comparison ranking of 'poor' was also recorded at initial deployment on September 1<sup>st</sup>.

- Churchill River above Grizzle Rapids**

- At deployment, all parameters were either 'excellent' or 'good'.
- At removal, all parameters were again either 'excellent' or 'good'.

▪ **Churchill River below Muskrat Falls**

- At deployment, all parameters ranked as either 'excellent' or 'good'.
- At removal, all parameters ranked as 'excellent' or 'good' except for dissolved oxygen, which was 'fair'.

▪ **Churchill River at English Point**

- At deployment, all parameters ranked as 'excellent'.
- At removal, pH was 'excellent' and temperature was 'good', while all other parameters were 'poor'. This discrepancy is due to inaccuracies with the data, most likely caused by sediment build-up around the sensors on the field sonde. This data has been removed from the data set (including pH).

**Data Interpretation**

- The following graphs and discussion illustrate water quality related events occurring from September 22/23 to October 27/November 4/6 on the Lower Churchill River Network.
- With the exception of water quantity data (stage & flow), all data used in the preparation of the graphs and subsequent discussion below adhere to stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

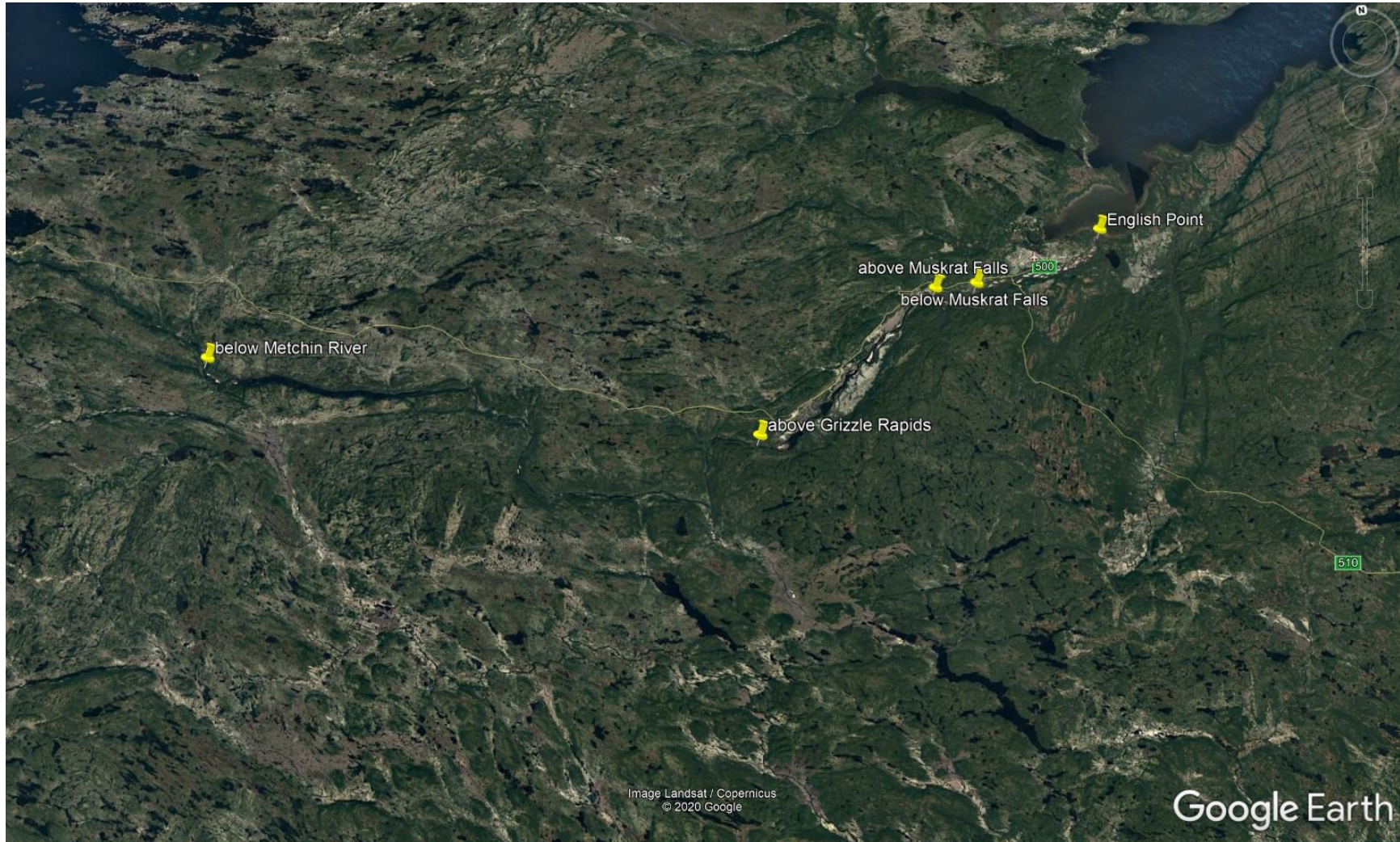


Figure 1: Lower Churchill Network of Real-Time Water Quality Stations

## Churchill River below Metchin River

### Water Temperature

- Over the deployment period, water temperature ranged from 1.4°C to 9.5°C, with a median value of 5.1°C (Figure 2). Air temperature data was obtained from the Metchin River near TLH Weather Station.
- Water temperature slowly decreased over the course of deployment. This is to be expected as air temperatures were also decreasing over the same period through October. Water temperature data exhibits a diurnal pattern as expected, and closely correlates with ambient air temperatures.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Metchin River: Water and Air Temperature & Stage

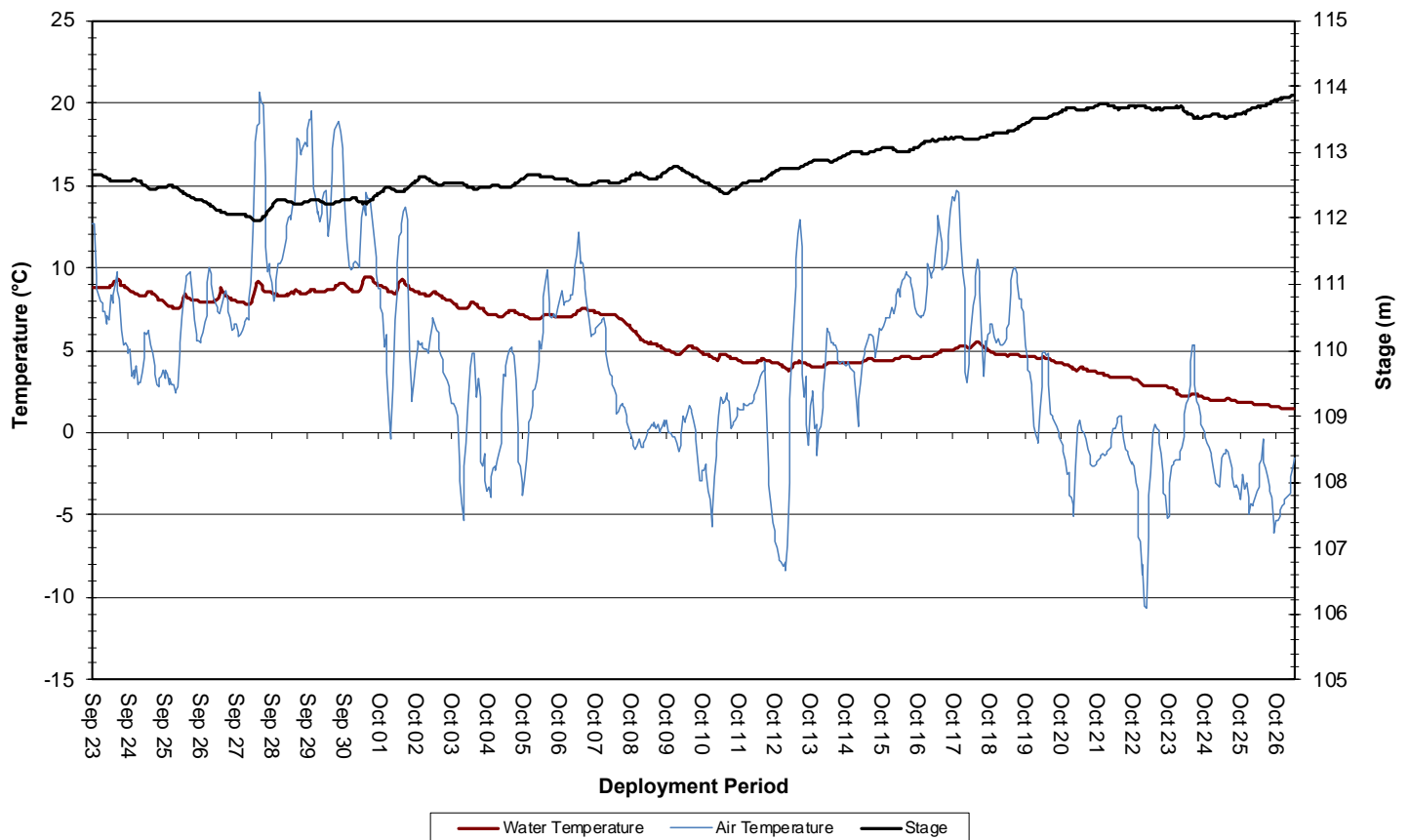


Figure 2: Water and Air Temperature & Stage at Churchill River below Metchin River



## pH

- Over the deployment period, pH values ranged from 6.70 to 7.03 pH units, with a median value of 6.80 (Figure 3).
- pH values were stable, albeit slightly decreasing, over the course of deployment. pH remained within the CCME's Guidelines for the Protection of Aquatic Life for the duration of deployment.
- Photosynthesis uses up hydrogen molecules; this causes the concentration of hydrogen ions to decrease, which in turn causes pH to increase. For this reason, pH may be higher during daylight hours and during the growing season when photosynthesis is at a maximum. This is illustrated by the diurnal fluctuations in pH values (Figure 3).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Metchin River: pH & Stage

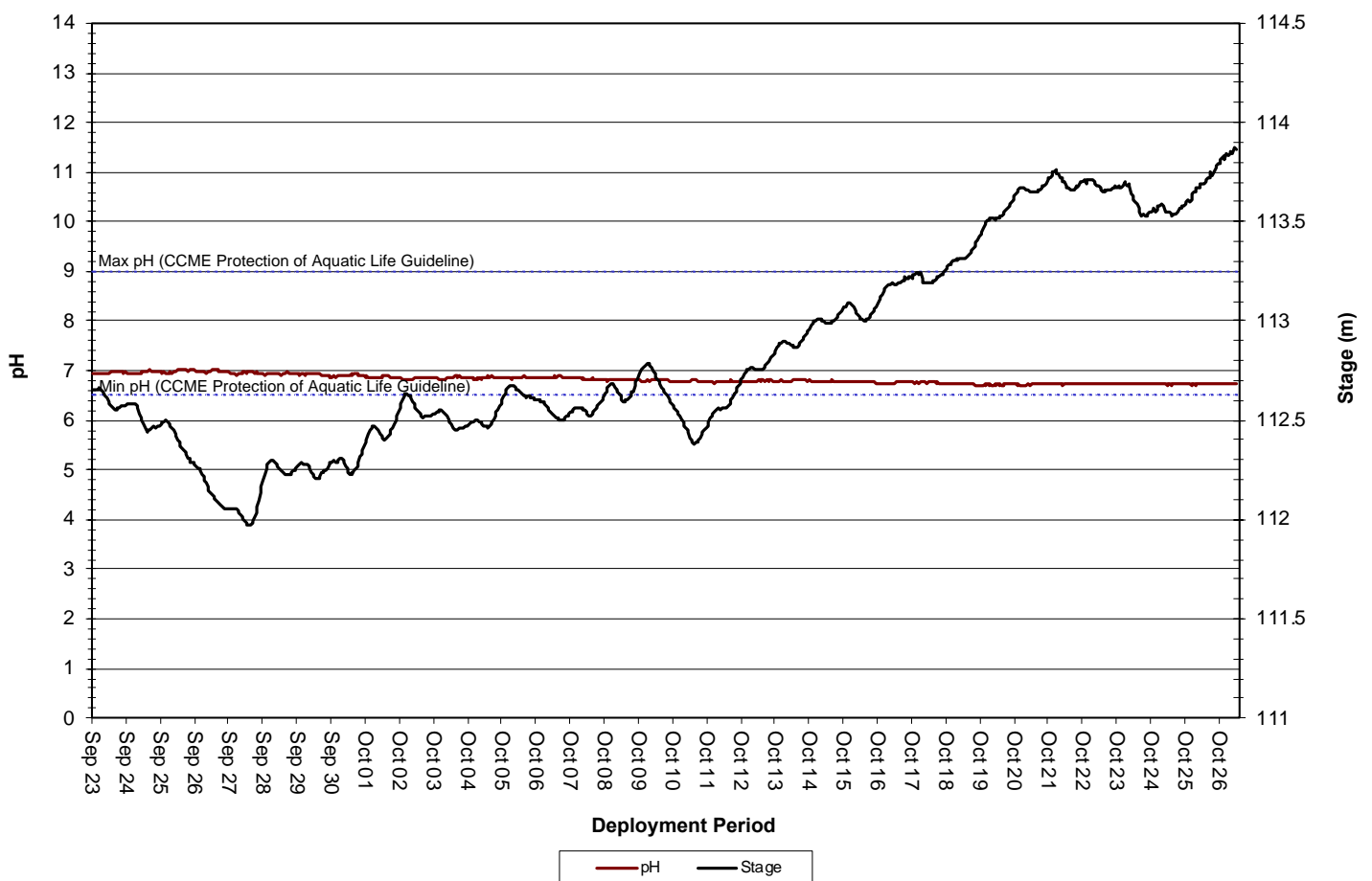


Figure 3: pH & Stage at Churchill River below Metchin River

### Specific Conductivity

- Over the deployment period, specific conductivity ranged from 18.2 $\mu$ S/cm to 25.4 $\mu$ S/cm, with a median value of 19.7 $\mu$ S/cm (Figure 4).
- The relationship between conductivity and stage is generally inverted. When stage levels increase, specific conductivity levels decrease as the increased amount of water in the river system dilutes solids that are present. This relationship is somewhat evident in the graph below (Figure 4).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Metchin River: Specific Conductivity & Stage

