



# Real-Time Water Quality 2025 Annual Report

## Churchill River Network

May 21 to October 30, 2025



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

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## **Acknowledgements**

The Real-Time Water Quality (RTWQ) monitoring network on the Churchill River is successful in tracking emerging water quality issues, as well as creating a database of baseline and post baseline water quality data due to the hard work and diligence of certain individuals. The management and staff of NL Hydro (formerly Nalcor Energy) work in cooperation with the management and staff of the Department of Environment, Conservation and Climate Change (ECC), as well as Environment and Climate Change Canada (ECCC), to ensure the protection of ambient water resources in the Churchill River.

Employees with the Water Resources Management Division (WRMD) of the Department of ECC were integral in ensuring the smooth operation of such a technologically advanced network. WRMD staff were responsible for deployment and removal of instruments including cleaning, calibration, and maintenance, as well as preparation of monthly deployment reports for the 2025 season.

Water Survey of Canada staff with ECCC played an essential role in the data logging/communication aspect of the network. These individuals visited the site regularly to ensure the data logging equipment was operating properly and transmitting data efficiently. Finally, they played the lead role in dealing with hydrological quantity and flow issues.

Staff from each agency are fully committed to improving this network and ensuring it provides meaningful and accurate water quality/quantity data that can be used in decision-making processes. This network is continually successful due to the participation and collaboration of all three agencies.

## **Abbreviations**

ECCC	Environment and Climate Change Canada
ECC	NL Department of Environment, Conservation and Climate Change
WRMD	Water Resources Management Division
CRbelowMR	Station at Churchill River below Metchin River
CRaboveGR	Station at Churchill River above Grizzle Rapids
CRbelowMF	Station at Churchill River below Muskrat Falls
CRatEngPt	Station at Churchill River at English Point
DO	Dissolved Oxygen
NL	Newfoundland and Labrador
QA/QC	Quality Assurance and Quality Control
RTWQ	Real-Time Water Quality
WRMD	Water Resources Management Division
%Sat	Percent Saturation

## History

- The RTWQ monitoring network on the Lower Churchill River was successfully established by WRMD and ECCC in cooperation with NL Hydro in September 2008.
- The objective of the network is to identify and track emerging water quality or quantity management issues and ensure protection of ambient water resources along the Lower Churchill River. The information collected will serve to monitor and assess water quality throughout the several phases of the Lower Churchill Hydroelectric Generation Project.
- The original network, established in 2008, consisted of four water quality/quantity monitoring stations along the Lower Churchill River from just below the confluence with Metchin River to just below Muskrat Falls. In addition, there were two water quantity monitoring stations on the Churchill River below the Tailrace and above Grizzle Rapids, which strictly recorded stage level continuously. There were also hydrometric stations on select tributaries to the Churchill River (ie. East Metchin River, Pinus River, Minipi River (Figure 1)).
- In 2011, WRMD in cooperation with ECCC established another water quality/quantity monitoring station at the mouth of the Churchill River (Churchill River at English Point). While owned by WRMD, this station is included in this annual report for comparison purposes (Figure 1). A water quantity station was also established at Lake Melville east of Little River in 2011.
- Construction at the Muskrat Falls Hydroelectric Generation site began in 2013.
- During the 2014 deployment year, one water quality/quantity monitoring station (Churchill River below Metchin River) and three water quantity monitoring stations (Churchill River above Churchill Falls Tailrace, East Metchin River below Highway Bridge and Minipi River below Minipi Lake) were discontinued as per changes to the Memorandum of Agreement between WRMD and NL Hydro. An additional water quantity monitoring station (Churchill River at Mid Pool) was added to the agreement in 2014.
- During the 2017 deployment year, several stations were reactivated or added to the Churchill River network. Stations at Churchill River below Metchin River and Churchill River above Churchill Falls Tailrace were reactivated. New stations at Churchill River below Churchill Falls Tailrace, Churchill River at Happy Valley, and Mud Lake at Mud Lake were installed. With the exception of Churchill River below Metchin River, these reactivated and new stations collect water quantity data only.
- Continuous monitoring at four water quality/quantity monitoring stations in the Lower Churchill River Network recommenced in spring 2025. This annual deployment report illustrates, discusses and summarizes water quality related events from May 21 to October 30, 2025. Instruments were generally deployed for 40-60 day intervals referred to as deployment periods.