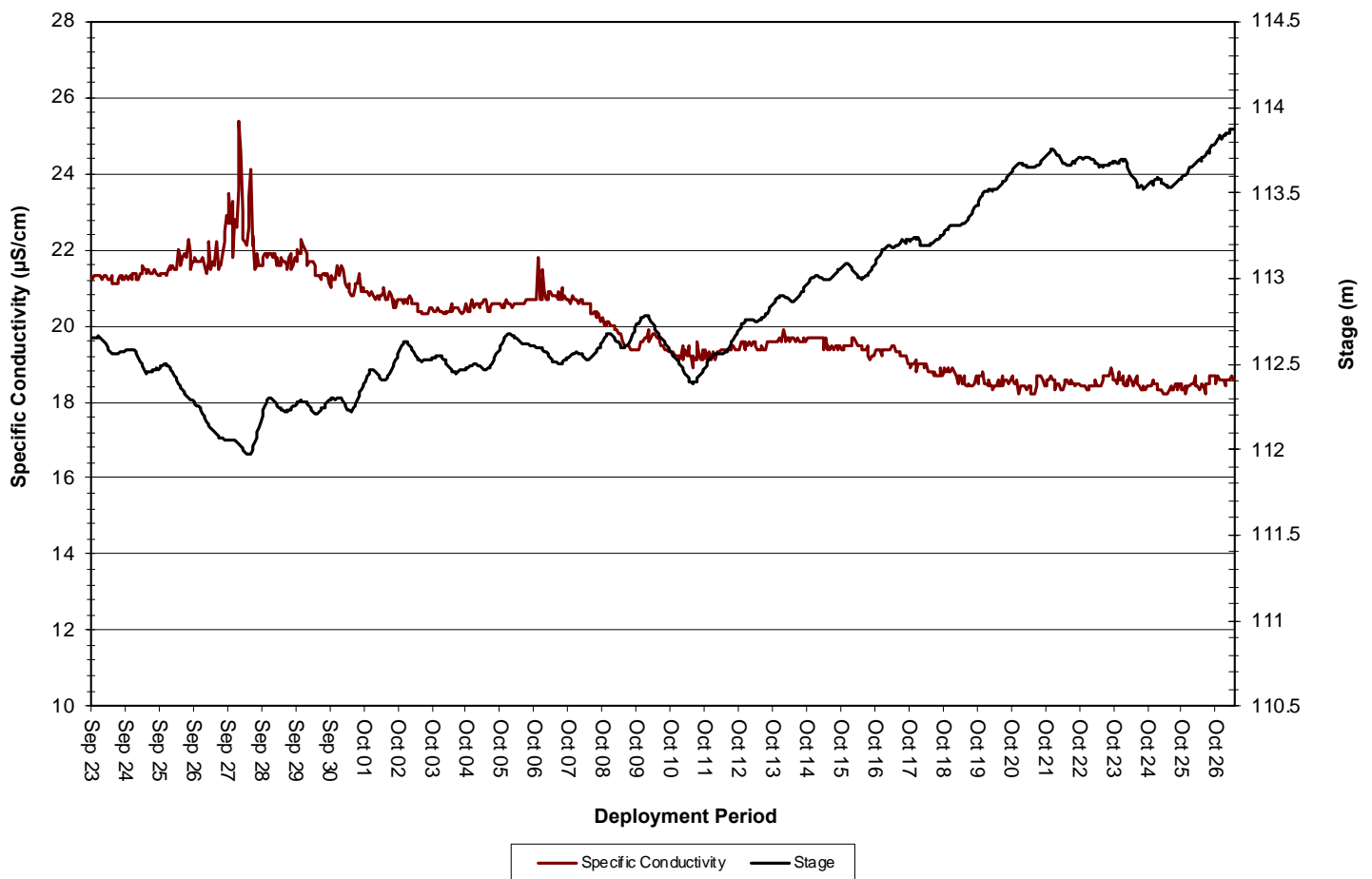


Figure 4: Specific Conductivity & Stage at Churchill River below Metchin River

### Dissolved Oxygen

- Over the deployment period, dissolved oxygen content ranged from 12.96mg/L to 15.59mg/L, with a median value of 14.12mg/L. Saturation of dissolved oxygen ranged from 108.4% to 124.8%, with a median value of 112.4% (Figure 5).
- There is an evident relationship between water temperature and dissolved oxygen. Over the deployment period, dissolved oxygen levels gradually increased, as water temperatures gradually decreased. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels were above the CCME's Guidelines for the Protection of Early and Other Life Stages for the duration of deployment.

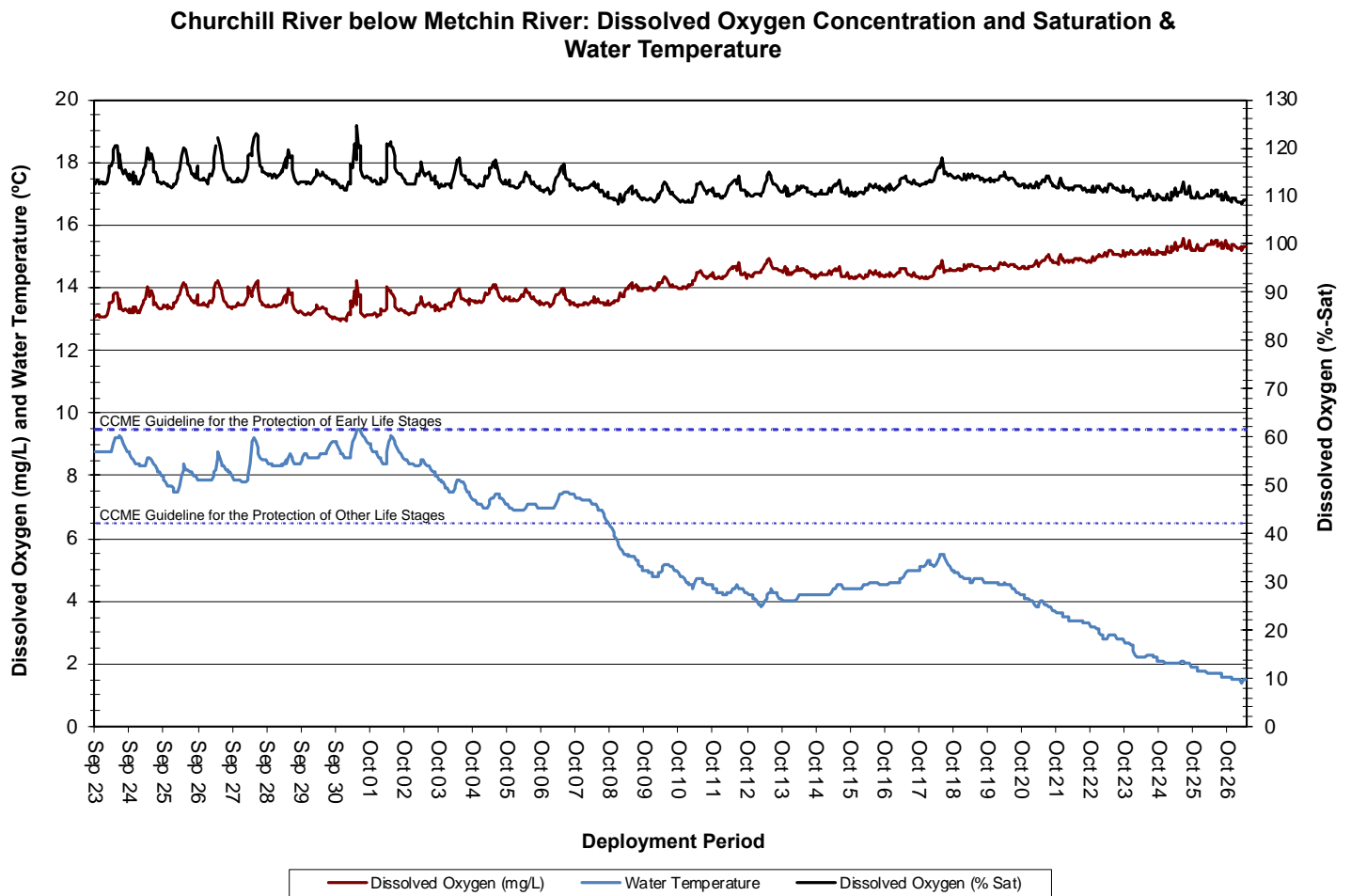


Figure 5: Dissolved Oxygen & Water Temperature at Churchill River below Metchin River

## Turbidity

- Over the deployment period, turbidity ranged from 1.1NTU to 16.4NTU, with a median value of 1.7NTU (Figure 6). A median value of 1.7NTU indicates a low level of natural background turbidity in the waterbody. Precipitation data was obtained from the Metchin River near TLH Weather Station.
- Many of the turbidity spikes observed throughout the deployment period correlate with precipitation events (Figure 6); however, other turbidity events do not coincide with any precipitation. This station is located at a wide and deep section of the Churchill River and therefore turbidity levels are likely less susceptible to precipitation events as compared to other areas. Turbidity levels returned to background levels following each observed increase.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Metchin River: Turbidity, Precipitation & Stage

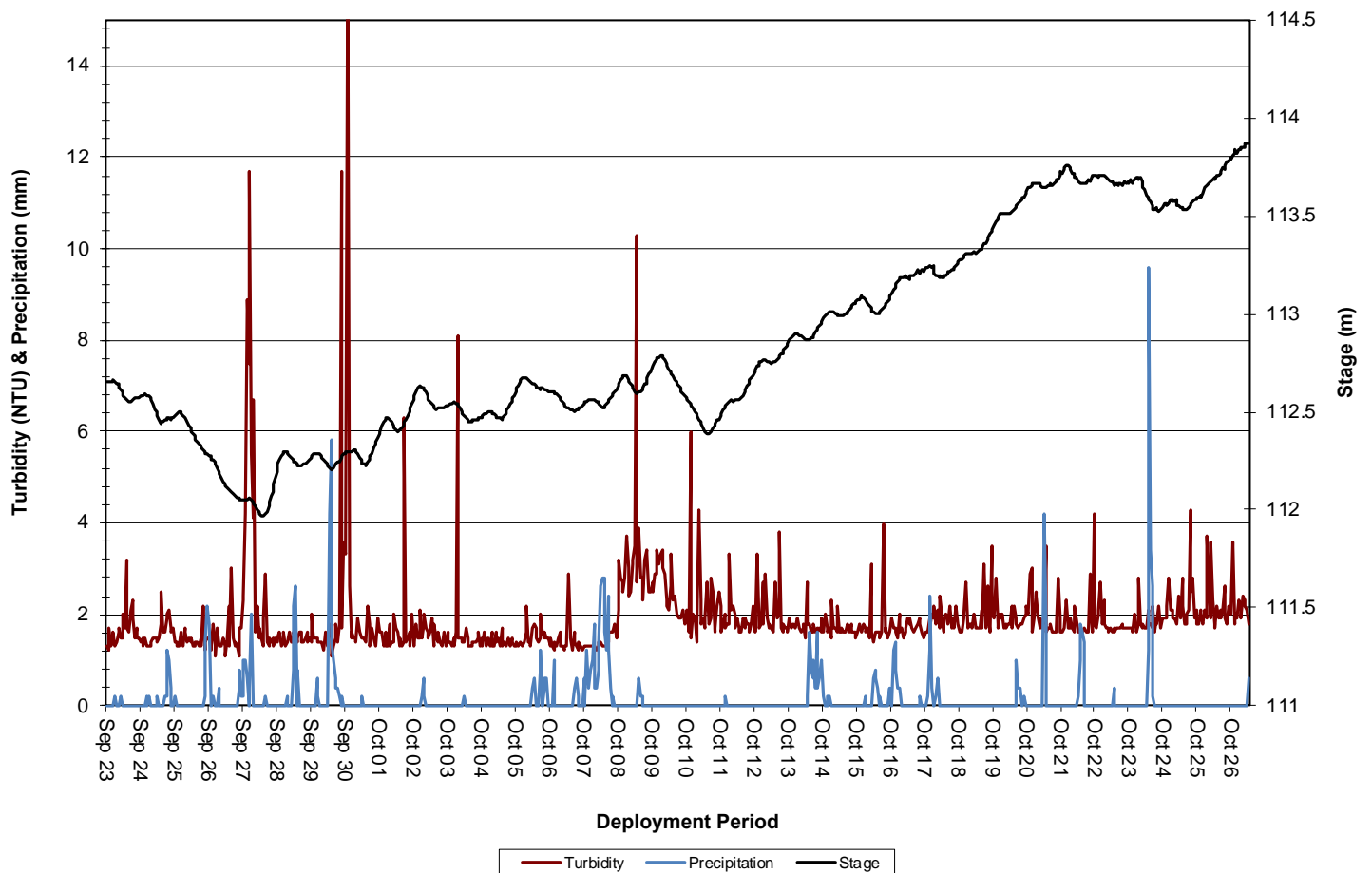
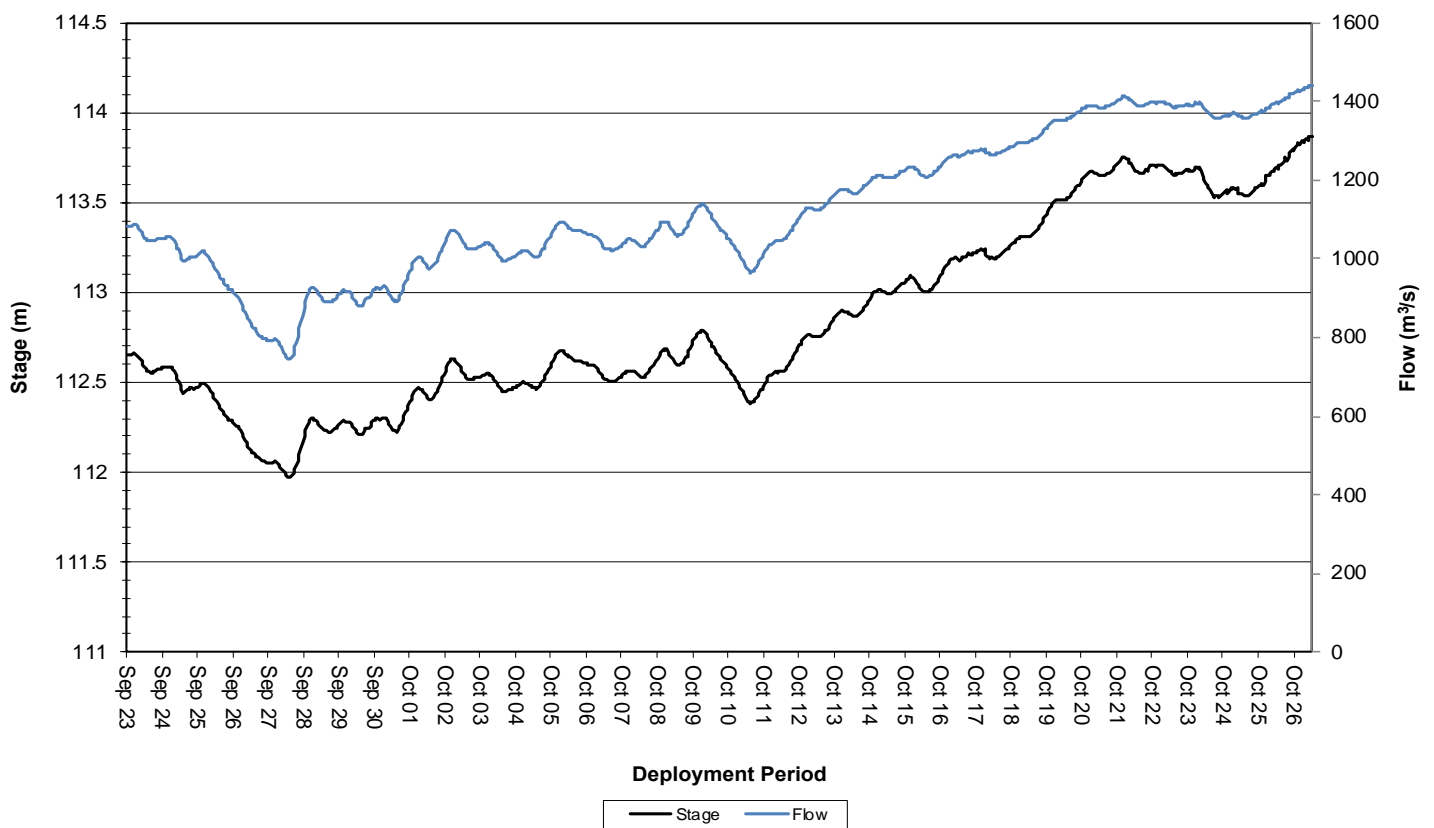


Figure 6: Turbidity, Precipitation & Stage at Churchill River below Metchin River

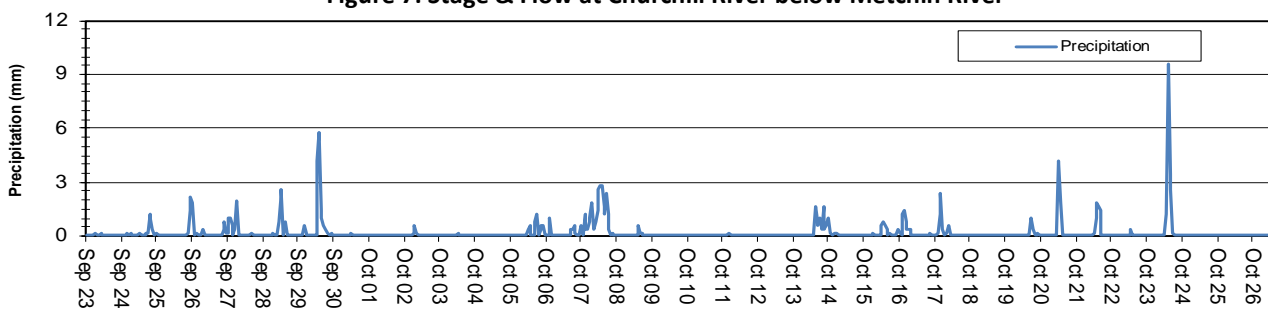
### Stage and Flow

- Over the deployment period, stage levels ranged from 111.97m to 113.87m, with a median value of 112.64m. Flow ranged from 744.71m<sup>3</sup>/s to 1438.12m<sup>3</sup>/s, with a median value of 1078.31m<sup>3</sup>/s (Figure 7). Precipitation data was obtained from the Metchin River near TLH Weather Station.
- Stage and flow followed a similar trend over the deployment period, and both increased steadily across deployment. Precipitation amounts across the same period generally correlate with increases in both stage and flow (Figure 8).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Churchill River below Metchin River: Stage & Flow**



**Figure 7: Stage & Flow at Churchill River below Metchin River**



**Figure 8: Precipitation at Churchill River below Metchin River**

## Churchill River above Grizzle Rapids

### Water Temperature

- Over the deployment period, water temperature ranged from 2.6°C to 10.7°C, with a median value of 6.8°C (Figure 9). Air temperature data was obtained from the Muskrat Falls MET Station.
- Water temperature slowly decreased across the deployment period. This trend is to be expected as air temperatures also decreased through the fall months. Water temperature data exhibits a diurnal pattern, and closely correlates with ambient air temperatures.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River above Grizzle Rapids: Water & Air Temperature and Stage

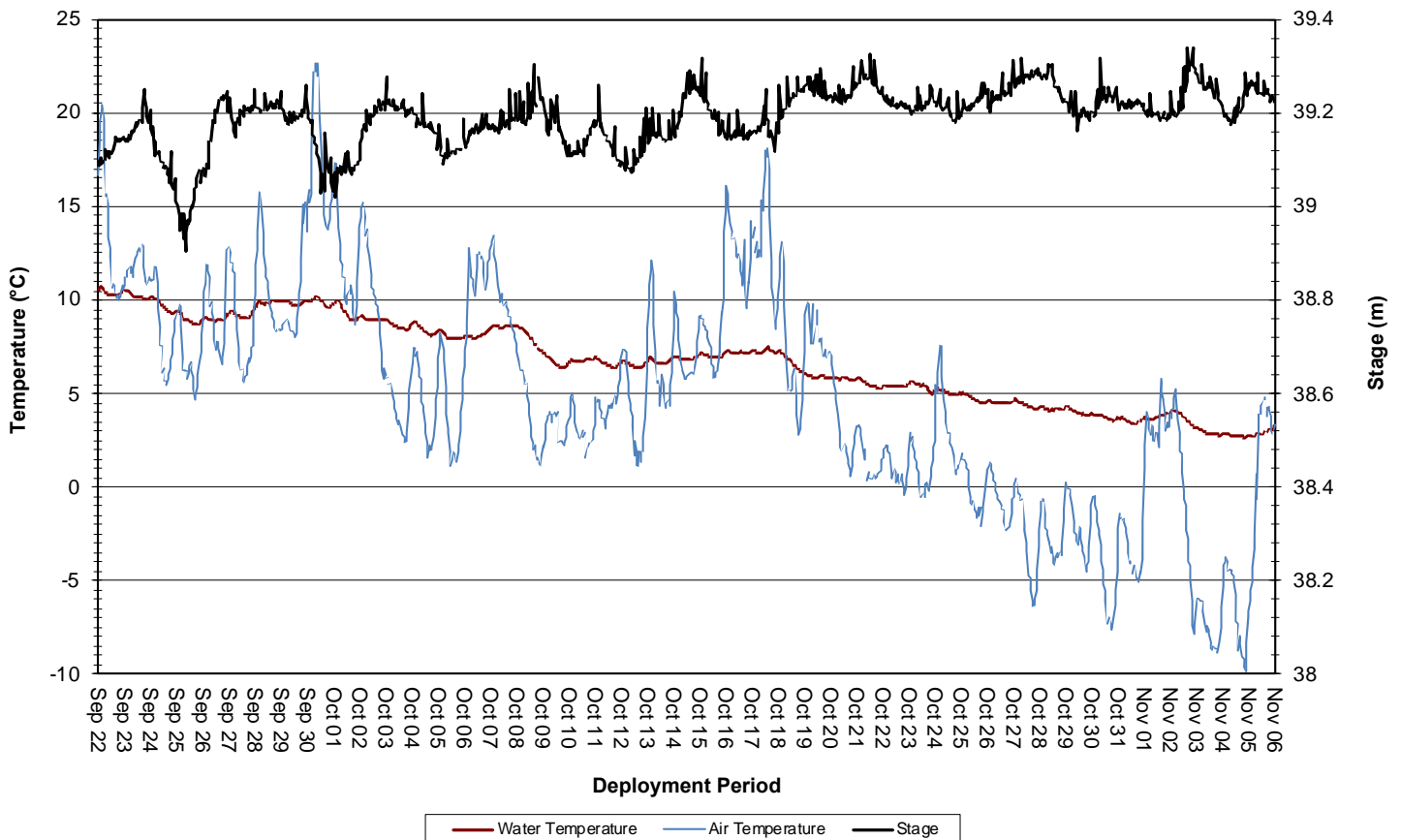
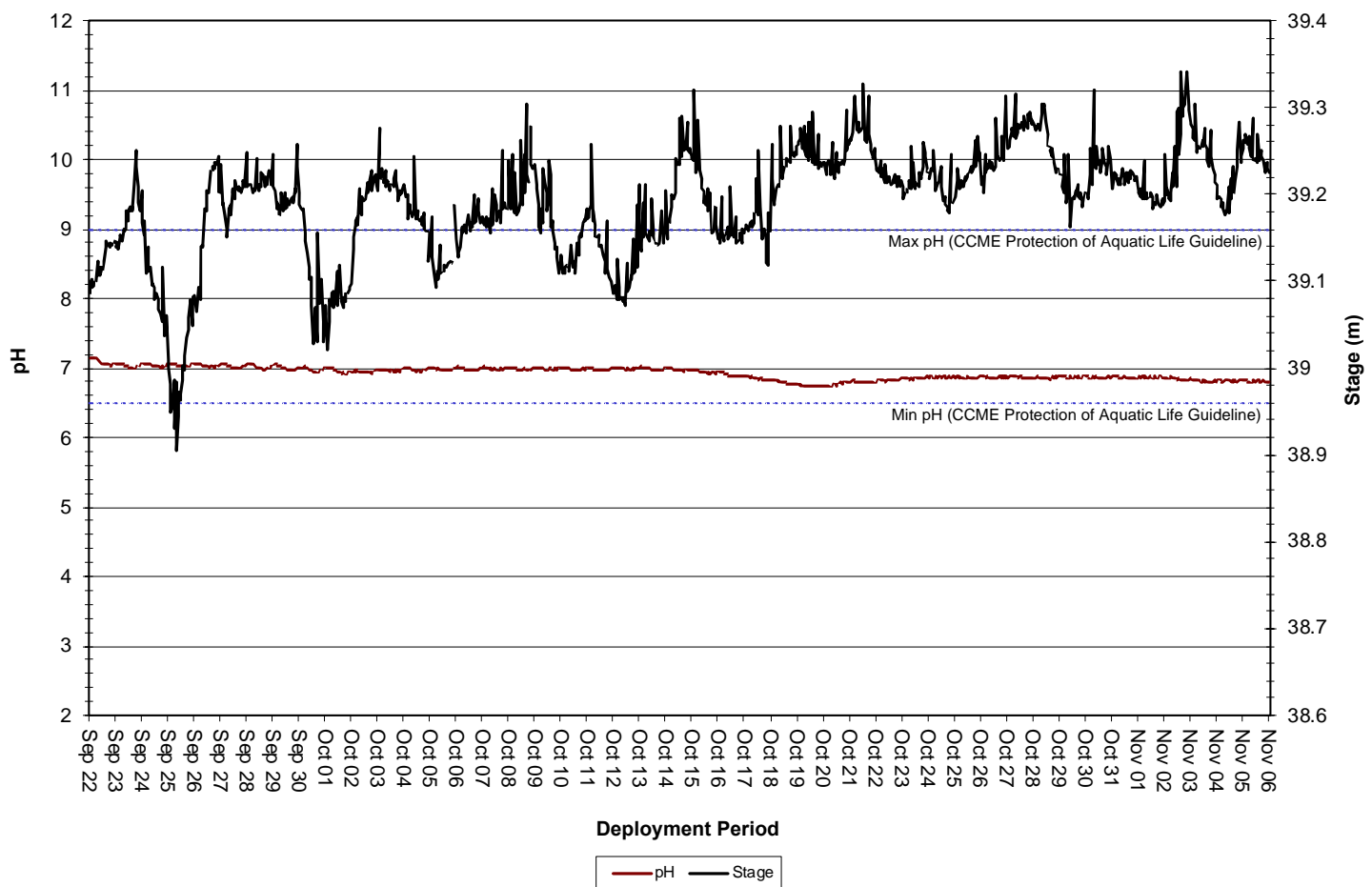


Figure 9: Water and Air Temperature & Stage at Churchill River above Grizzle Rapids

**pH**

- Over the deployment period, pH values ranged from 6.73 pH units to 7.16 pH units, with a median value of 6.94 (Figure 10).
- pH values were quite stable and remained within the CCME’s Guidelines for the Protection of Aquatic Life for the duration of deployment.
- Photosynthesis uses up hydrogen molecules; this causes the concentration of hydrogen ions to decrease, which in turn causes pH to increase. For this reason, pH may be higher during daylight hours and during the growing season when photosynthesis is at a maximum. This is illustrated by the diurnal fluctuations in pH values (Figure 10).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Churchill River above Grizzle Rapids: pH & Stage**



**Figure 10: pH & Stage at Churchill River above Grizzle Rapids**

### Specific Conductivity

- Over the deployment period, specific conductivity ranged from 15.6 $\mu$ S/cm to 18.5 $\mu$ S/cm, with a median of 17.4 $\mu$ S/cm (Figure 11).
- The relationship between conductivity and stage is generally inverted. When stage levels increase, specific conductivity levels decrease as the increased amount of water in the river system dilutes solids that are present. This relationship is somewhat evident in the graph below (Figure 11).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River above Grizzle Rapids: Specific Conductivity & Stage