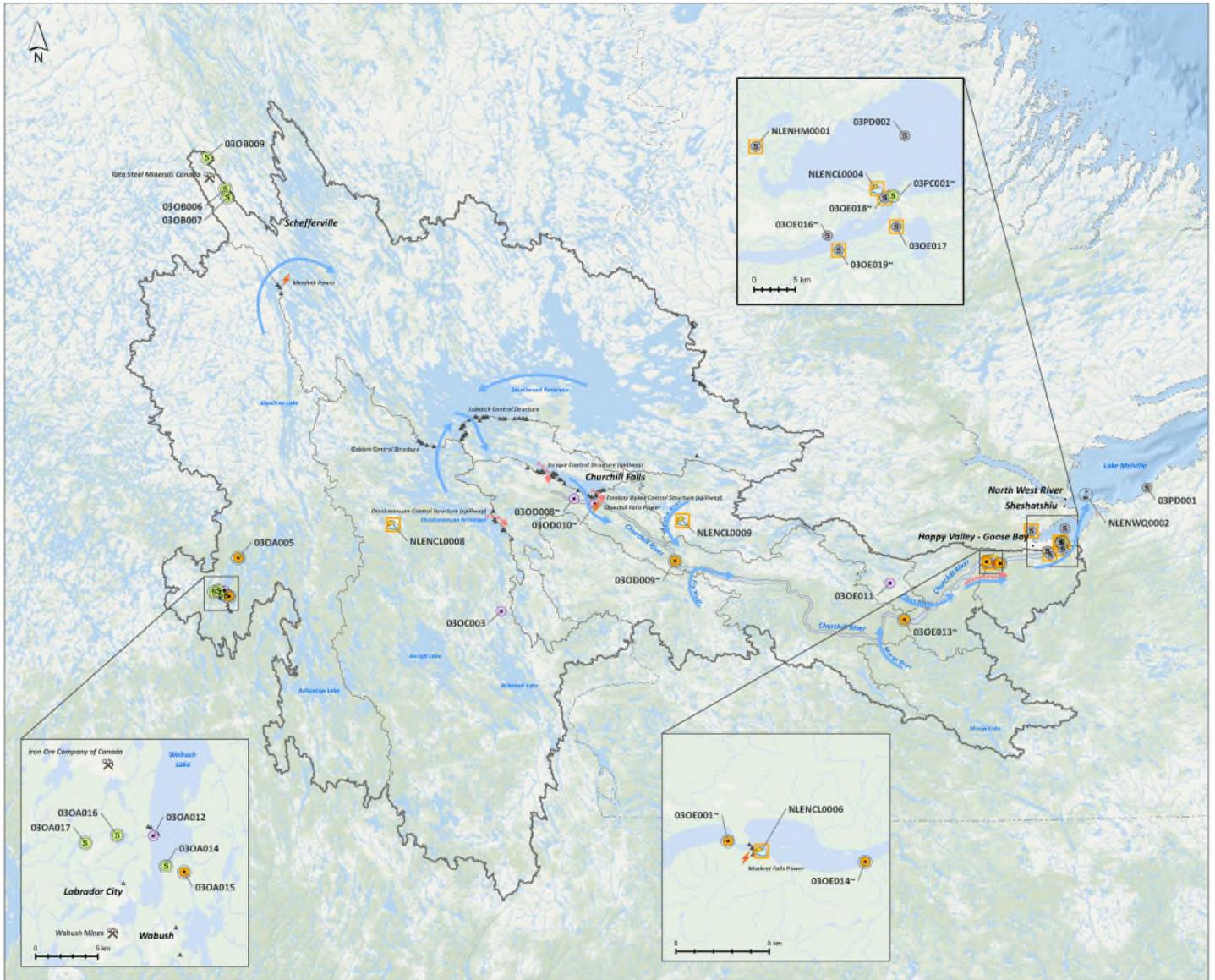


Figure 1: Churchill River Station Network Map

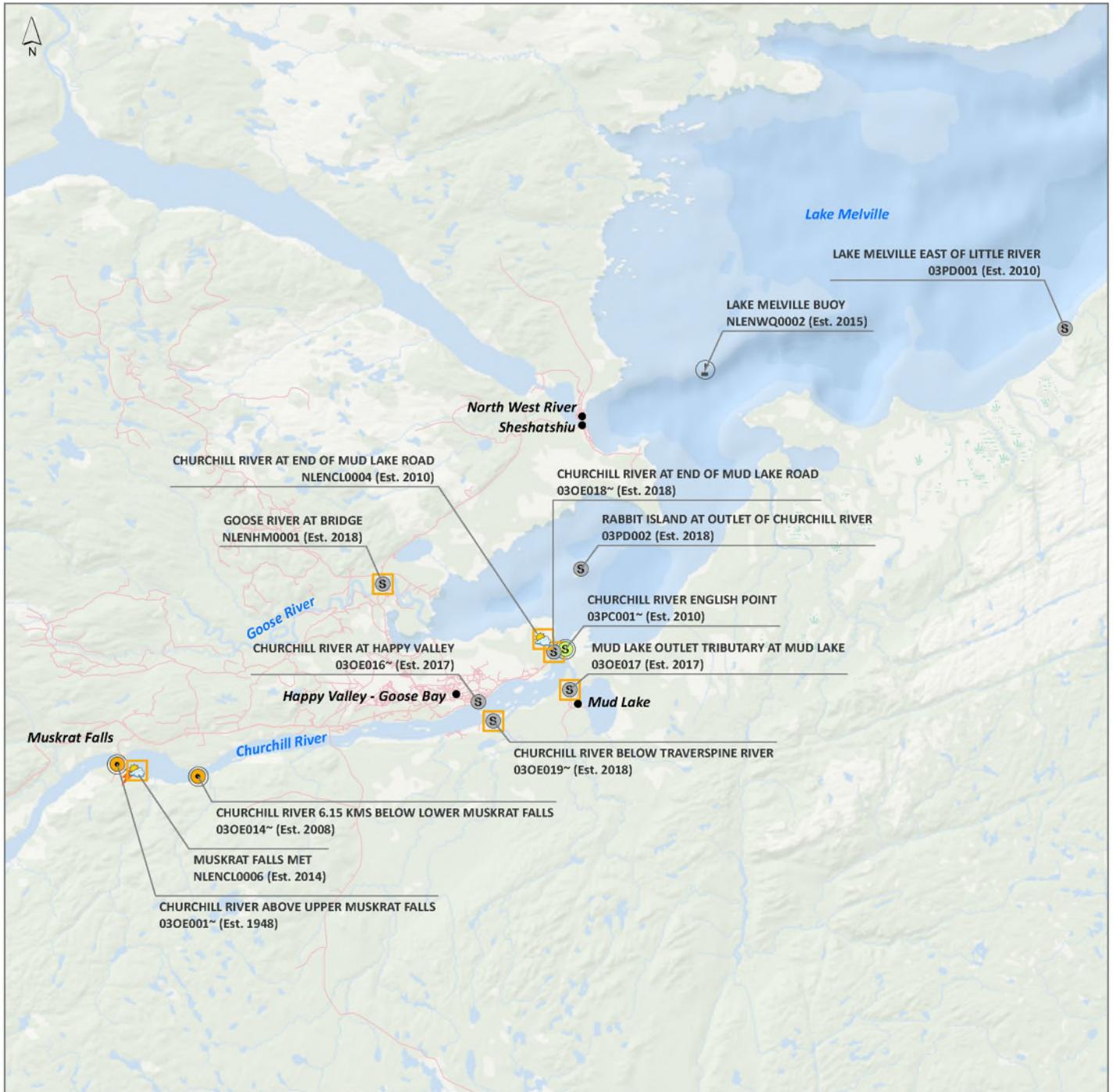


Figure 2: Lower Churchill River Network Station Map

## Maintenance and Calibration

- Regular maintenance and calibration of the instruments is required to ensure data accuracy. This procedure is the responsibility of ECC staff and is performed generally every 30-50 days.
- Maintenance includes a thorough cleaning of the instrument and replacement of any small sensor parts that are damaged or unsuitable for reuse. Once the instrument is cleaned, ECC staff carefully calibrate each sensor attachment for pH, specific conductivity, dissolved oxygen and turbidity.
- Installation and removal dates for each station during the 2025 deployment season are summarized in Table 1.

**Table 1: Installation and removal dates for 2025 deployment season**

Station	Initial Installation	Removal	Deployment Periods (days)
Churchill River below Metchin River	July 3	October 28	66, 49
Churchill River above Grizzle Rapids	July 3	October 29	66, 50
Churchill River below Muskrat Falls	May 21	October 29	43, 65, 50
Churchill River at English Point	May 21	October 30	43, 68, 48

## 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. The procedure is based on the approach used by the United States Geological Survey (USGS).
  - At deployment and removal, a QA/QC Instrument is temporarily deployed adjacent to 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 2).

**Table 2: 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 > 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

- 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 measurement is taken too soon it may not accurately portray the water body.
- Comparison rankings for the Lower Churchill River stations during the 2025 deployment season are summarized in Table 3.
- For additional information and explanations of rankings, please refer to the monthly deployment reports.

**Table 3: Comparison rankings for Lower Churchill River stations, 2025 deployment season**

Station	Date	Action	Temperature	pH	Specific Conductivity	Dissolved Oxygen	Turbidity
Churchill River below Metchin River		Deployment	-	Instrument	not	Deployed	-
		Removal	-	-	-	-	-
	July 3, 2025	Deployment	Good	Good	Excellent	Excellent	Good
	September 9, 2025	Removal	Excellent	Marginal	Excellent	Excellent	Excellent
	September 9, 2025	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	October 28, 2025	Removal	Excellent	Fair	Good	Excellent	Poor
Churchill River above Grizzle Rapids		Deployment	-	Instrument	not	Deployed	-
		Removal	-	-	-	-	-
	July 3, 2025	Deployment	Good	Fair	Excellent	Excellent	Excellent
	September 9, 2025	Removal	Excellent	Poor	Excellent	Excellent	Excellent
	September 9, 2025	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	October 29, 2025	Removal	Excellent	Fair	Good	Excellent	Excellent
Churchill River below Muskrat Falls	May 21, 2025	Deployment	Excellent	Fair	Excellent	Excellent	Good
	July 4, 2025	Removal	Marginal	Excellent	Marginal	Poor	Good
	July 4, 2025	Deployment	Good	Good	Excellent	Excellent	Good
	September 9, 2025	Removal	Good	Excellent	Excellent	Excellent	Poor
	September 9, 2025	Deployment	Excellent	Good	Excellent	Excellent	Good
	October 29, 2025	Removal	Excellent	Fair	Excellent	Excellent	Excellent
Churchill River at English Point	May 21, 2025	Deployment	Good	Excellent	Excellent	Excellent	Good
	July 4, 2025	Removal	Good	Excellent	Excellent	Excellent	Excellent
	July 4, 2025	Deployment	Excellent	Good	Excellent	Fair	Excellent
	September 12, 2025	Removal	Excellent	Good	Excellent	Fair	Excellent
	September 12, 2025	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	October 30, 2025	Removal	Good	Marginal	Fair	Excellent	Excellent

## **Data Interpretation and Review**

- The following graphs and discussions illustrate significant water quality-related trends from May 21 to October 30 throughout the Churchill River network. In this summary of all 2025 deployment periods, general patterns will be discussed. For more detailed analysis and discussion of specific events, please refer to the monthly deployment reports.
- With the exception of water quantity data (stage and flow), all data used in the preparation of the graphs and subsequent discussion below adhere to stringent QA/QC protocol.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data (stage and flow). Corrected data can be obtained upon request.
- For a general comparison, 2023 and 2024 data have been included to show trends in water quality on the Churchill River over the previous 3 years.
- Summary statistics are calculated using the entire data set. This means that the number of values used to calculate the median, minimum, and maximum vary from year to year, and from station to station, depending on the length of the deployment season.

## Churchill River below Metchin River

### Temperature

- Over the 2025 deployment season, water temperature ranged from 6.13°C to 19.9°C, with a median value of 15°C (Figure 3).
- As expected, this station displayed an increasing trend until mid August, after which water temperatures steadily decreased through late summer and fall. Increased fluctuations in water temperature throughout the deployment may be attributable to the instrument being located out of, or in very little, water due to low water levels.