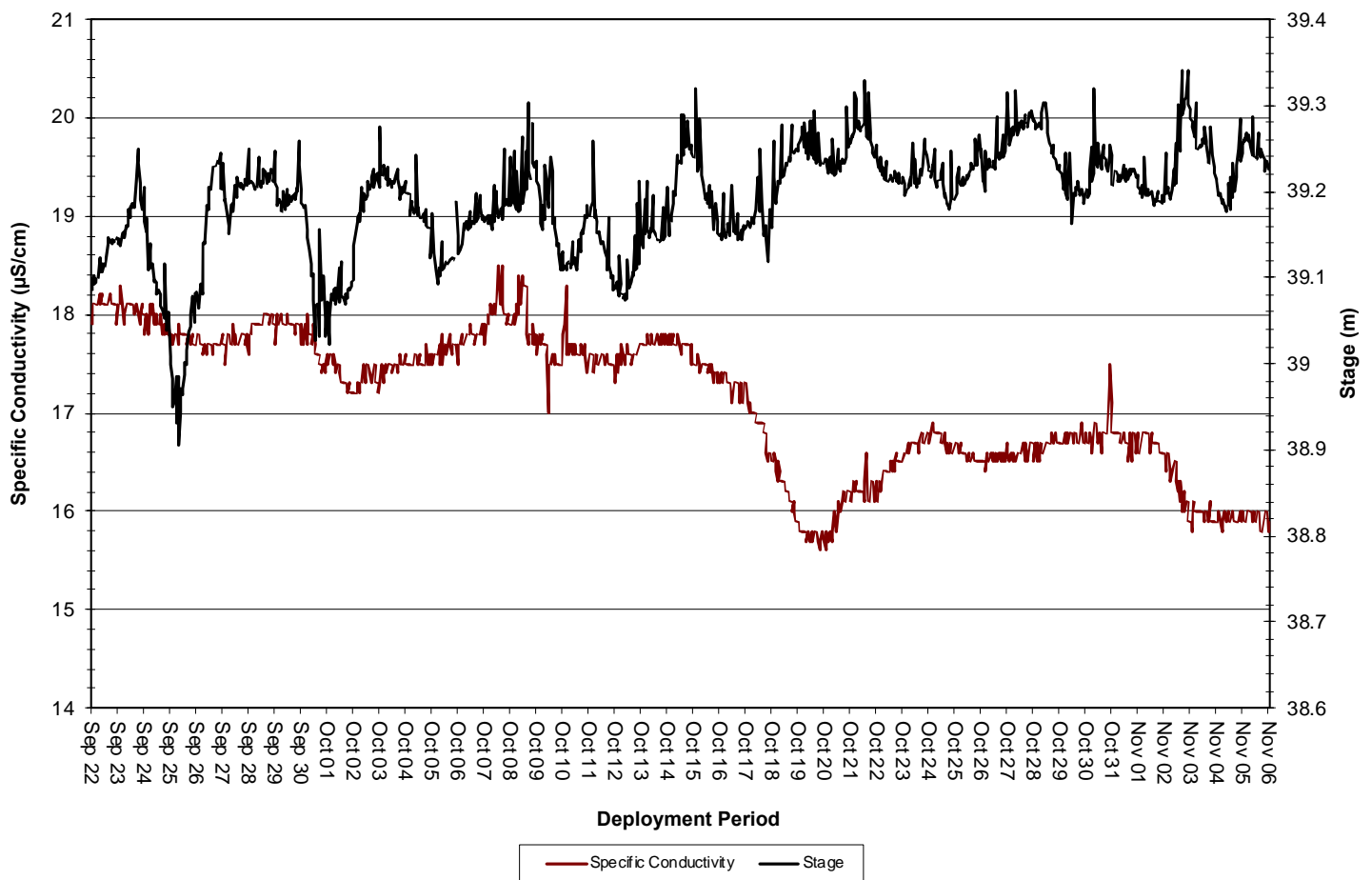


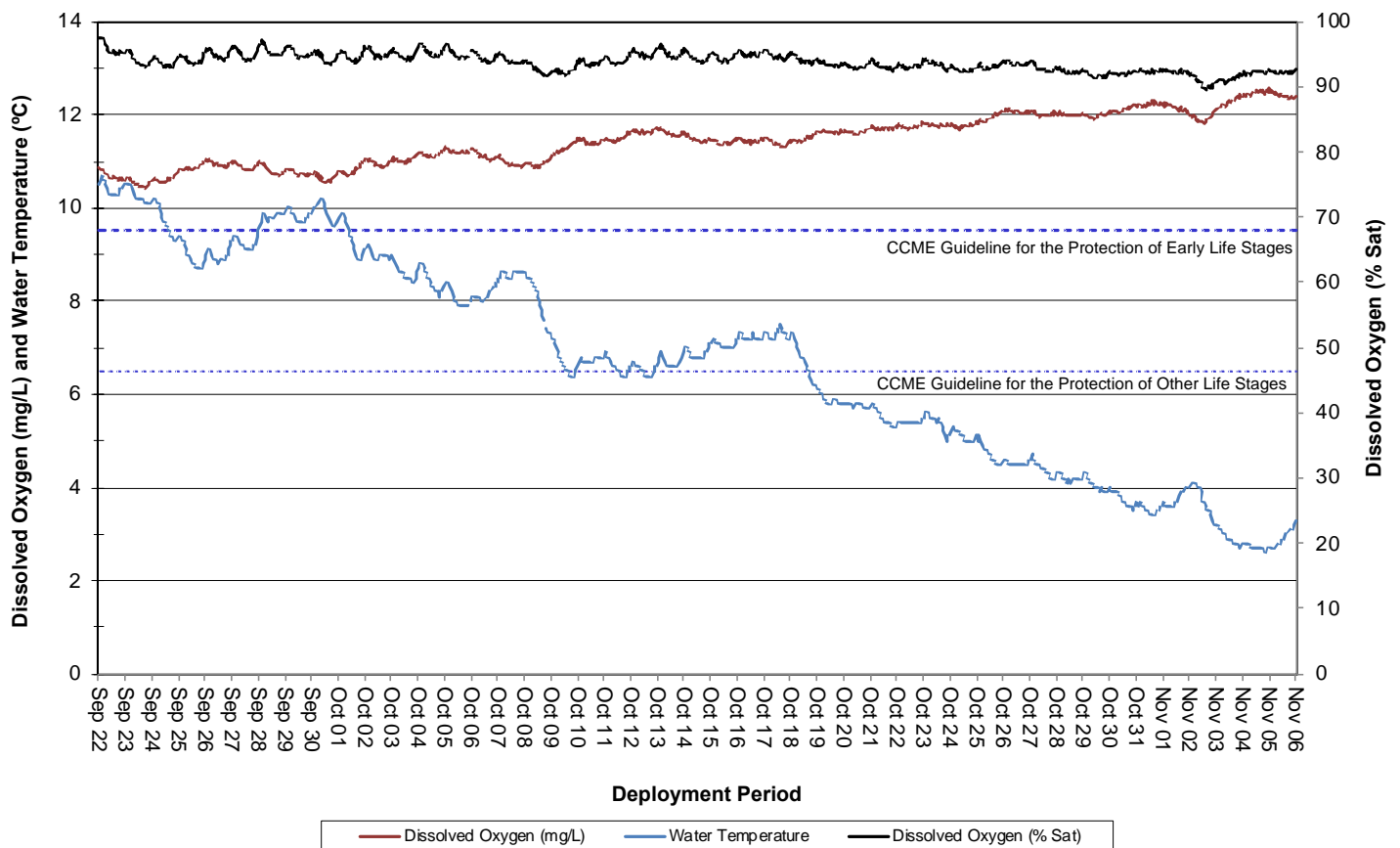
Figure 11: Specific Conductivity & Stage at Churchill River above Grizzle Rapids



### Dissolved Oxygen

- Over the deployment period, dissolved oxygen content ranged from 10.43mg/L to 12.55mg/L, with a median value of 11.46mg/L. Saturation of dissolved oxygen ranged from 89.6% saturation to 97.6% saturation, with a median value of 93.8% (Figure 12).
- There is an evident relationship between water temperature and dissolved oxygen. Over the deployment period, dissolved oxygen levels gradually increased as water temperatures gradually decreased. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels were above the CCME's Guidelines for the Protection of Early and Other Life Stages for the duration of deployment. This is to be expected given the cooler water temperatures observed through October.

**Churchill River above Grizzle Rapids: Dissolved Oxygen Concentration and Saturation & Water Temperature**



**Figure 12: Dissolved Oxygen & Water Temperature at Churchill River above Grizzle Rapids**

### Turbidity

- Over the deployment period, turbidity ranged from 0.0NTU to 5.6NTU, with a median value of 0.0NTU (Figure 13). A median value of 0.0NTU indicates a very low level of natural background turbidity in the waterbody.
- Turbidity spikes observed over the deployment period somewhat correlated with precipitation events (Figure 13); however, this station is located at a wide and deep section of the Churchill River and so turbidity levels are less susceptible to precipitation events. Precipitation data was obtained from the Muskrat Falls MET Station.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River above Grizzle Rapids: Turbidity, Precipitation & Stage

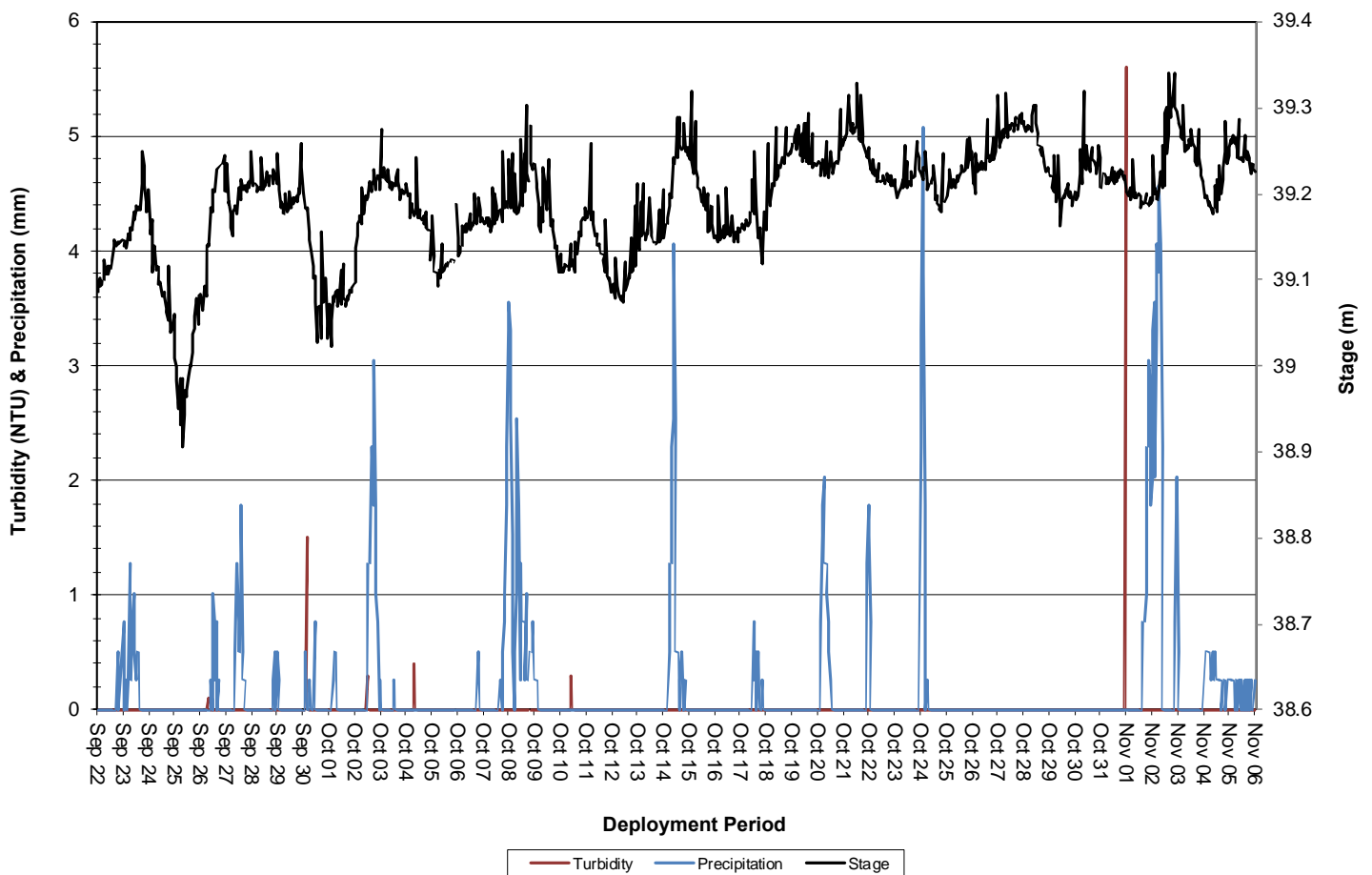


Figure 13: Turbidity, Precipitation & Stage at Churchill River above Grizzle Rapids

### Stage

- Over the deployment period, stage ranged from 38.91m to 39.34m, with a median value of 39.20m (Figure 14). Precipitation data was obtained from the Muskrat Falls MET Station.
- Stage was relatively stable across the course of deployment, and increases in stage correlated closely with precipitation events across the same period (Figure 14).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River above Grizzle Rapids: Stage & Precipitation

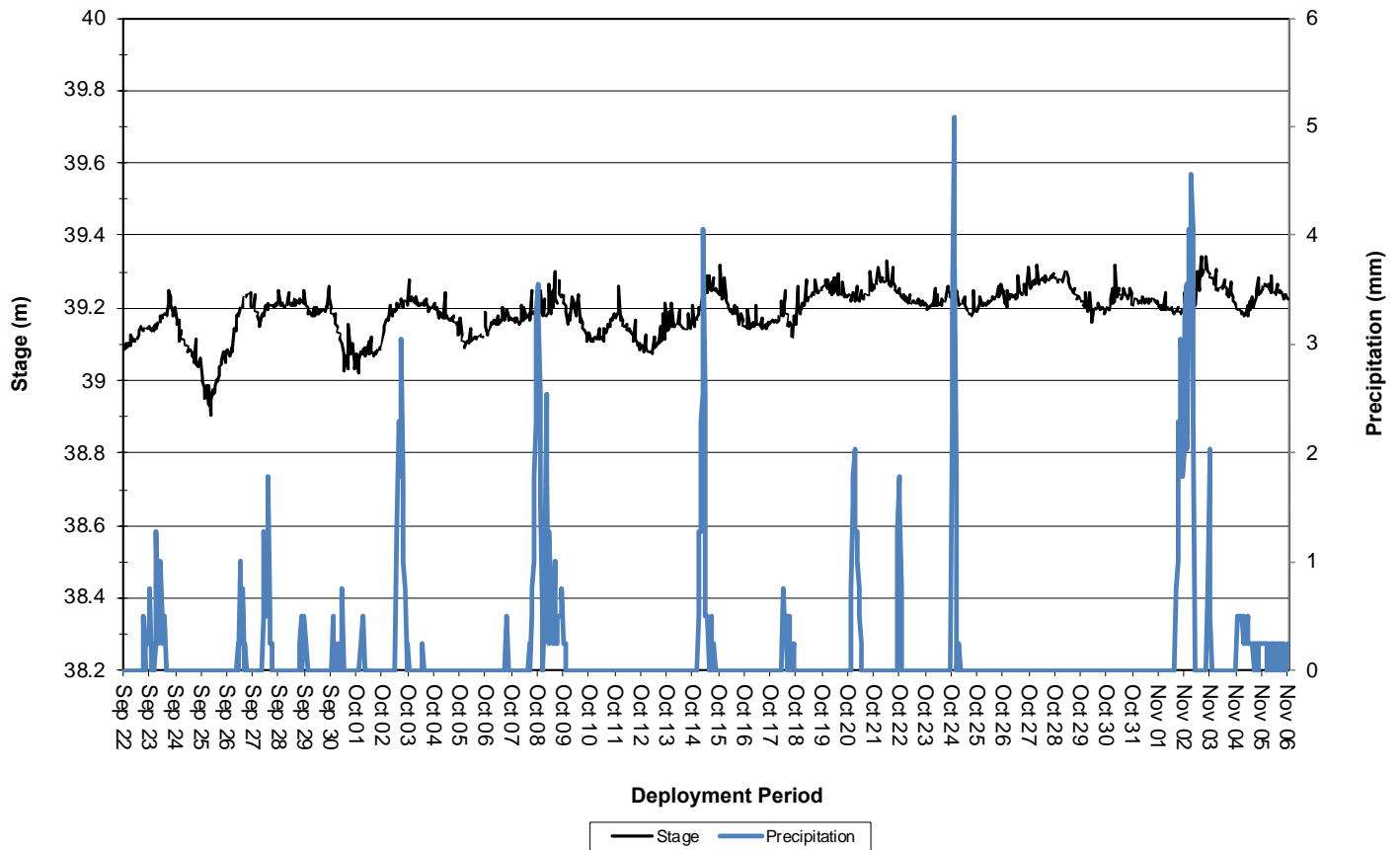


Figure 14: Stage & Precipitation at Churchill River above Grizzle Rapids

## Churchill River below Muskrat Falls

### Water Temperature

- Over the deployment period, water temperature ranged from 2.7°C to 13.8°C, with a median value of 8.4°C (Figure 15). Air temperature data was obtained from the Muskrat Falls MET Station.
- Water temperature slowly decreased over the course of the deployment period. This is to be expected as ambient air temperatures also decreased through the fall months. Water temperatures closely correlate with ambient air temperatures.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Muskrat Falls: Water and Air Temperature & Stage