Water Temperature & Stage at Churchill River below Metchin River

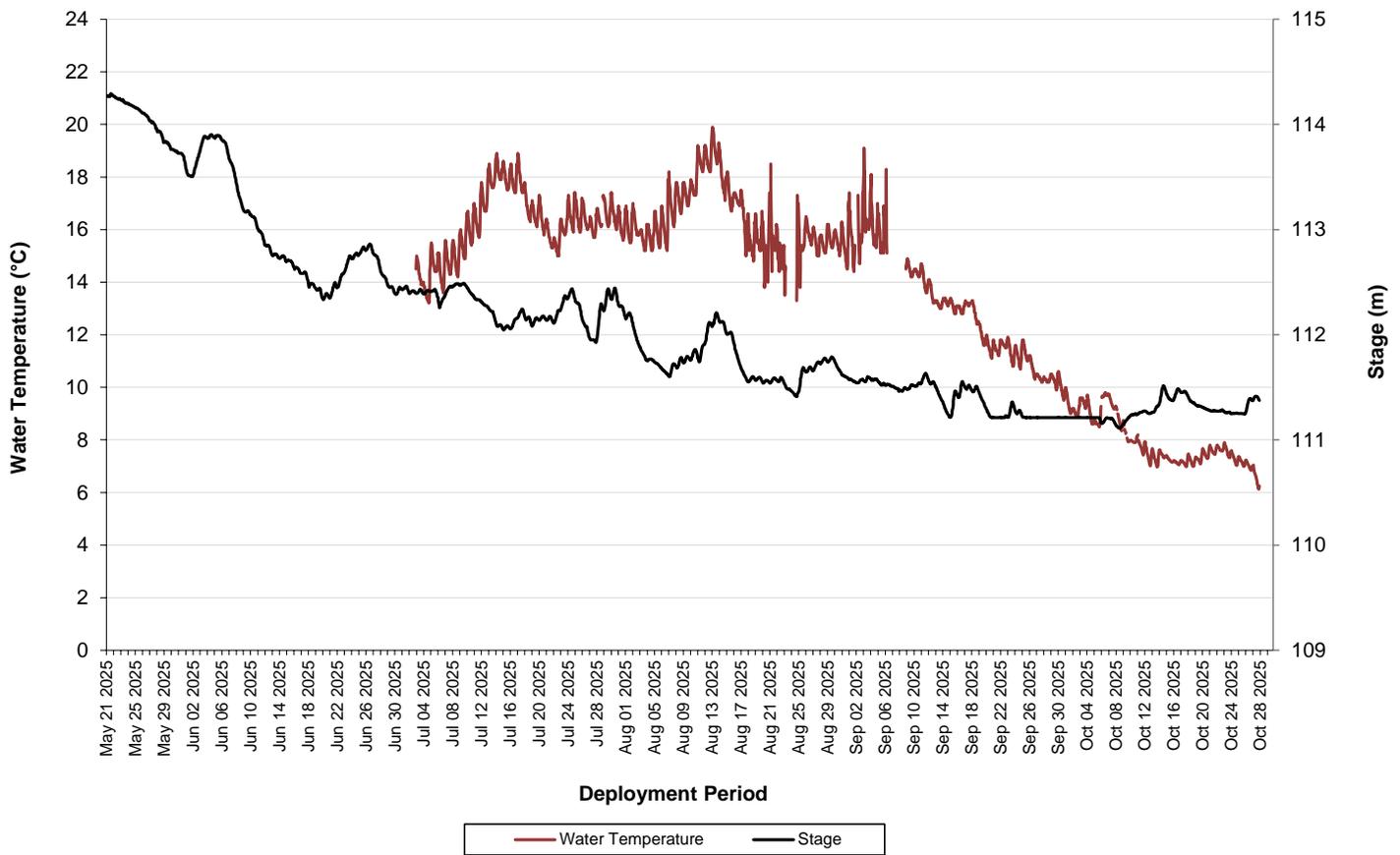
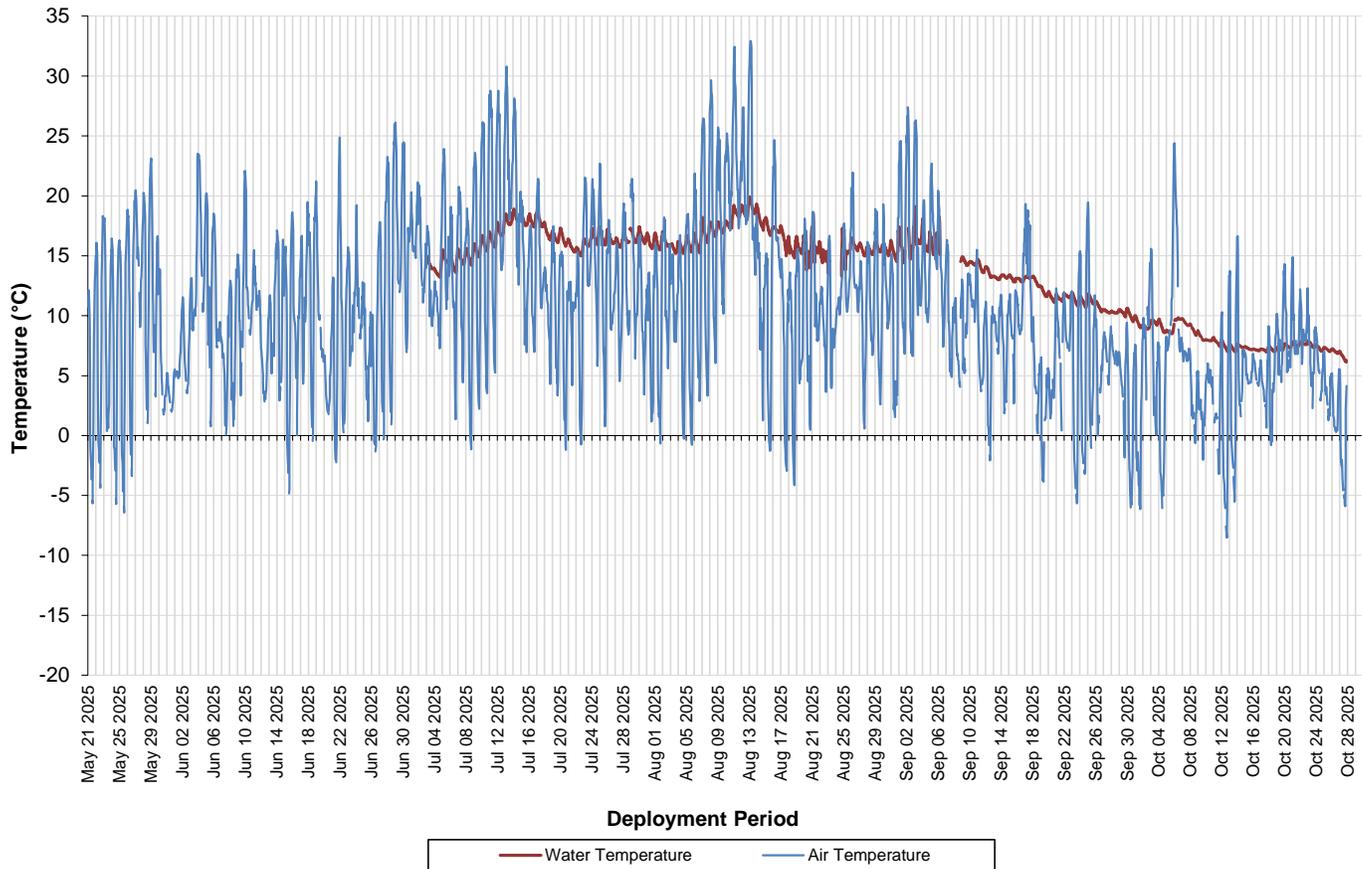


Figure 3: Water Temperature & Stage at Churchill River below Metchin River

Temperature (°C)	2025	2024	2023
Min	6.13	-1.1	8.7
Max	19.9	20.5	21.6
Median	15.0	16.4	14.9

- Water temperature values showed a typical seasonal trend and closely correlated with ambient air temperatures. Water and air temperatures both decreased from mid-August through the fall months (Figure 4). Air temperature data was obtained from the Metchin River near TLH climate station.

**Water Temperature & Air Temperature at Churchill River below Metchin River**



**Figure 4: Water Temperature & Air Temperature at Churchill River below Metchin River**

### pH

- Over the 2025 deployment season, pH ranged from 6.69 to 7.44 pH units, with a median value of 7.01 pH units (Figure 5).
- pH values were relatively stable over the majority of the deployment season. Increased fluctuations in pH values as stage levels were dropping to their lowest are likely due to the instrument being located out of, or in very little, water.
- pH values were within the CCME's Guidelines for the Protection of Aquatic Life (>6.5 and <9.0 pH units) throughout the deployment season.

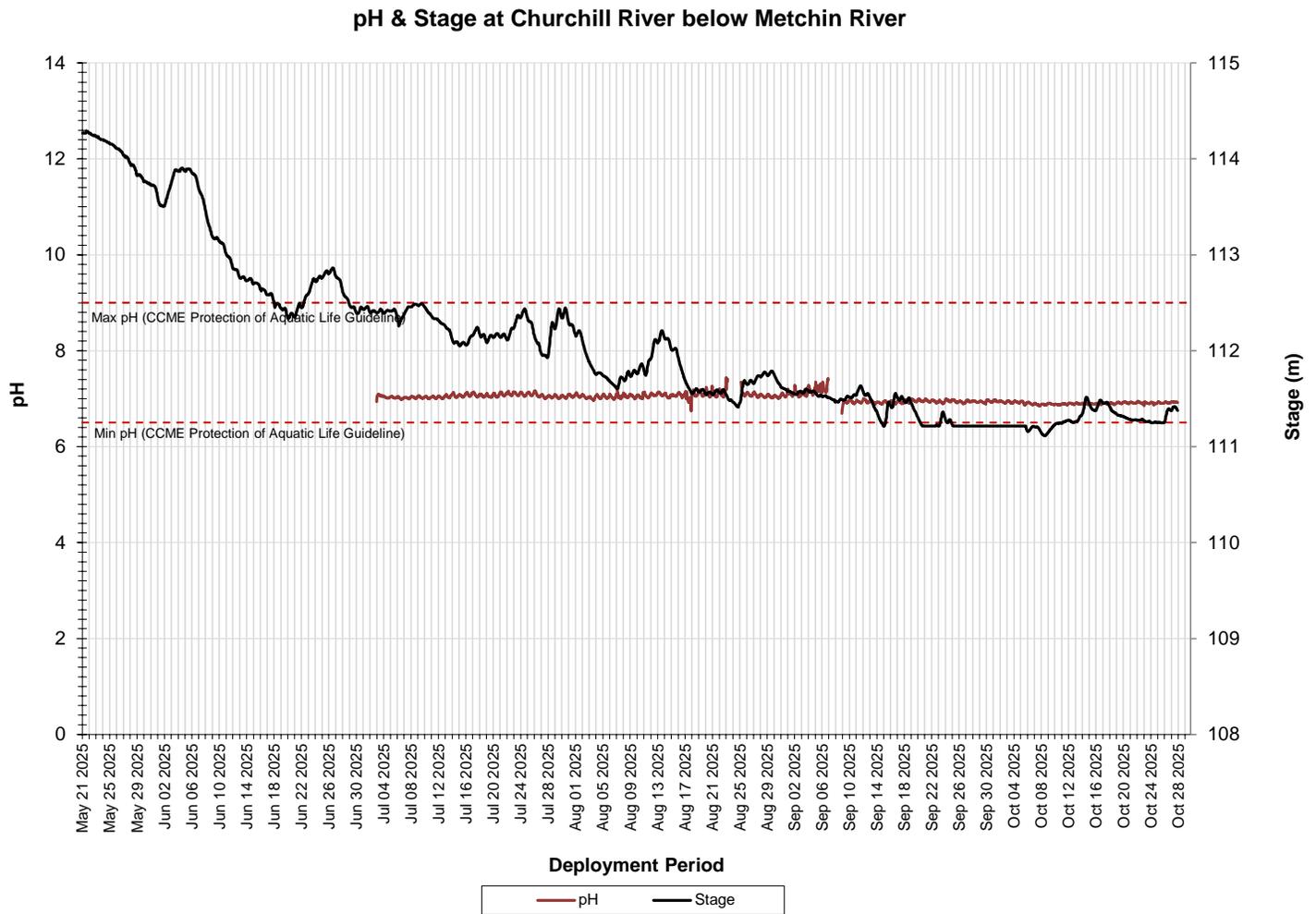


Figure 5: pH & Stage at Churchill River below Metchin River

pH (units)	2025	2024	2023
Min	6.69	0	0
Max	7.44	14	7.37
Median	7.01	6.96	7.11

### Specific Conductivity

- Over the 2025 deployment season, specific conductivity ranged from 9.9 $\mu$ S/cm to 42.1 $\mu$ S/cm, with a median value of 23.4 $\mu$ S/cm (Figure 6), which was similar to previous years.
- Increases and decreases in specific conductivity are generally related to fluctuations in stage. As stage decreases, specific conductivity usually increases as the concentration of dissolved solids increases. Inversely, when stage increases due to precipitation events, specific conductivity usually decreases due to the dilution of dissolved solids. This relationship is somewhat evident in the graph below.
- In 2025, water levels were very low along the Churchill River. Increased fluctuations in late August and early October likely occurred due to the instrument sitting in very little or no water.