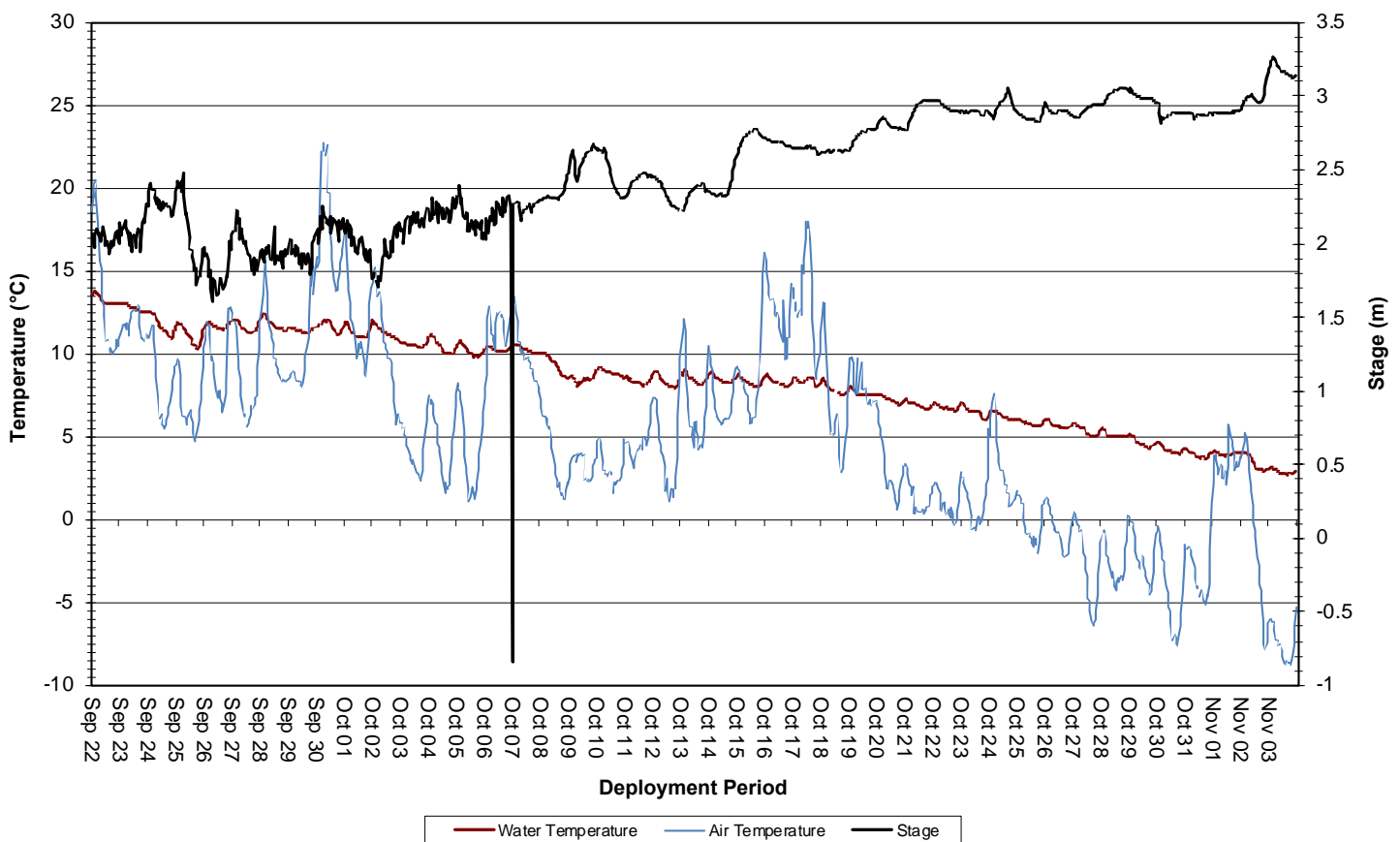
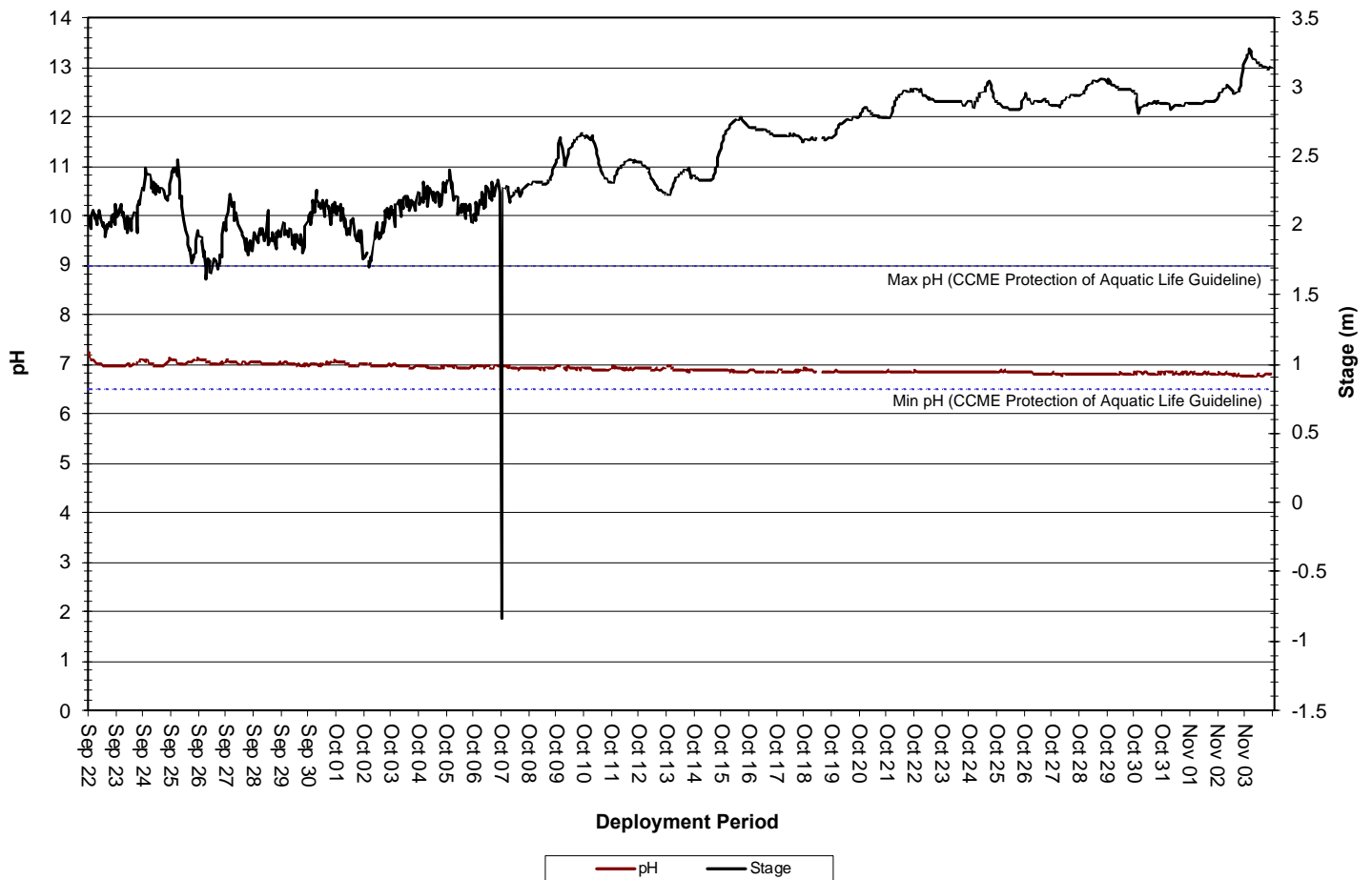


Figure 15: Water and Air Temperature & Stage at Churchill River below Muskrat Falls

**pH**

- Over the deployment period, pH ranged from 6.75 pH units to 7.23 pH units, with a median value of 6.89 (Figure 16).
- pH values were quite stable over the course of deployment, and remained within the CCME's Guidelines for the Protection of Aquatic Life for the duration of deployment (Figure 16).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Churchill River below Muskrat Falls: pH & Stage**



**Figure 16: pH & Stage at Churchill River below Muskrat Falls**

### Specific Conductivity

- Over the deployment period, specific conductivity ranged from 13.1 $\mu$ S/cm to 19.6 $\mu$ S/cm, with a median value of 17.5 $\mu$ S/cm (Figure 17).
- The relationship between conductivity and stage is generally inversed. When stage decreases, specific conductivity increases as the decreased amount of water in the river system concentrates solids that are present, and vice versa. This relationship is somewhat apparent in the graph below.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Muskrat Falls: Specific Conductivity & Stage



Figure 17: Specific Conductivity & Stage at Churchill River below Muskrat Falls

### Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 10.35mg/L to 14.38mg/L, with a median value of 11.91mg/L. Saturation of dissolved oxygen ranged from 95.1% to 113.5%, with a median value of 104.4% (Figure 18).
- Dissolved oxygen and water temperature exhibit an inverse relationship: as one parameter increases, the other decreases, and vice versa. Dissolved oxygen levels slowly increased over the course of deployment. This is to be expected since water temperatures were slowly decreasing over the same period. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures.
- Dissolved oxygen levels remained above the CCME's Guidelines for the Protection of Early and Other Life Stages for the duration of deployment.

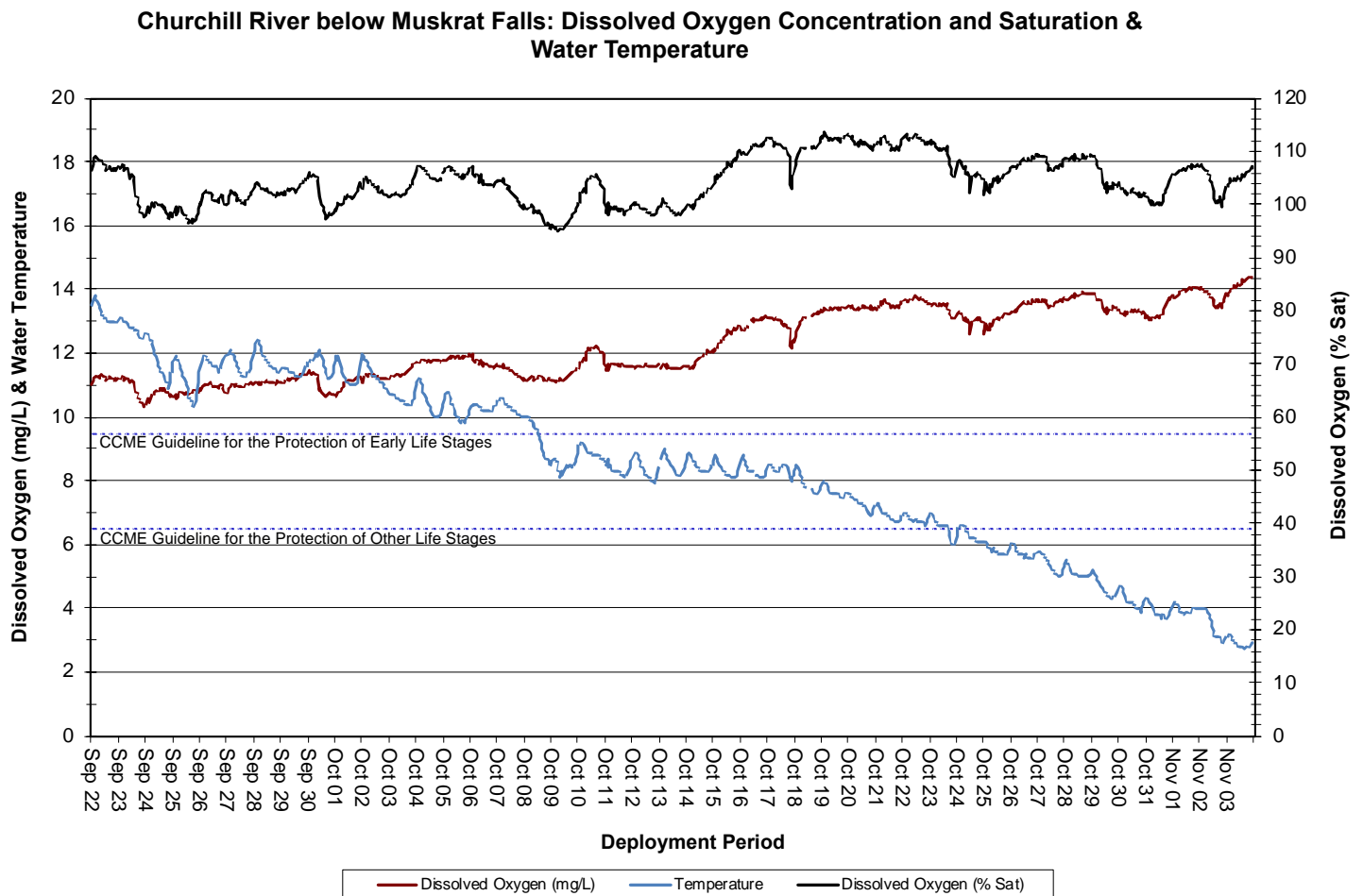


Figure 18: Dissolved Oxygen & Water Temperature at Churchill River below Muskrat Falls

## Turbidity

- Over the deployment period, turbidity ranged from 0.1NTU to 43.4NTU, with a median value of 3.9NTU. A median value of 3.9NTU indicates a small amount of natural background turbidity in the waterbody. Precipitation data was obtained from the Muskrat Falls MET Station.
- Some of the larger turbidity spikes observed over the deployment period correlate with changes in stage and precipitation events (Figure 19). This station is located at a wide and deep section of the Churchill River with a sandy bottom, and therefore turbidity levels are less susceptible to precipitation events as compared to other areas.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River below Muskrat Falls: Turbidity, Stage & Precipitation