Specific Conductivity & Stage at Churchill River below Metchin River

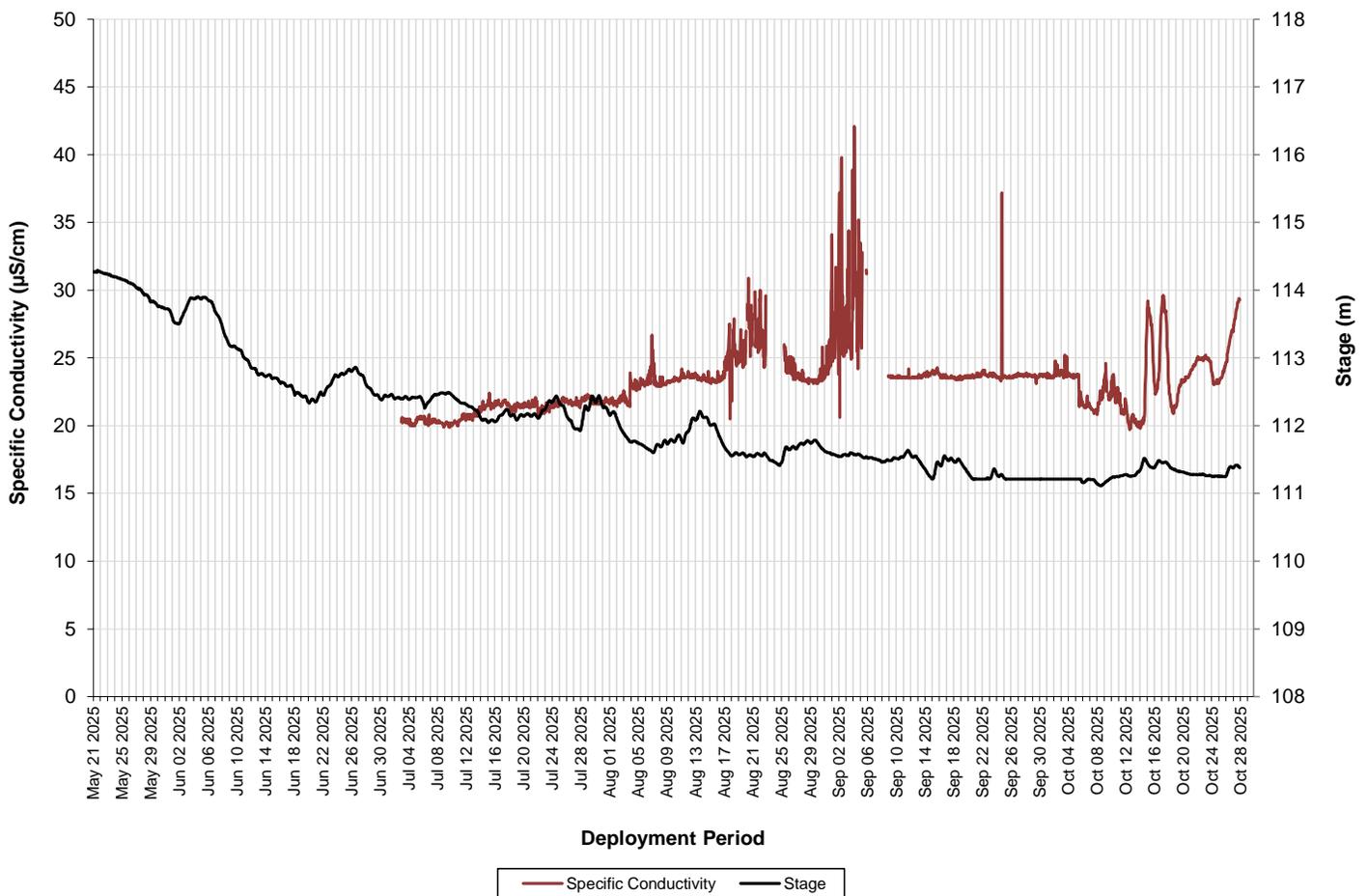


Figure 6: Specific Conductivity & Stage at Churchill River below Metchin River

Specific Conductivity ( $\mu$ S/cm)	2025	2024	2023
Min	9.9	0	18.6
Max	42.1	46.0	43.6
Median	23.4	24.0	22.0

### Dissolved Oxygen

- Over the 2025 deployment season, dissolved oxygen ranged from 8.91mg/L to 11.85mg/L, with a median value of 9.84mg/L, and percent saturation ranged from 92.4% to 105.1%, with a median value of 97.4% (Figure 7).
- Dissolved oxygen content fluctuates regularly on a daily basis. Percent saturation is generally consistent throughout the deployment season. As water temperatures decreased into the fall, dissolved oxygen content steadily increased.
- Dissolved oxygen values were above the CCME’s Guidelines for the Protection of Early and Other Life Stages (6.5mg/L and 9.5mg/L respectively) for most of the deployment season; values fell below the CCME’s Guideline for the Protection of Early Life Stages during periods of highest water temperatures. This is to be expected as dissolved oxygen levels are generally lower in warmer water bodies. Increased fluctuations in dissolved oxygen values in late August are attributable to the instrument being located out of, or in very little water.

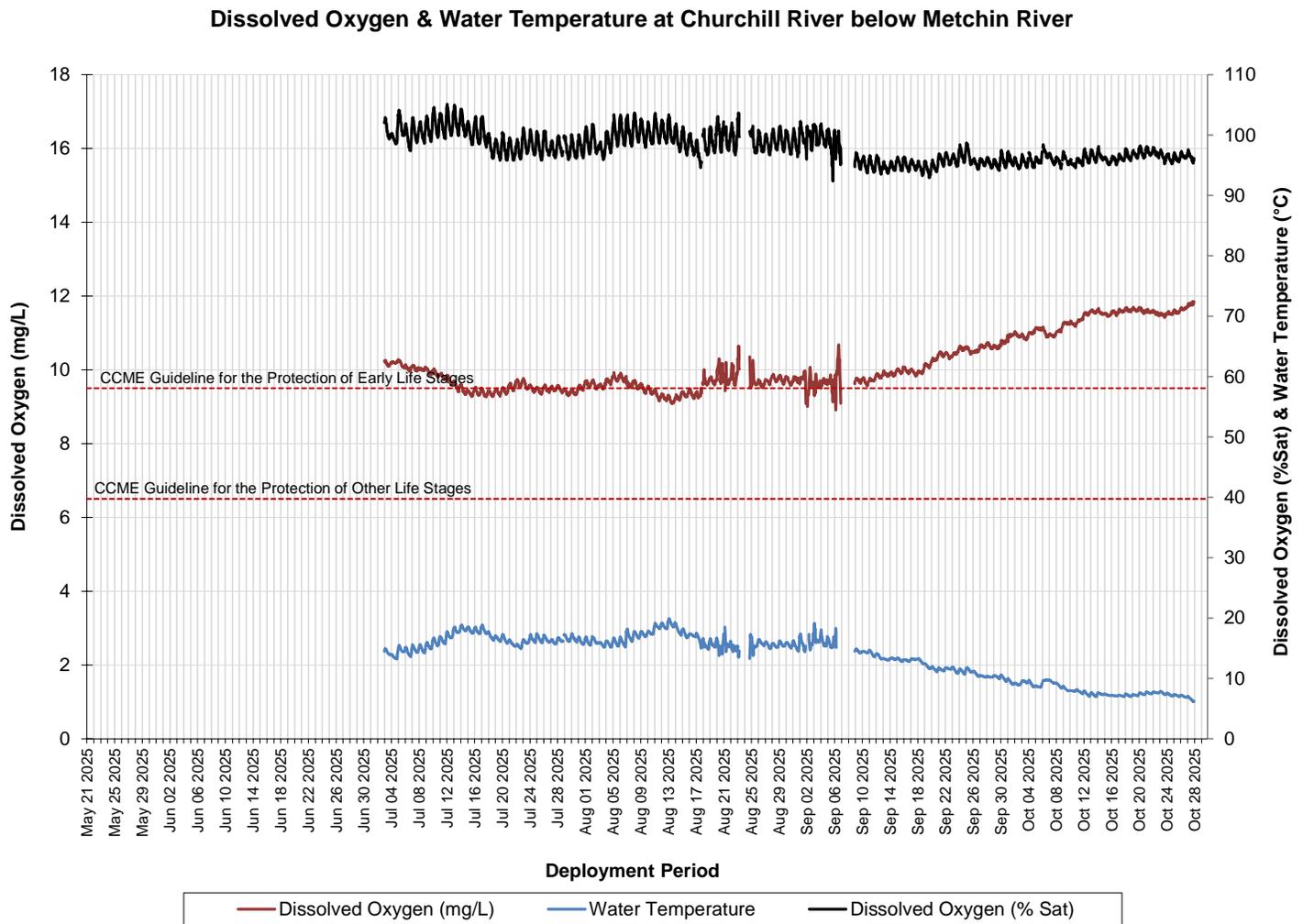


Figure 7: Dissolved Oxygen & Water Temperature at Churchill River below Metchin River

Dissolved Oxygen (mg/L)	2025	2024	2023		Dissolved Oxygen (%Sat)	2025	2024	2023
Min	8.91	0	8.62		Min	92.4	0	92.6
Max	11.85	15.06	11.36		Max	105.1	104.7	104.2
Median	9.84	9.43	9.96		Median	97.4	95.5	97.7

### Turbidity & Precipitation

- Over the 2025 deployment season, turbidity ranged from 0 NTU to 372.9 NTU, with a median value of 0 NTU (Figure 8). A median value of 0 NTU indicates that there is very little natural background turbidity at this station.
- Turbidity is graphed below against stage and precipitation. Precipitation events often correlate closely with temporary increases in both stage and turbidity levels, which can be observed in the graph below. It is important to note, however, that this station is located on a very wide and deep section of the Churchill River and so turbidity is less influenced by precipitation events when compared to other stations. Precipitation data was obtained from the Metchin River at TLH climate station.
- Significant fluctuations occurred throughout the deployment, possibly due to the low water levels around the sonde. Mid-October until removal, turbidity continually increased, indicating the sensor was fouled or buried.

Turbidity, Stage & Precipitation at Churchill River below Metchin River

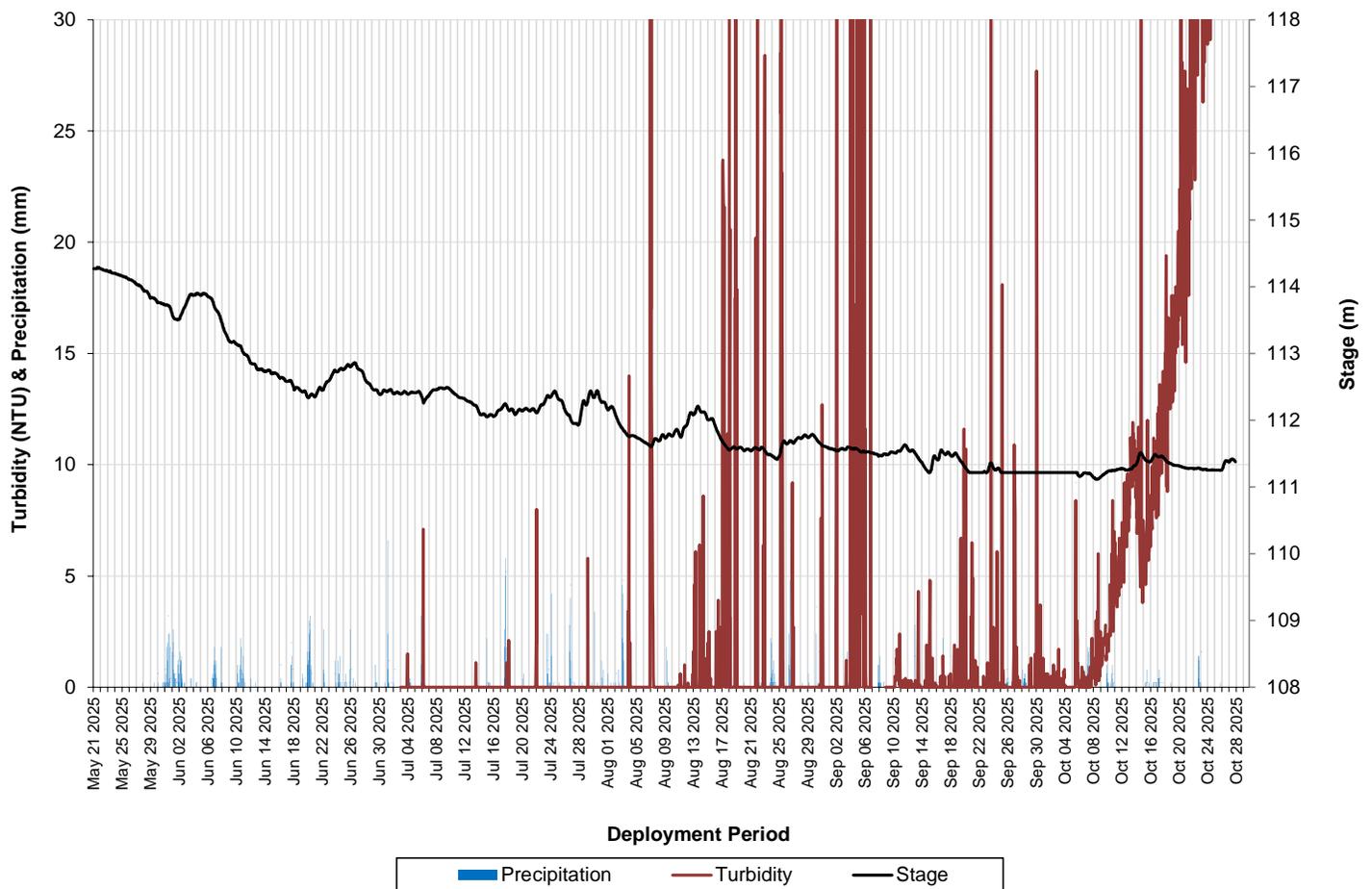


Figure 8: Turbidity, Stage & Precipitation at Churchill River below Metchin River

Turbidity (NTU)	2025	2024	2023
Min	0	0	0
Max	372.9	3000	5
Median	0	0	0

### Stage & Flow

- Over the 2025 deployment season, stage ranged from 111.113m to 114.292m, with a median value of 111.818m (Figure 9). Stage was decreasing throughout the deployment season and was lower than previous years. Flow data was limited as the stage was lower than the known correlated flow values. The available flow data ranged from 236.273m<sup>3</sup>/s to 1532.458m<sup>3</sup>/s, with a median value of 982.927m<sup>3</sup>/s, which was also lower than previous years.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Stage & Flow at Churchill River below Metchin River

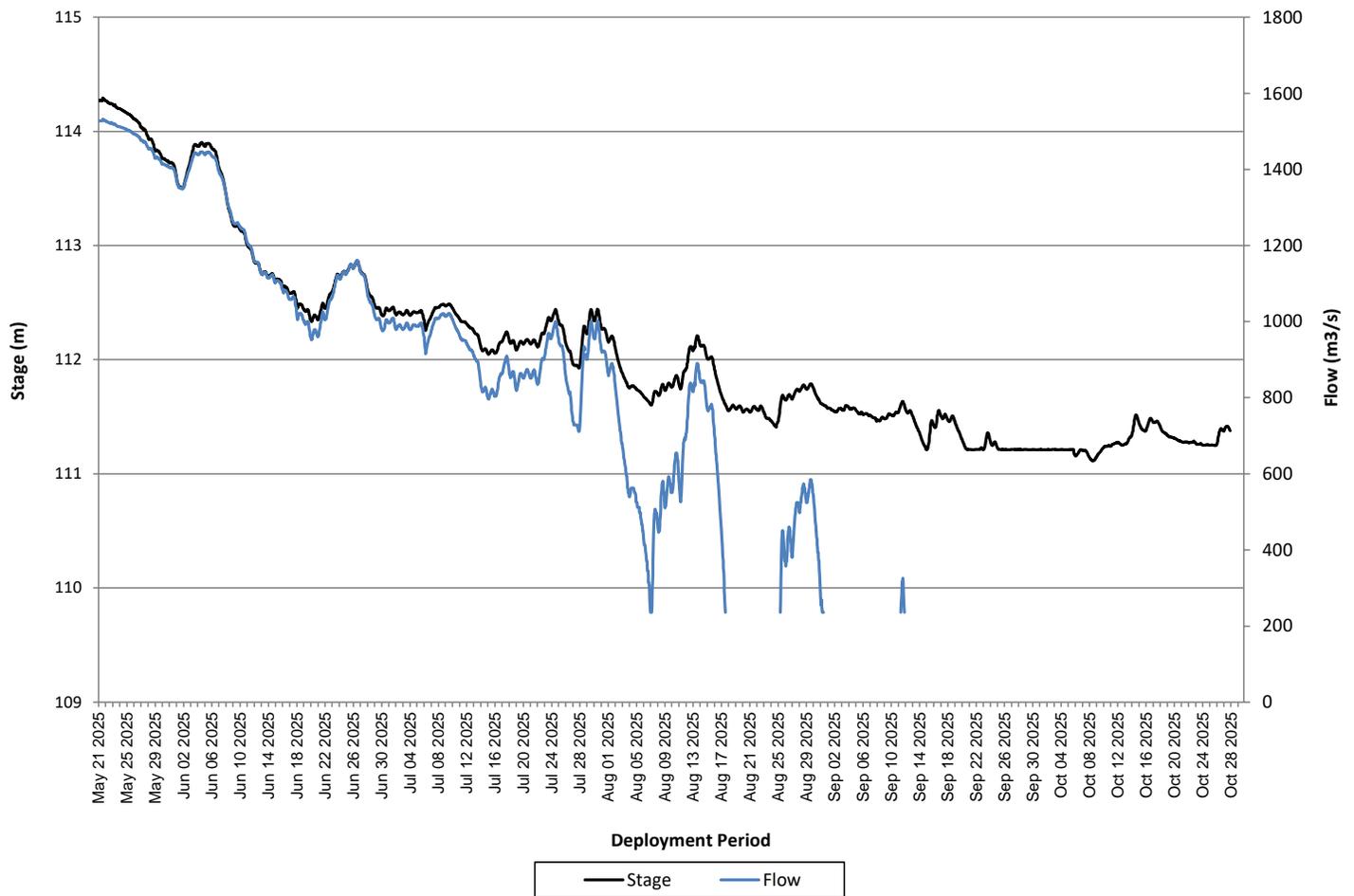


Figure 9: Stage & Flow at Churchill River below Metchin River

Stage (m)	2025	2024	2023	Flow (m <sup>3</sup> /s)	2025	2024	2023
Min	111.113	111.797	112.061	Min	236.273	759.843	913.34
Max	114.292	114.486	113.568	Max	1532.458	1610.487	1414.355
Median	111.818	112.238	112.863	Median	982.927	997.963	1222.708