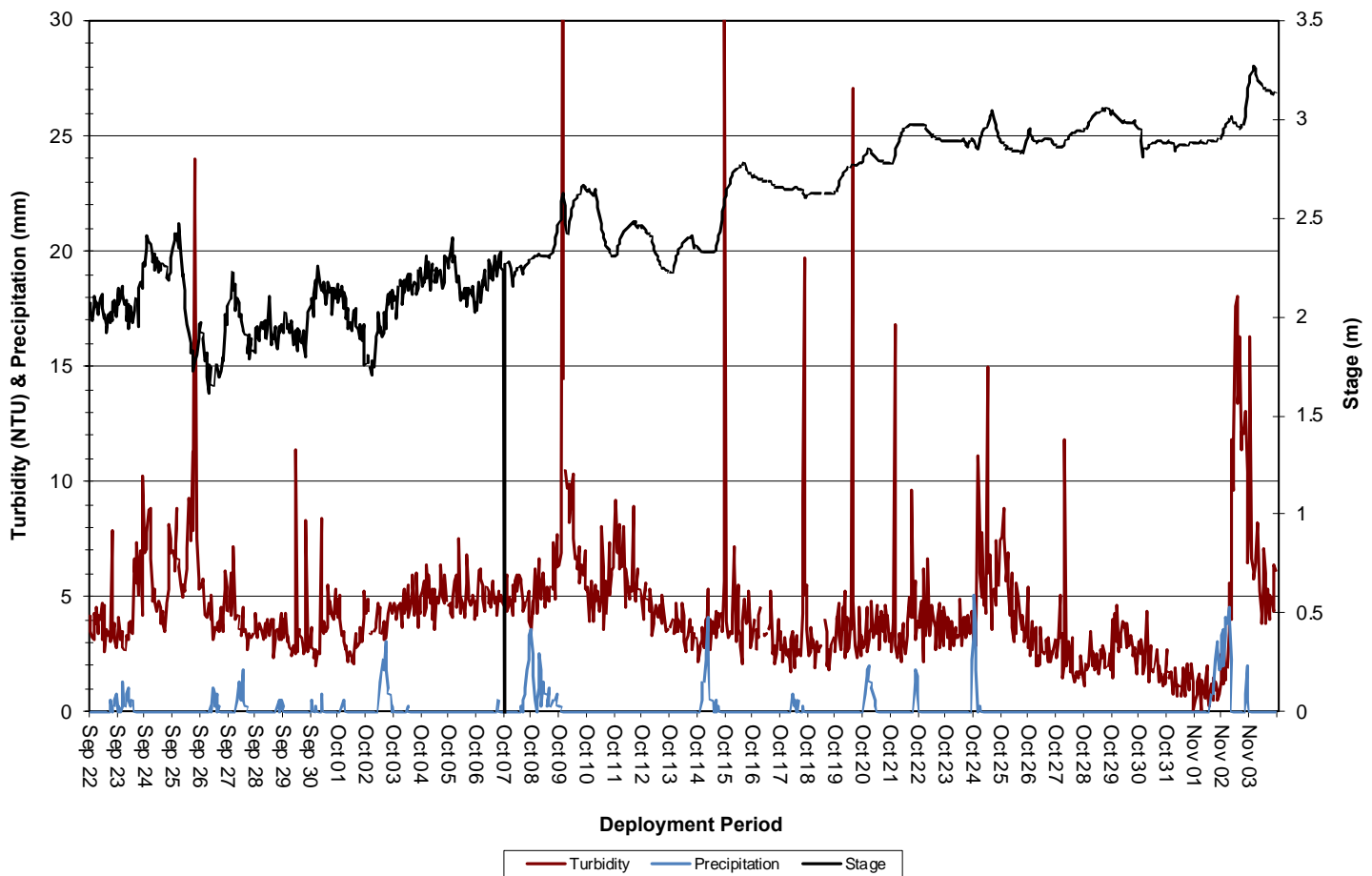


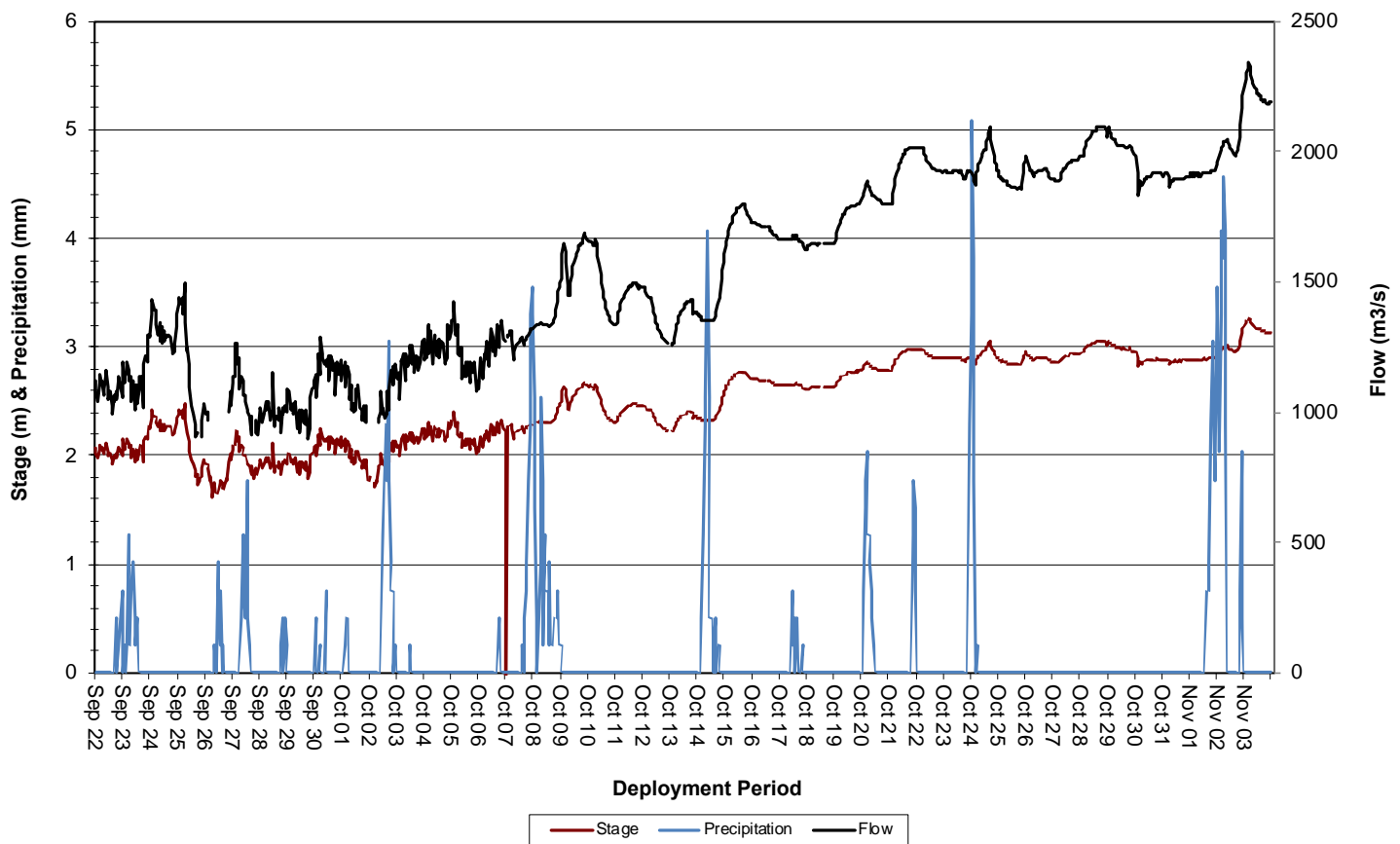
Figure 19: Turbidity, Precipitation & Stage at Churchill River below Muskrat Falls



### Stage & Flow

- Over the deployment period, stage ranged from -0.84m to 3.27m, with a median value of 2.48m. Flow ranged from 894.70m<sup>3</sup>/s to 2338.22m<sup>3</sup>/s, with a median value of 1596.83m<sup>3</sup>/s (Figure 20). Precipitation data was obtained from the Muskrat Falls MET Station.
- Stage and flow were variable, but steadily increasing, over the course of deployment and followed a very similar trend. Increases in stage and flow correlated with precipitation events on several occasions; however, other increases did not correlate with precipitation events. This is likely related to the fact that this station is located on a very wide section of the Churchill River and therefore not as easily influenced by smaller precipitation events.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Churchill River below Muskrat Falls: Stage, Flow & Precipitation**



**Figure 20: Stage, Flow & Precipitation at Churchill River below Muskrat Falls**

## Churchill River at English Point

### Water Temperature

- Water temperature ranged from 2.4°C to 13.1°C, with a median value of 8.0°C (Figure 21). Air temperature data was obtained from the Churchill River at End of Mud Lake Road Weather Station.
- Water temperature decreased slowly over the course of deployment. Water temperatures closely correlated with ambient air temperatures, which followed a similar trend across the same period.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River at English Point: Water and Air Temperature & Stage

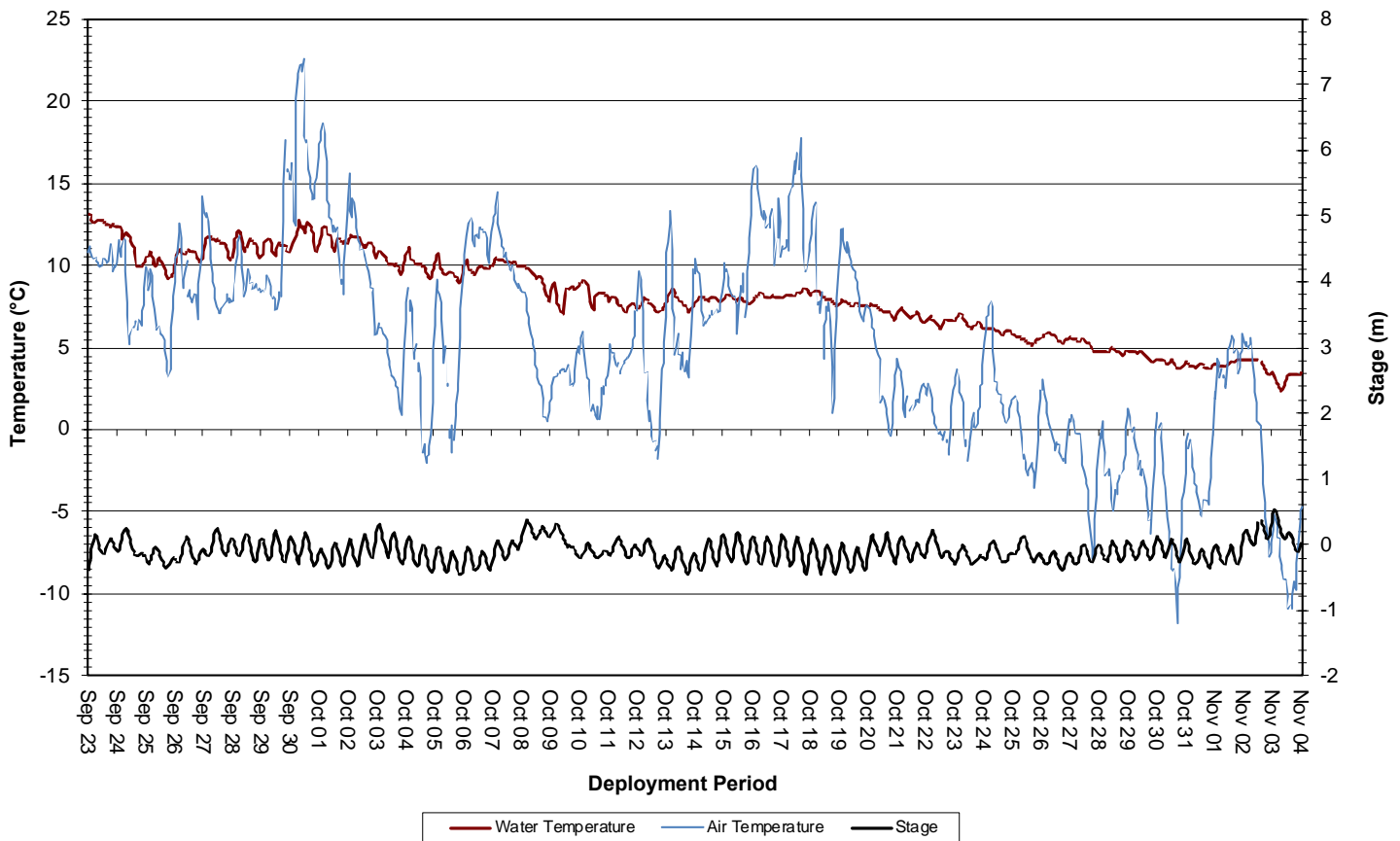


Figure 21: Water and Air Temperature & Stage at Churchill River at English Point

## pH

- Over the deployment period, pH ranged from 6.41 pH units to 7.13 pH units, with a median value of 6.91 (Figure 22).
- pH values were variable across the deployment period but remained within the CCME's Guidelines for the Protection of Aquatic Life for the majority of deployment. pH values from October 10<sup>th</sup> onwards were removed from the dataset due to sediment build-up around the sensors.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River at English Point: pH & Stage

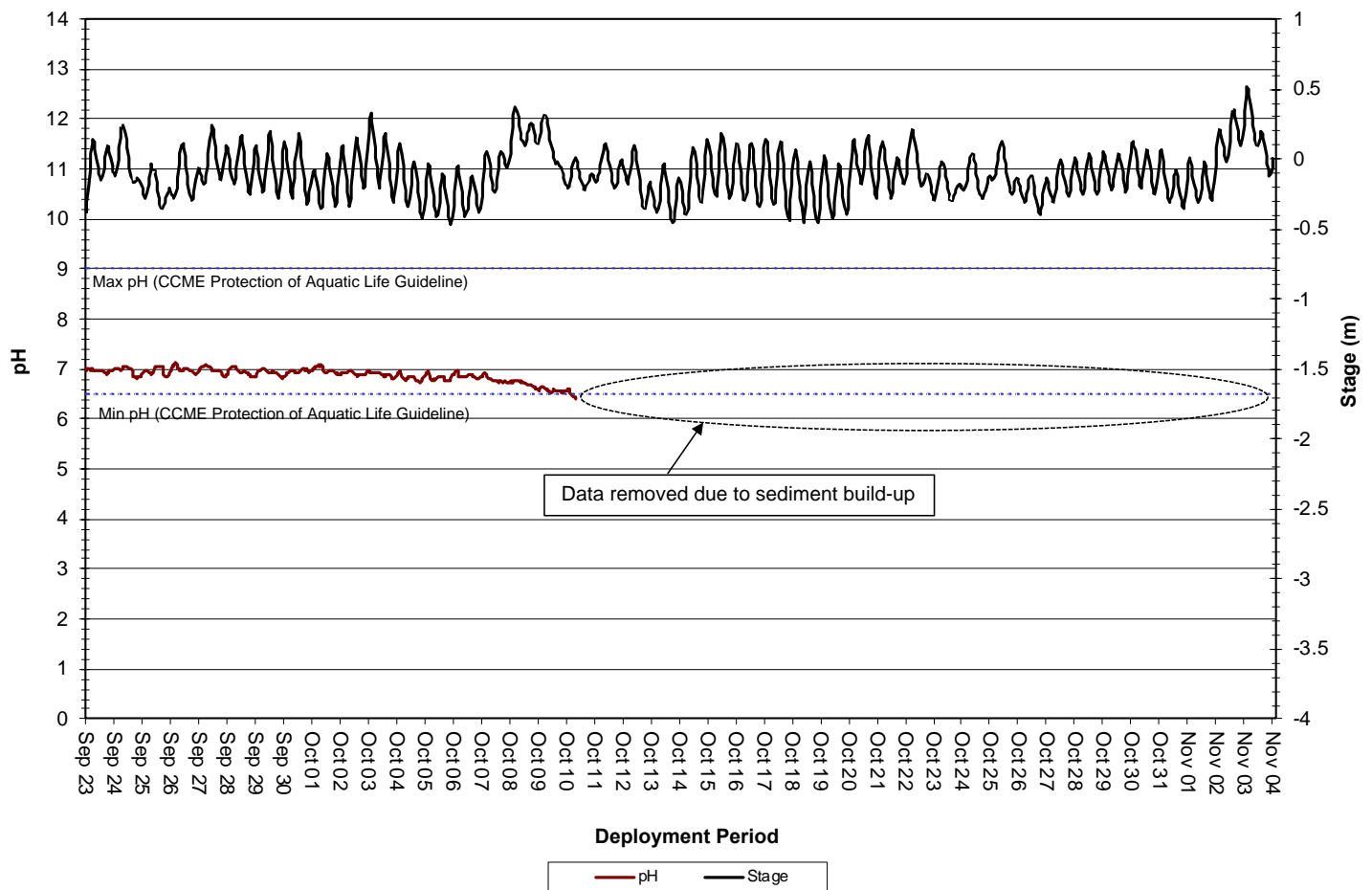


Figure 22: pH & Stage at Churchill River at English Point

### Specific Conductivity

- Over the deployment period, specific conductivity ranged from 16.9 $\mu\text{S}/\text{cm}$  to 42.6 $\mu\text{S}/\text{cm}$ , with a median value of 24.5 $\mu\text{S}/\text{cm}$  (Figure 23).
- Specific conductivity fluctuates considerably at this location due to the tidal influences of the Atlantic Ocean on Lake Melville. As the tide comes in, specific conductivity increases as dissolved solids and salinity increase, and vice versa as the tide goes out. This increase and decrease in specific conductivity and stage occurs twice daily. This pattern is generally consistent throughout the deployment period (Figure 23).
- Specific conductivity values from October 10<sup>th</sup> onwards were removed from the dataset due to sediment build-up around the sensors.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River at English Point: Specific Conductivity & Stage

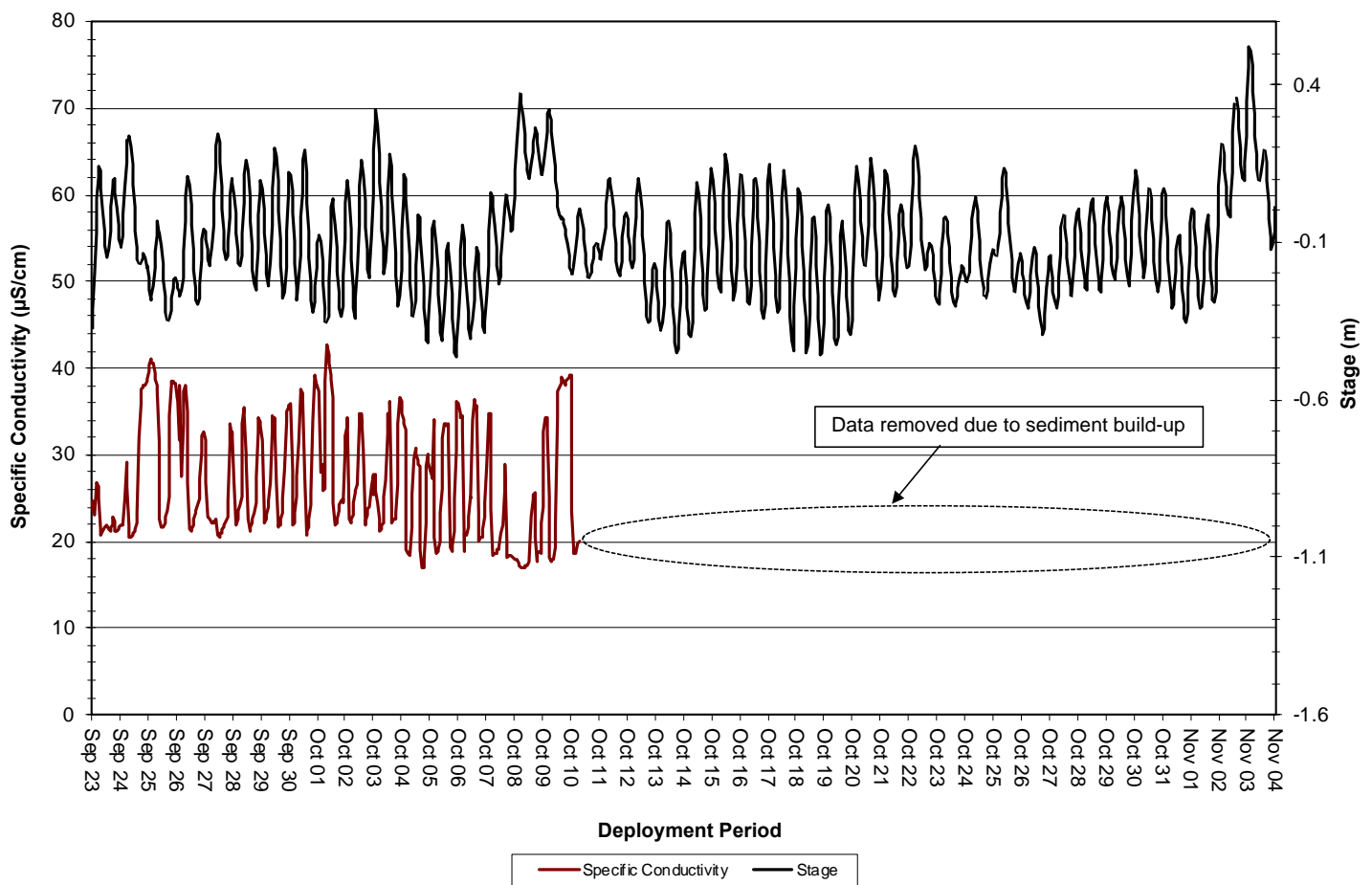


Figure 23: Specific Conductivity & Stage at Churchill River at English Point

### Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 10.09mg/L to 11.49mg/L, with a median value of 10.66mg/L. Saturation of dissolved oxygen ranged from 86.6% to 104.2% saturation, with a median value of 96.5% (Figure 24).
- There is an evident relationship between water temperature and dissolved oxygen. As water temperatures decreased over the deployment period, dissolved oxygen levels gradually increased. Dissolved oxygen levels also follow a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels remained above the CCME’s Guidelines for the Protection of Early and Other Life Stages for the duration of deployment (Figure 24). Dissolved oxygen values from October 10<sup>th</sup> onwards were removed from the dataset due to sediment build-up around the sensors.