## Churchill River above Grizzle Rapids

### Temperature

- Over the 2025 deployment season, water temperature ranged from 7.1°C to 20.7°C, with a median value of 15.3°C (Figure 10), which was similar to previous seasons.
- Water temperatures peaked in mid August, after which temperatures steadily declined through September and October.

Water Temperature & Stage at Churchill River above Grizzle Rapids

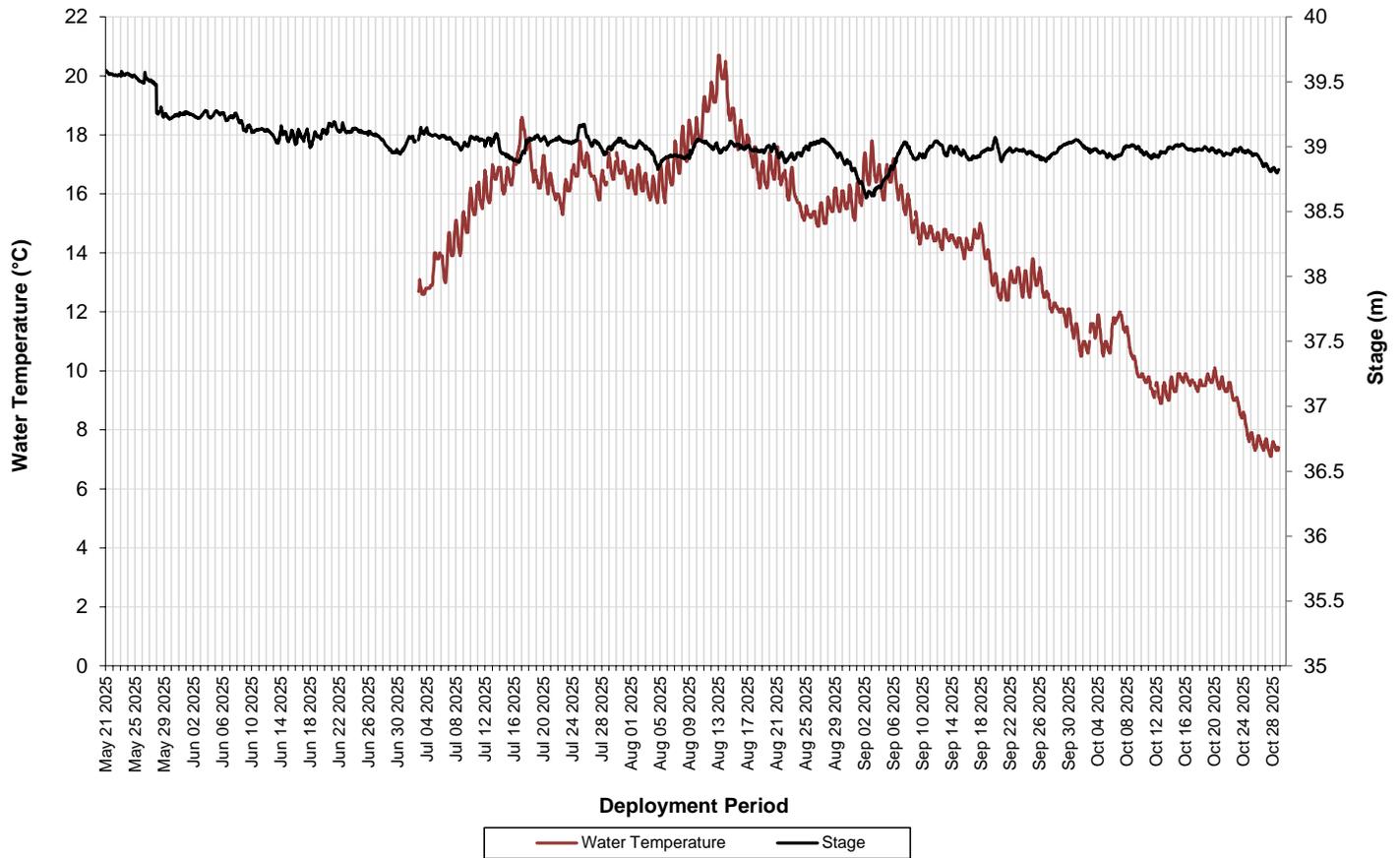
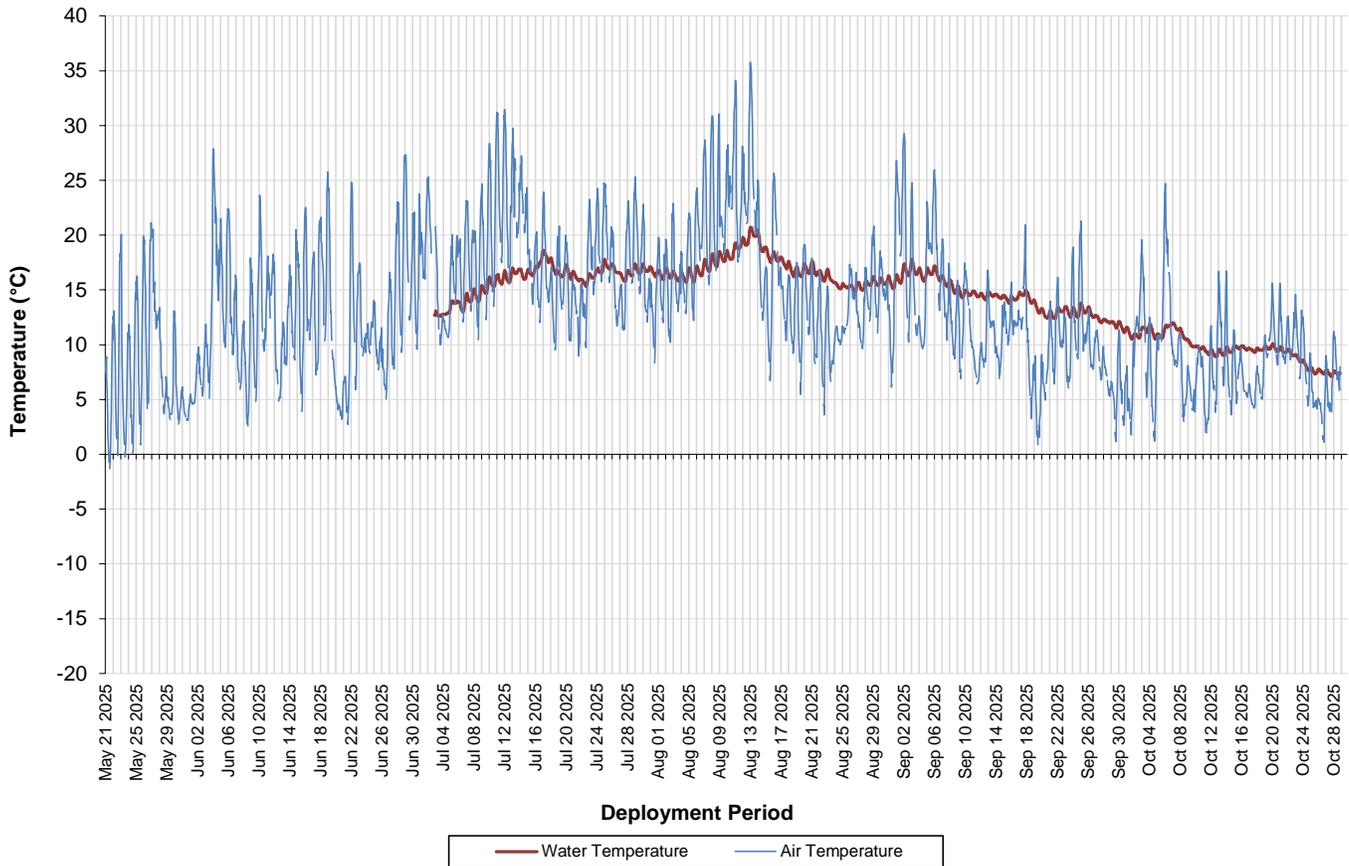


Figure 10: Water Temperature & Stage at Churchill River above Grizzle Rapids

Temperature (°C)	2025	2024	2023
Min	7.1	5.6	6.6
Max	20.7	20.6	21.5
Median	15.3	16.7	16.4

- Water and air temperatures both showed typical seasonal trends (Figure 11), where temperatures steadily increased until August, after which they gradually declined again through late summer and fall. Air temperature data was obtained from the Metchin River near TLH climate station.

**Water Temperature & Air Temperature at Churchill River above Grizzle Rapids**

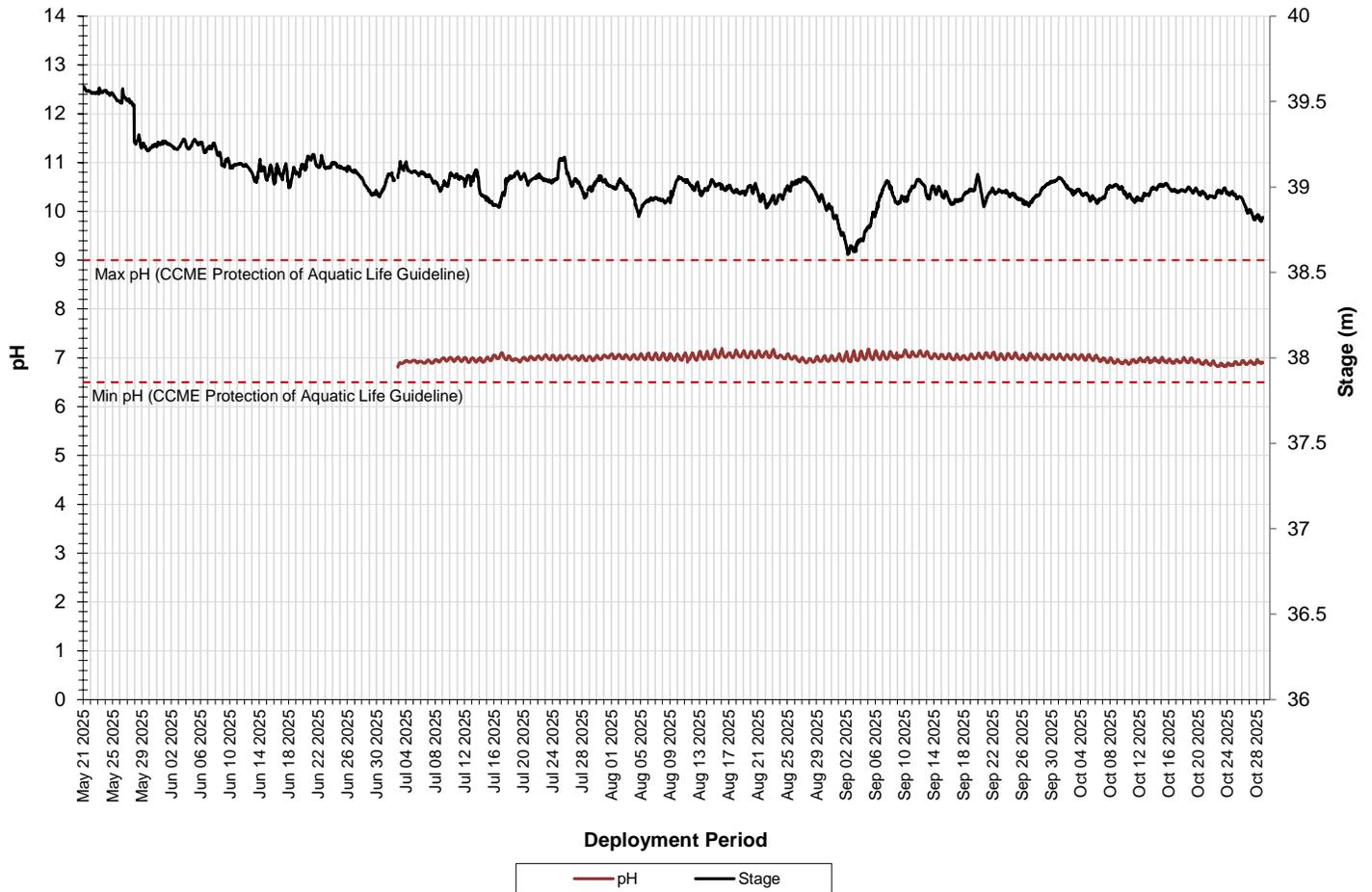


**Figure 11: Water Temperature & Air Temperature at Churchill River above Grizzle Rapids**

**pH**

- Over the 2025 deployment season, pH ranged from 6.81 to 7.19 pH units, with a median value of 6.99 pH units (Figure 12).
- pH values were relatively consistent across the deployment season and remained within the CCME’s Guidelines for the Protection of Aquatic Life (>6.5 and <9.0 pH units) throughout the deployment season.

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



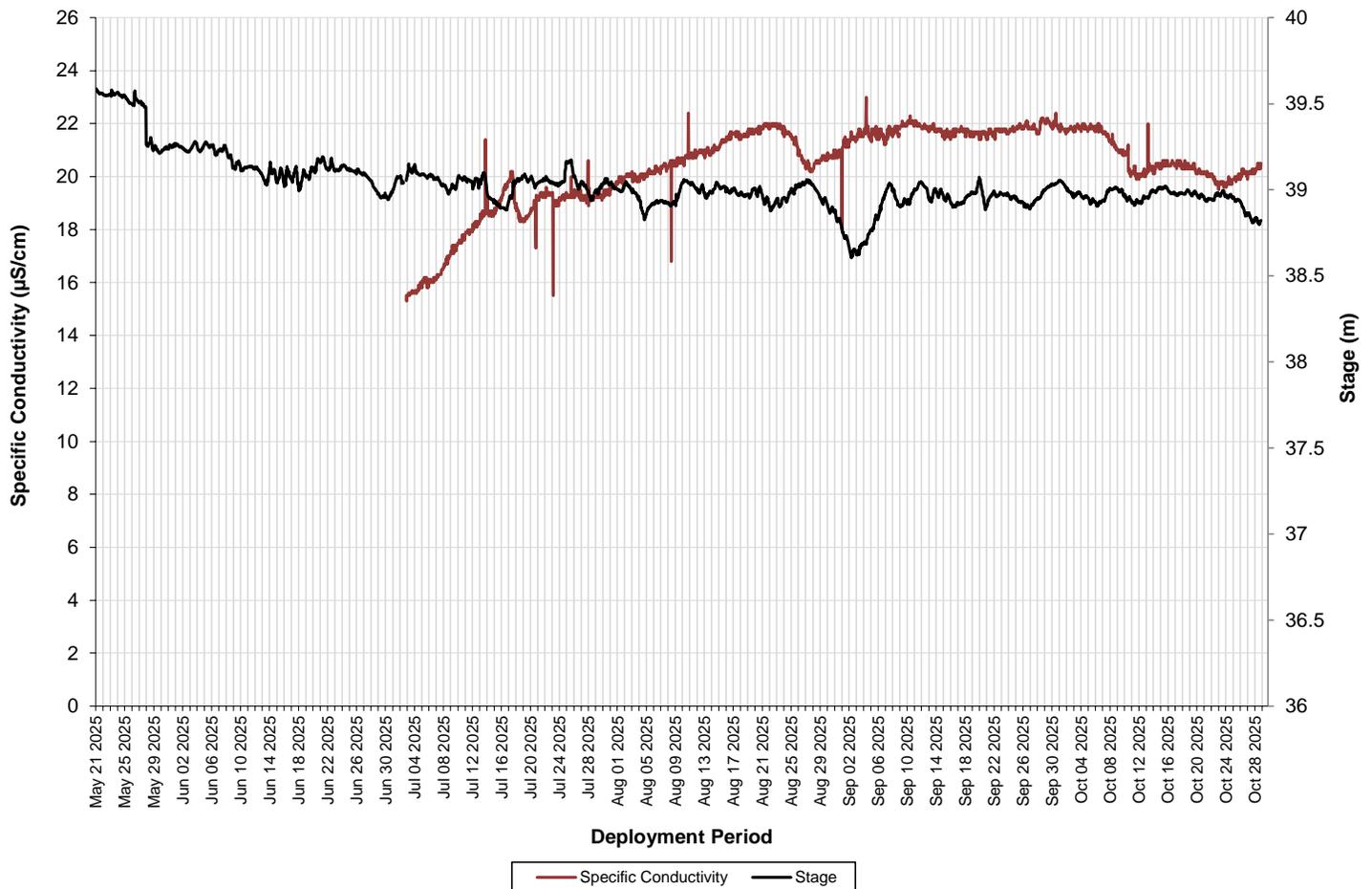
**Figure 12: pH & Stage at Churchill River above Grizzle Rapids**

pH (units)	2025	2024	2023
Min	6.81	0	6.81
Max	7.19	14.0	7.14
Median	6.99	6.97	6.92

### Specific Conductivity

- Over the 2025 deployment season, specific conductivity ranged from 15.3 $\mu$ S/cm to 23.0 $\mu$ S/cm, with a median value of 20.6 $\mu$ S/cm (Figure 13), which was similar to the median values from previous years.
- Specific conductivity was relatively consistent across the deployment season, with increases and decreases in specific conductivity generally correlating with fluctuations in stage. As stage decreases, specific conductivity usually increases as the concentration of dissolved solids increases. Inversely, when stage increases, specific conductivity decreases due to the dilution of dissolved solids in the water column. This relationship is somewhat evident in the graph below.