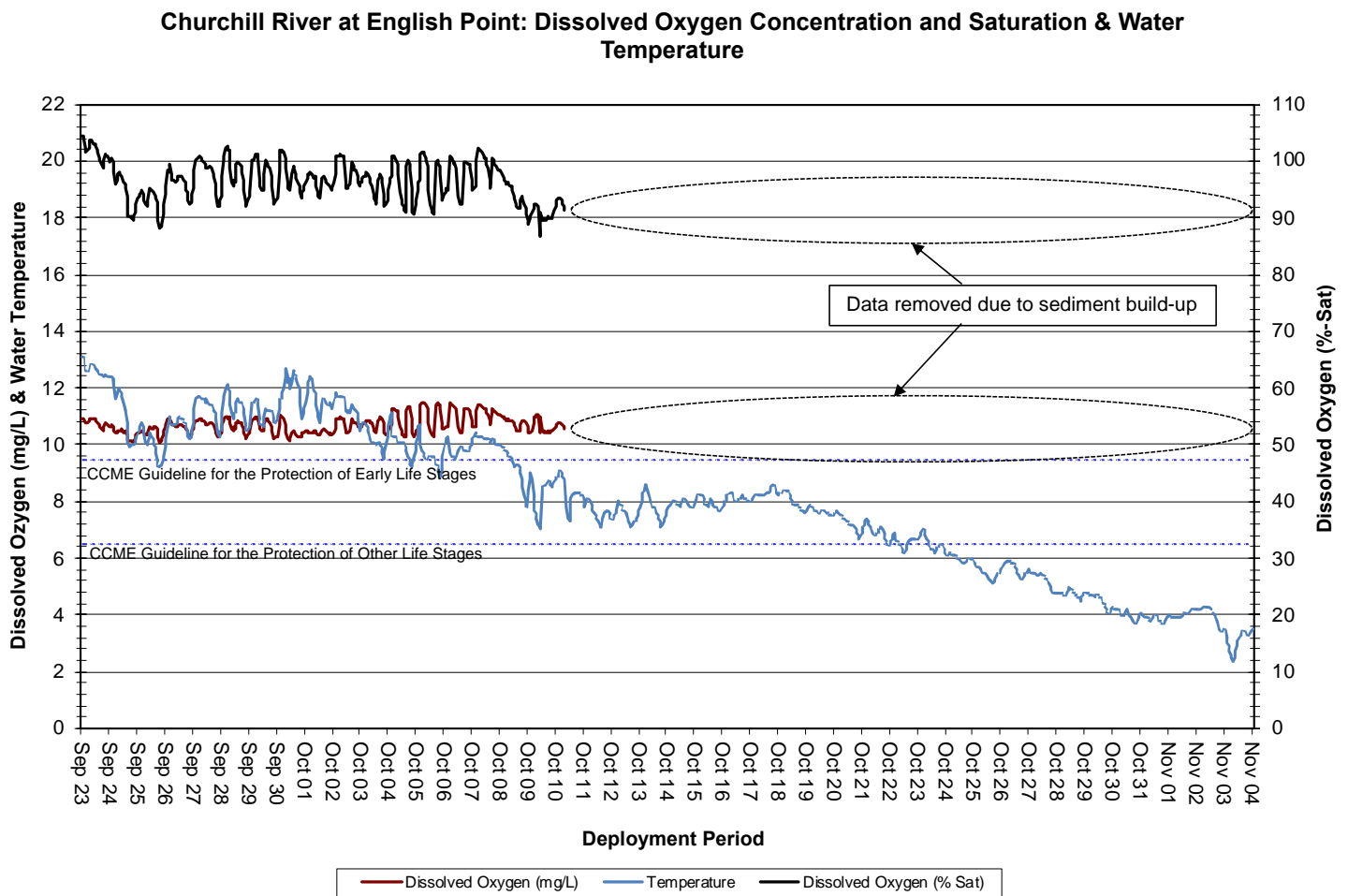
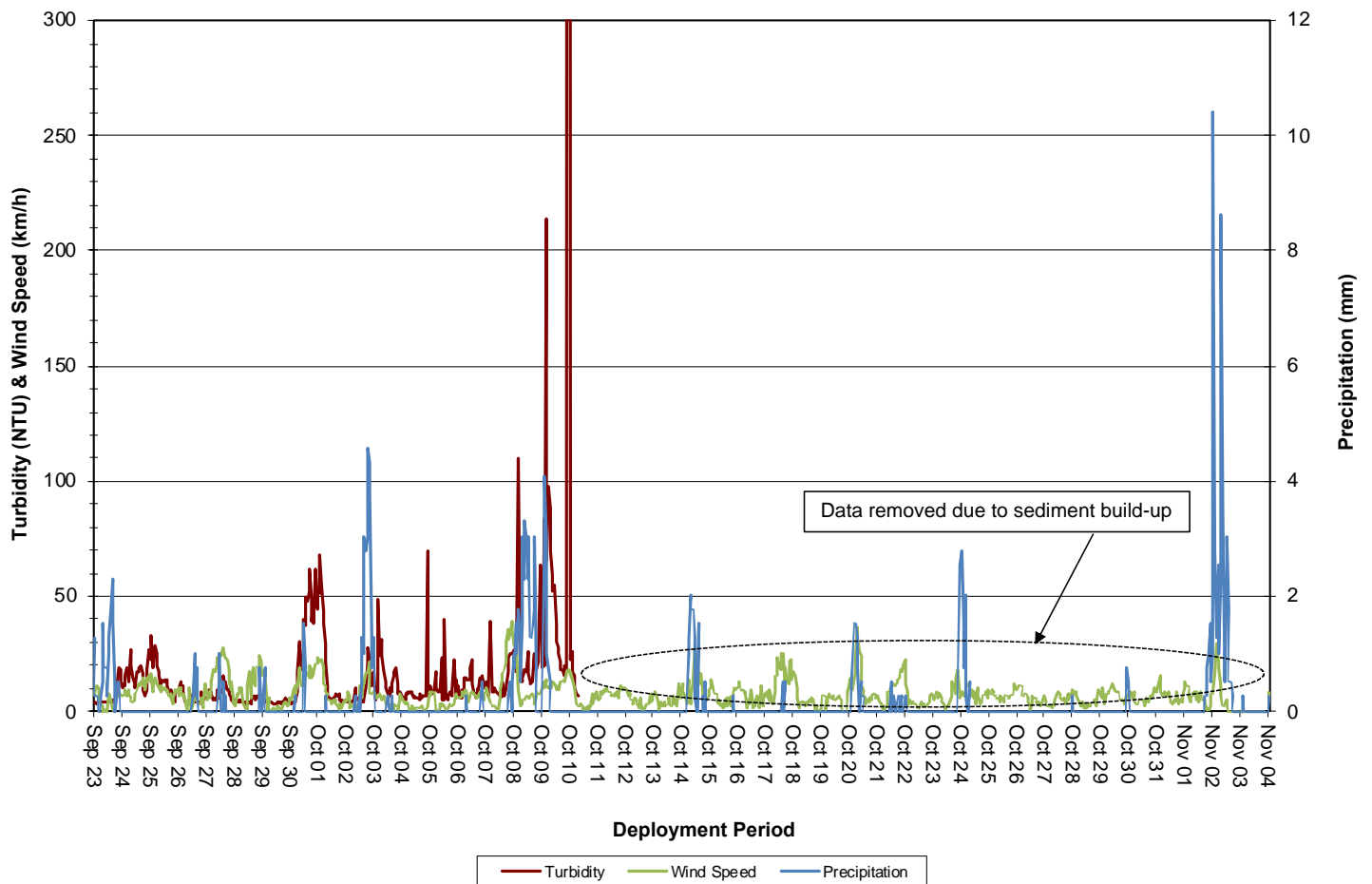


Figure 24: Dissolved Oxygen & Water Temperature at Churchill River at English Point

### Turbidity

- Over the deployment period, turbidity ranged from 3.1NTU to 2554.0NTU, with a median value of 8.5NTU (Figure 25). A median value of 8.5NTU indicates a low level of background turbidity; this is to be expected considering the sandy river bed and tidal influences present at this station. Precipitation data was obtained from the Churchill River at End of Mud Lake Road Weather Station.
- Turbidity events generally correlate with precipitation events, as these can increase the presence of suspended material in water. High winds and tidal influences can also contribute to turbidity events at this station by disturbing sediment from the river bed (Figure 25). Wind speed data was obtained from the Churchill River at End of Mud Lake Road weather station.
- Turbidity values from October 10<sup>th</sup> onwards were removed from the dataset due to sediment build-up around the sensors.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Churchill River at English Point: Turbidity, Precipitation & Wind Speed**



**Figure 25: Turbidity, Precipitation & Wind Speed at Churchill River at English Point**

### Stage

- Over the deployment period, stage ranged from -0.46m to 0.52m, with a median value of -0.12m (Figure 26). Precipitation data was obtained from the Churchill River at End of Mud Lake Road Weather Station.
- Stage fluctuates considerably at this location due to the tidal influences of the Atlantic Ocean. This pattern is consistent over the deployment period. Increases in stage often correlate with precipitation events (Figure 26).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Churchill River at English Point: Stage & Precipitation

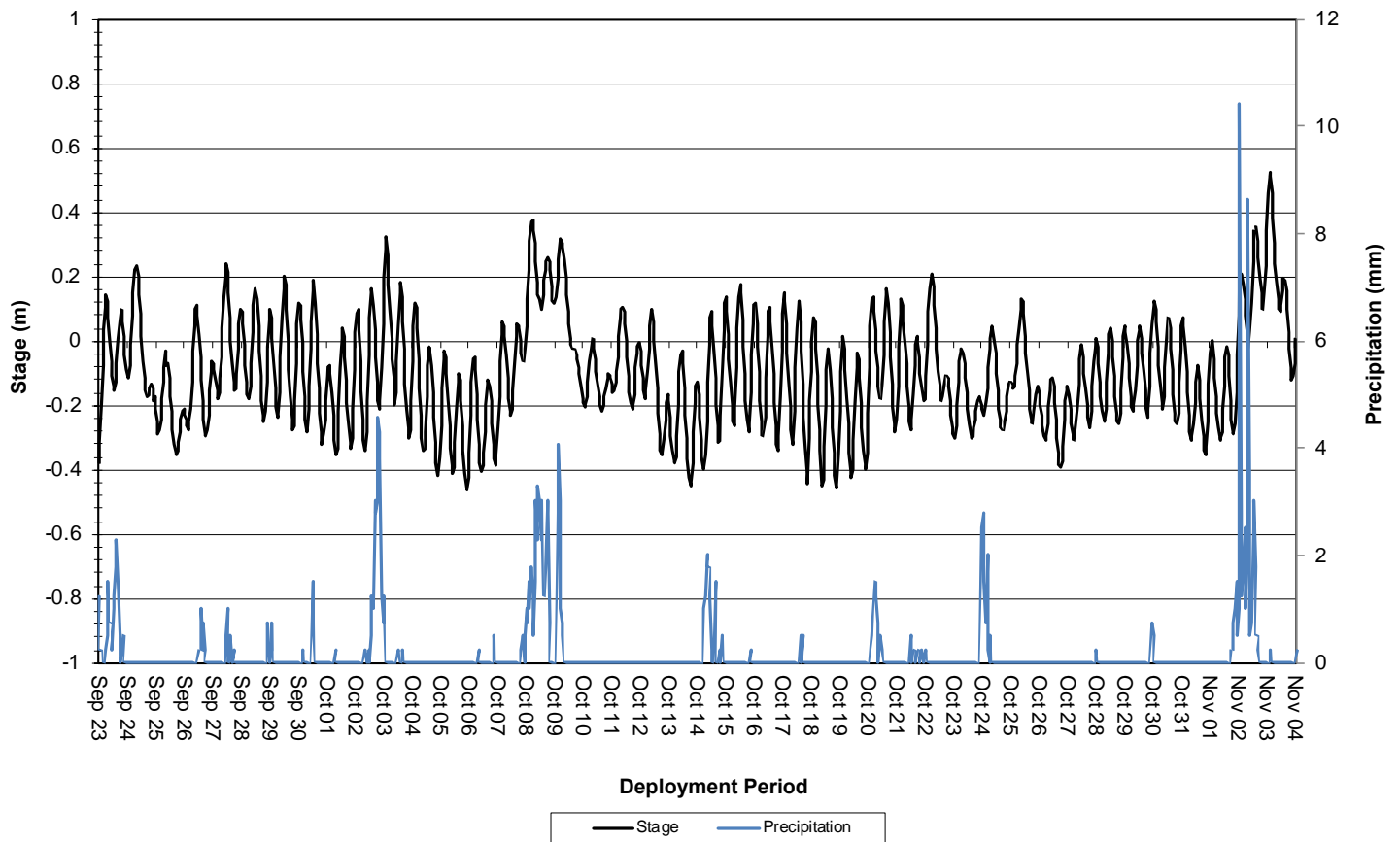


Figure 26: Stage & Precipitation at Churchill River at English Point

## **Conclusions**

- Instruments at four water quality monitoring stations on the Lower Churchill River were deployed from September 22/23 to October 27/November 4/6, 2020.
- Water temperature decreased slowly at all stations over the course of deployment. This is to be expected based on ambient air temperature trends during the same period through the fall months.
- pH was relatively stable at all stations over the course of deployment. pH was within the CCME's Guidelines for the Protection of Aquatic Life for the duration of deployment at Churchill River below Metchin River, above Grizzle Rapids, and below Muskrat Falls, while pH at Churchill River at English Point was within the Guidelines for the majority of deployment.
- Specific conductivity was variable over the course of deployment at all stations. Since English Point is influenced by tides in Lake Melville, specific conductivity values at the Churchill River at English Point station had a much wider range, which is comparable to other deployments at this location.
- Dissolved oxygen levels slowly increased over the course of deployment at all stations as water temperatures decreased through October. Dissolved oxygen levels are generally higher in water at cooler temperatures. Dissolved oxygen levels remained above the CCME's Guidelines for the Protection of Early and Other Life Stages for the duration of deployment at all stations.
- Turbidity events occurred at all stations and were generally related to precipitation events. In most cases, turbidity values returned to background levels following each observed event.



## References

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- Fondriest Environmental Inc. (2016b). Fundamentals of Environmental Measurements [Online]. Available at: <http://www.fondriest.com/environmental-measurements/parameters/water-quality/water-temperature/#watertemp1> [Accessed December 12, 2017].
- Swenson, H.A., and Baldwin, H.L. (1965). A Primer on Water Quality, U.S. Geological Survey. Available at: <https://pubs.usgs.gov/gip/7000057/report.pdf> [Accessed December 12, 2017].
- United States Geological Survey. (2017). Water properties: Dissolved oxygen [Online]. Available at: <https://water.usgs.gov/edu/dissolvedoxygen.html> [Accessed December 12, 2017].

## **APPENDIX A**

### **Water Parameter Description**

## Water Parameter Description

**Dissolved Oxygen** - The amount of Dissolved Oxygen (DO) (mg/l or % saturation) in the water is vital to aquatic organisms for their survival. The concentration of DO is affected by such things as water temperature, water depth and flow (e.g., aeration by rapids, riffles etc.), consumption by aerobic organisms, consumption by inorganic chemical reactions, consumption by plants during darkness, and production by plants during the daylight (USGS, 2017).

**Flow** - Flow (m<sup>3</sup>/s) is a measure of how quickly a volume of water is displaced in streams, rivers, and other channels.

**pH** - pH is a measure of the relative amount of free hydrogen and hydroxyl ions in water. pH is an important indicator of chemically changing water, and determines the solubility and biological availability of nutrients and heavy metals in the water (USGS, 2017).

**Specific conductivity** - Specific conductivity (µs/cm) is a measure of water's ability to conduct electricity, with values normalized to a water temperature of 25°C. Specific conductance indicates the concentration of dissolved solids (such as salts) in the water, which can affect the growth and reproduction of aquatic life. Specific conductivity is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (Fondriest Environmental Inc, 2016).

**Stage** - Stage (m) is the elevation of the water surface and is often used as a surrogate for the more difficult to measure flow.

**Temperature** - Essential to the measurement of most water quality parameters, temperature (°C) controls most aquatic processes. Water temperature is influenced by such things as ambient air temperature, solar radiation, meteorological events, industrial effluence, wastewater, inflowing tributaries, as well as water body size and depth. In turn, water temperature has an influence on the metabolic rates and biological activity of aquatic organisms (Fondriest Environmental Inc, 2016b).

**Total Dissolved Solids** - Total Dissolved Solids (TDS) (g/l) is a measure of alkaline salts dissolved in water or in fine suspension and can affect the growth and reproduction of aquatic life. It is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (Swenson and Baldwin, 1965).

**Turbidity** - Turbidity (NTU) is a measure of the translucence of water and indicates the amount of suspended material in the water. Turbidity is caused by any substance that makes water cloudy (e.g., soil erosion, micro-organisms, vegetation, chemicals, etc.) and can correspond to precipitation events, high stage, and floating debris near the sensor (Swenson and Baldwin 1965).

**APPENDIX B**  
**Grab Sample Results**

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-


**COC Number:**  
**Date Reported:** 2020-11-11  
**Date Submitted:** 2020-11-04  
**Sample Matrix:** Water

<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1526563	WS-S-0000 CR Below MR	2020-6328-00-SI-SP	2020-10-27	Alkalinity as CaCO3	mg/L	5	9
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	<1
				Colour	TCU	2	22
				Conductivity	uS/cm	5	21
				Dissolved Organic Carbon	mg/L	0.5	3.7
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	0.092
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	7.13
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	14
				Total Kjeldahl Nitrogen	mg/L	0.100	0.143
				Total Organic Carbon	mg/L	0.5	4.0
				Turbidity	NTU	0.1	1.4
				Aluminum	mg/L	0.01	0.07

Sample comment:

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
 Results relate only to the parameters tested on the samples submitted.  
 Methods references and/or additional QA/QC information available on request.

APPROVAL:   
 Sarah Horner

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-


**COC Number:**  
**Date Reported:** 2020-11-11  
**Date Submitted:** 2020-11-04  
**Sample Matrix:** Water

<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1526563	WS-S-0000 CR Below MR	2020-6328-00-SI-SP	2020-10-27	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	<0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.16
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	0.02
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.011

Sample comment:

Report comment:

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APPROVAL:   
 Sarah Horner

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-


**COC Number:**  
**Date Reported:** 2020-11-11  
**Date Submitted:** 2020-11-04  
**Sample Matrix:** Water

<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1526563	WS-S-0000 CR Below MR	2020-6328-00-SI-SP	2020-10-27	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.012
				Total Suspended Solids	mg/L	2	12

Sample comment:

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
 Results relate only to the parameters tested on the samples submitted.  
 Methods references and/or additional QA/QC information available on request.

APPROVAL:   
 Sarah Horner

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 863525  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

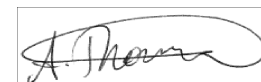
LAB ID	Supply / Description	Client Sample ID	Sample Date	ANALYTE	UNIT	MRL	RESULT
1518722	WS-S-0000 CR Above GR	2020-6319-00-SI-SP	2020-09-22	Alkalinity as CaCO3	mg/L	5	<5
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	<1
				Colour	TCU	2	19
				Conductivity	uS/cm	5	33
				Dissolved Organic Carbon	mg/L	0.5	4.1
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	<0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	5.22
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	21
				Total Kjeldahl Nitrogen	mg/L	0.100	0.117
				Total Organic Carbon	mg/L	0.5	4.1
				Turbidity	NTU	0.1	0.5
				Aluminum	mg/L	0.01	0.04

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
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APPROVAL: \_\_\_\_\_  
 Addrine Thomas



**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 863525  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

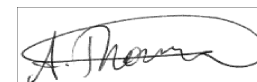
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1518722	WS-S-0000 CR Above GR	2020-6319-00-SI-SP	2020-09-22	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	<0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.10
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	<0.01
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.012

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
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**Purchase Order:** 219034377-5

**COC Number:** 863525  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

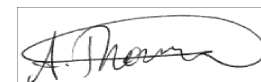
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1518722	WS-S-0000 CR Above GR	2020-6319-00-SI-SP	2020-09-22	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.003

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
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APPROVAL: \_\_\_\_\_  
 Addrine Thomas

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 866721  
**Date Reported:** 2020-11-23  
**Date Submitted:** 2020-11-13  
**Sample Matrix:** Water

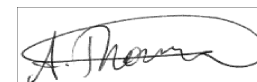
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1528512	WS-S-0000 CR above GR	2020-6329-00-SI-SP	2020-11-06	Alkalinity as CaCO3	mg/L	5	6
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	<1
				Colour	TCU	2	34
				Conductivity	uS/cm	5	16
				Dissolved Organic Carbon	mg/L	0.5	4.9
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	<0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	6.97
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	10
				Total Kjeldahl Nitrogen	mg/L	0.100	0.179
				Total Organic Carbon	mg/L	0.5	5.1
				Turbidity	NTU	0.1	0.5
				Aluminum	mg/L	0.01	0.06

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
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**Purchase Order:** 219034377-5

**COC Number:** 866721  
**Date Reported:** 2020-11-23  
**Date Submitted:** 2020-11-13  
**Sample Matrix:** Water

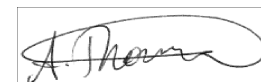
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1528512	WS-S-0000 CR above GR	2020-6329-00-SI-SP	2020-11-06	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	<0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.13
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	0.01
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.011

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
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 Methods references and/or additional QA/QC information available on request.



APPROVAL: \_\_\_\_\_  
 Addrine Thomas

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 866721  
**Date Reported:** 2020-11-23  
**Date Submitted:** 2020-11-13  
**Sample Matrix:** Water

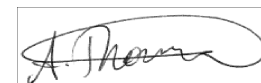
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1528512	WS-S-0000 CR above GR	2020-6329-00-SI-SP	2020-11-06	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.003
				Total Suspended Solids	mg/L	2	<2

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

Eurofins (Ottawa) is accredited for specific parameters by CALA. The scope can be viewed at <http://www.cala.ca/scopes/2602.pdf>.  
 Results relate only to the parameters tested on the samples submitted.  
 Methods references and/or additional QA/QC information available on request.



APPROVAL: \_\_\_\_\_

Addrine Thomas

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:**  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

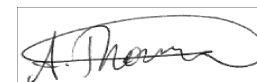
LAB ID	Supply / Description	Client Sample ID	Sample Date	ANALYTE	UNIT	MRL	RESULT
1518723	WS-S-0000 CR Below MF	2020-6320-00-SI-SP	2020-09-22	Alkalinity as CaCO3	mg/L	5	<5
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	<1
				Colour	TCU	2	46
				Conductivity	uS/cm	5	25
				Dissolved Organic Carbon	mg/L	0.5	4.0
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	<0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	6.35
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	16
				Total Kjeldahl Nitrogen	mg/L	0.100	0.513
				Total Organic Carbon	mg/L	0.5	4.0
				Turbidity	NTU	0.1	5.5
				Aluminum	mg/L	0.01	0.18

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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APPROVAL: \_\_\_\_\_  
 Addrine Thomas

**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:**  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

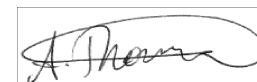
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1518723	WS-S-0000 CR Below MF	2020-6320-00-SI-SP	2020-09-22	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	<0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.20
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	<0.01
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.013

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Purchase Order:** 219034377-5

**COC Number:**  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

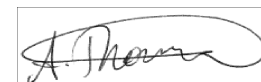
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1518723	WS-S-0000 CR Below MF	2020-6320-00-SI-SP	2020-09-22	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.008

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 866499  
**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

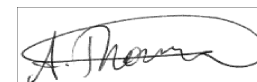
LAB ID	Supply / Description	Client Sample ID	Sample Date	ANALYTE	UNIT	MRL	RESULT
1527404	WS-S-0000 CR below MF	2020-6330-00-SI-SP	2020-11-04	Alkalinity as CaCO3	mg/L	5	5
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	<1
				Colour	TCU	2	40
				Conductivity	uS/cm	5	18
				Dissolved Organic Carbon	mg/L	0.5	6.7
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	<0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	7.04
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	12
				Total Kjeldahl Nitrogen	mg/L	0.100	0.148
				Total Organic Carbon	mg/L	0.5	6.6
				Turbidity	NTU	0.1	6.0
				Aluminum	mg/L	0.01	0.22

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Purchase Order:** 219034377-5

**COC Number:** 866499  
**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

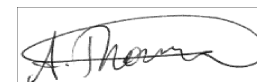
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1527404	WS-S-0000 CR below MF	2020-6330-00-SI-SP	2020-11-04	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	0.0007
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.25
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	0.01
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.012

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Purchase Order:** 219034377-5

**COC Number:** 866499  
**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

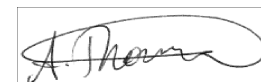
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1527404	WS-S-0000 CR below MF	2020-6330-00-SI-SP	2020-11-04	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.012
				Total Suspended Solids	mg/L	2	12

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:**  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

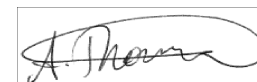
LAB ID	Supply / Description	Client Sample ID	Sample Date	ANALYTE	UNIT	MRL	RESULT
1518724	WS-S-0000 CR at EP	2020-6321-00-SI-SP	2020-09-23	Alkalinity as CaCO3	mg/L	5	<5
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	2
				Colour	TCU	2	47
				Conductivity	uS/cm	5	31
				Dissolved Organic Carbon	mg/L	0.5	4.0
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	5
				N-NH3 (Ammonia)	mg/L	0.010	<0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	6.49
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	20
				Total Kjeldahl Nitrogen	mg/L	0.100	0.396
				Total Organic Carbon	mg/L	0.5	4.1
				Turbidity	NTU	0.1	5.0
				Aluminum	mg/L	0.01	0.16

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**COC Number:**  
**Date Reported:** 2020-10-05  
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**Sample Matrix:** Water

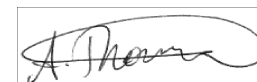
LAB ID	Supply / Description	Client Sample ID	Sample Date	ANALYTE	UNIT	MRL	RESULT
1518724	WS-S-0000 CR at EP	2020-6321-00-SI-SP	2020-09-23	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	<0.01
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	<0.001
				Copper	mg/L	0.001	<0.001
				Iron	mg/L	0.03	0.21
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	<1
				Manganese	mg/L	0.01	<0.01
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	<1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	<2
				Strontium	mg/L	0.001	0.016

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:**  
**Date Reported:** 2020-10-05  
**Date Submitted:** 2020-09-28  
**Sample Matrix:** Water

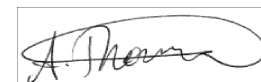
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1518724	WS-S-0000 CR at EP	2020-6321-00-SI-SP	2020-09-23	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.009

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Client:** Department of Environment  
**Attention:** Ms. Leona Hyde  
**Client Project:**  
**Purchase Order:** 219034377-5

**COC Number:** 866499  
**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

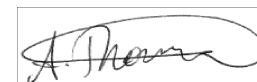
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1527405	WS-S-0000 CR at EP	2020-6331-00-SI-SP	2020-11-04	Alkalinity as CaCO3	mg/L	5	<5
				Bromide	mg/L	0.25	<0.25
				Chloride	mg/L	1	5
				Colour	TCU	2	77
				Conductivity	uS/cm	5	38
				Dissolved Organic Carbon	mg/L	0.5	7.6
				Fluoride	mg/L	0.10	<0.10
				Hardness as CaCO3	mg/L	1	13
				N-NH3 (Ammonia)	mg/L	0.010	0.010
				N-NO2 (Nitrite)	mg/L	0.10	<0.10
				N-NO3 (Nitrate)	mg/L	0.10	<0.10
				pH		1.00	7.11
				Sulphate	mg/L	1	<1
				Total Dissolved Solids (COND - CALC)	mg/L	1	25
				Total Kjeldahl Nitrogen	mg/L	0.100	0.229
				Total Organic Carbon	mg/L	0.5	8.0
				Turbidity	NTU	0.1	0.9
				Aluminum	mg/L	0.01	1.03

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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**Purchase Order:** 219034377-5

**COC Number:** 866499  
**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

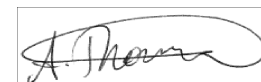
<u>LAB ID</u>	<u>Supply / Description</u>	<u>Client Sample ID</u>	<u>Sample Date</u>	<u>ANALYTE</u>	<u>UNIT</u>	<u>MRL</u>	<u>RESULT</u>
1527405	WS-S-0000 CR at EP	2020-6331-00-SI-SP	2020-11-04	Antimony	mg/L	0.0005	<0.0005
				Arsenic	mg/L	0.001	<0.001
				Barium	mg/L	0.01	0.02
				Boron	mg/L	0.01	<0.01
				Calcium	mg/L	1	2
				Cadmium	mg/L	0.0001	<0.0001
				Chromium	mg/L	0.001	0.002
				Copper	mg/L	0.001	0.003
				Iron	mg/L	0.03	1.35
				Lead	mg/L	0.001	<0.001
				Magnesium	mg/L	1	2
				Manganese	mg/L	0.01	0.04
				Mercury	mg/L	0.0001	<0.0001
				Nickel	mg/L	0.005	<0.005
				Potassium	mg/L	1	1
				Selenium	mg/L	0.001	<0.001
				Sodium	mg/L	2	4
				Strontium	mg/L	0.001	0.019

Sample comment:

Holding time for turbidity analysis was exceeded.

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**Purchase Order:** 219034377-5

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**Date Reported:** 2020-11-16  
**Date Submitted:** 2020-11-09  
**Sample Matrix:** Water

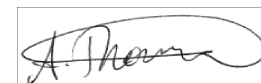
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1527405	WS-S-0000 CR at EP	2020-6331-00-SI-SP	2020-11-04	Uranium	mg/L	0.001	<0.001
				Zinc	mg/L	0.01	<0.01
				Phosphorus	mg/L	0.002	0.135
				Total Suspended Solids	mg/L	2	88

Sample comment:

Holding time for turbidity analysis was exceeded.

Report comment:

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