**Specific Conductivity & Stage at Churchill River above Grizzle Rapids**



**Figure 13: Specific Conductivity & Stage at Churchill River above Grizzle Rapids**

Specific Conductivity ( $\mu$ S/cm)	2025	2024	2023
Min	15.3	10.5	19.1
Max	23.0	35.6	24.3
Median	20.6	21.0	21.1

### Dissolved Oxygen

- Over the 2025 deployment season, dissolved oxygen ranged from 8.92mg/L to 11.80mg/L, with a median value of 9.88mg/L. Percent saturation ranged from 94.2% to 104.7%, with a median value of 99.1% (Figure 14).
- Dissolved oxygen content displayed a typical seasonal trend, where levels were lowest during the summer months and then increased through the fall (September-October). Warmer temperatures decrease the amount of oxygen present in the water, and vice versa. Percent saturation remained fairly consistent across the deployment season.
- Dissolved oxygen values remained above the CCME’s Guidelines for the Protection of Early and Other Life Stages (6.5mg/L and 9.5mg/L respectively), with the exception of two short-term drops in July and August when water temperatures were at their warmest.

Dissolved Oxygen & Water Temperature at Churchill River above Grizzle Rapids

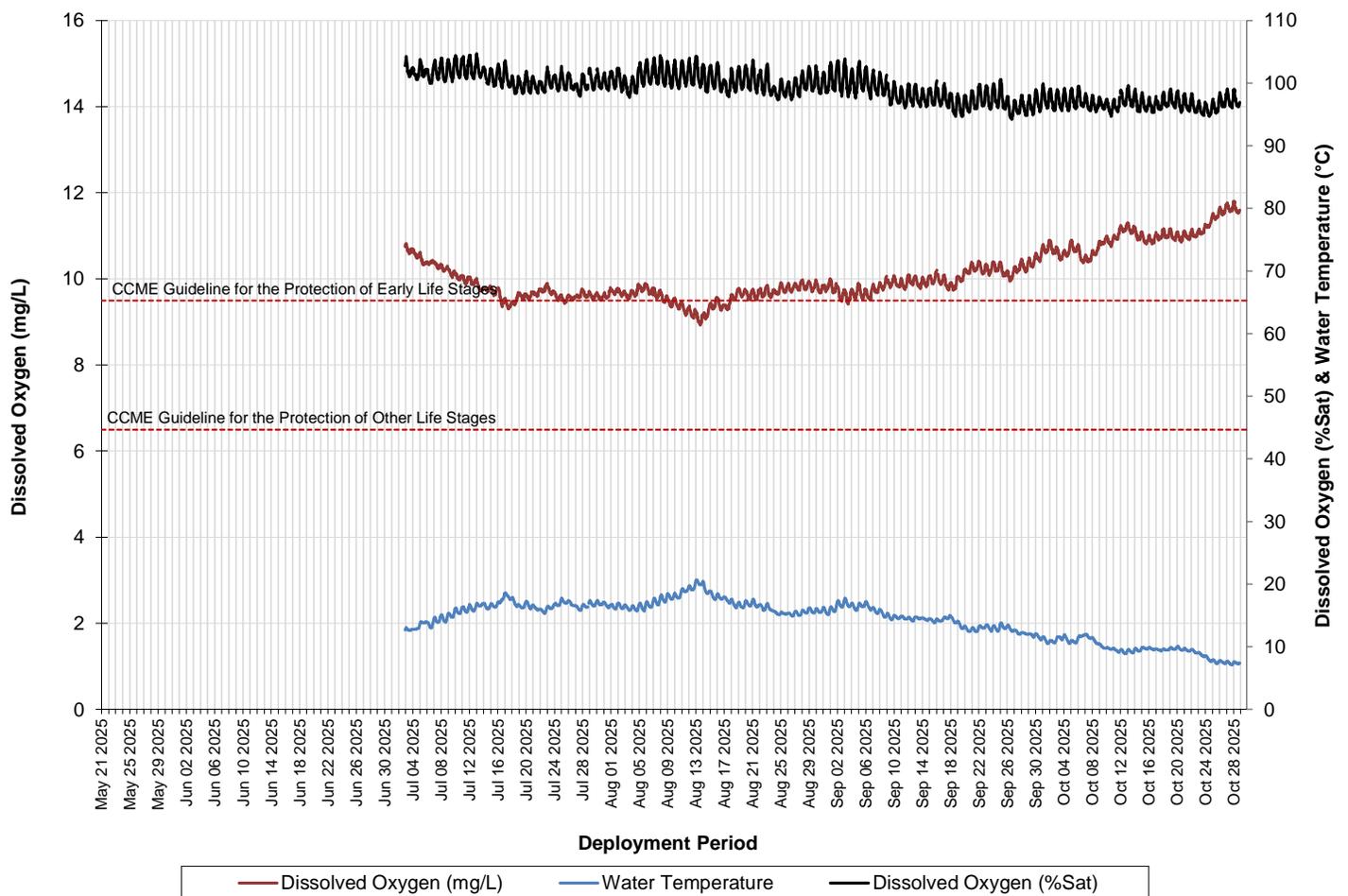


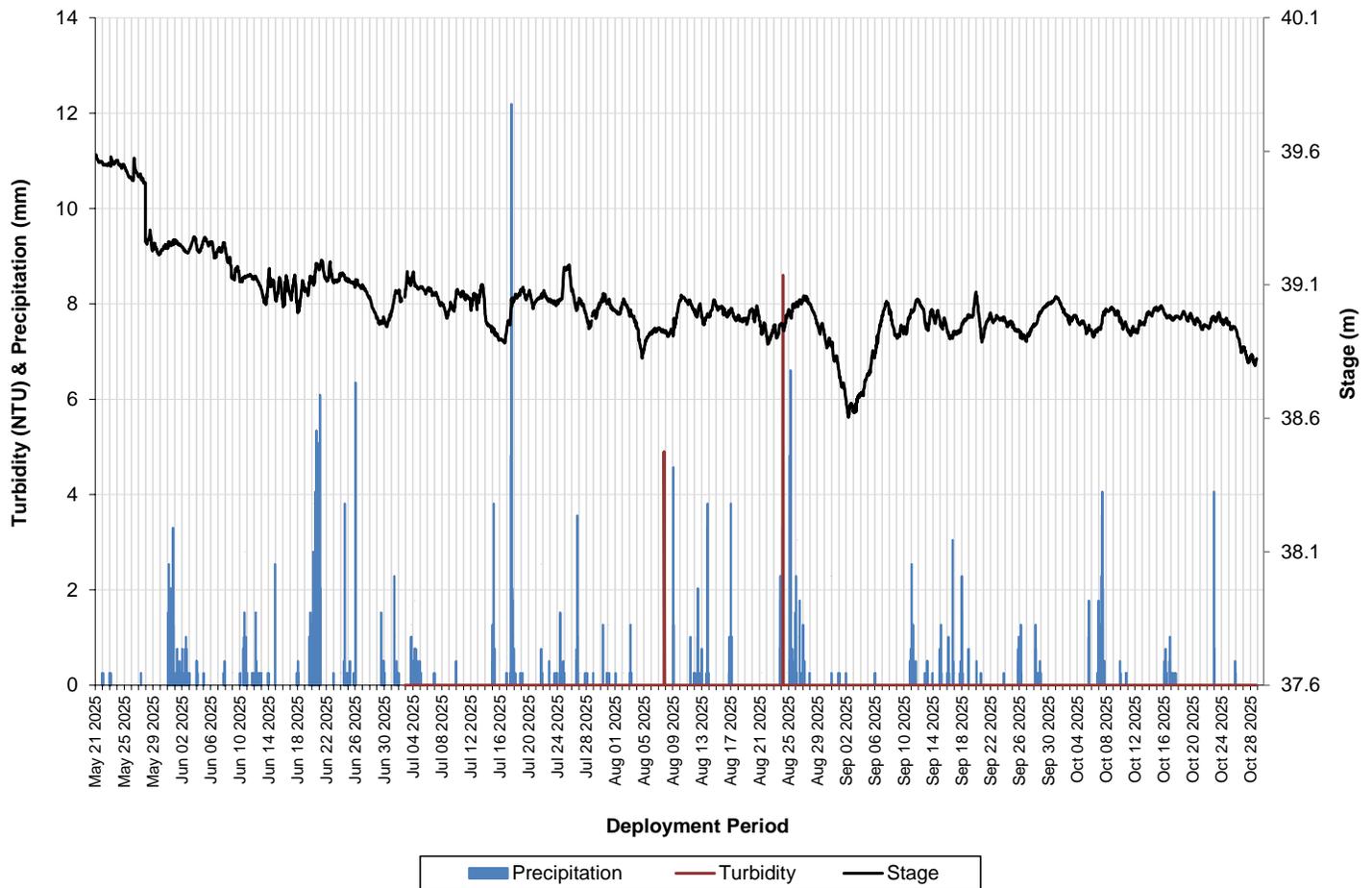
Figure 14: Dissolved Oxygen & Water Temperature at Churchill River above Grizzle Rapids

Dissolved Oxygen (mg/L)	2025	2024	2023		Dissolved Oxygen (% Sat)	2025	2024	2023
Min	8.92	8.7	8.66		Min	94.2	90.5	93.7
Max	11.80	11.86	11.63		Max	104.7	100.8	102.7
Median	9.88	9.33	9.56		Median	99.1	95.8	96.9

### Turbidity & Precipitation

- Over the 2025 deployment season, turbidity ranged from 0 NTU to 8.6 NTU, with a median value of 0 NTU (Figure 15). A median value of 0 NTU indicates that there is a low level of natural background turbidity at this station, which is similar to previous seasons.
- Turbidity spikes generally correlate with increases in stage, which often correlate with precipitation events. Turbidity levels returned to background levels following each observed increase.

**Turbidity, Stage & Precipitation at Churchill River above Grizzle Rapids**



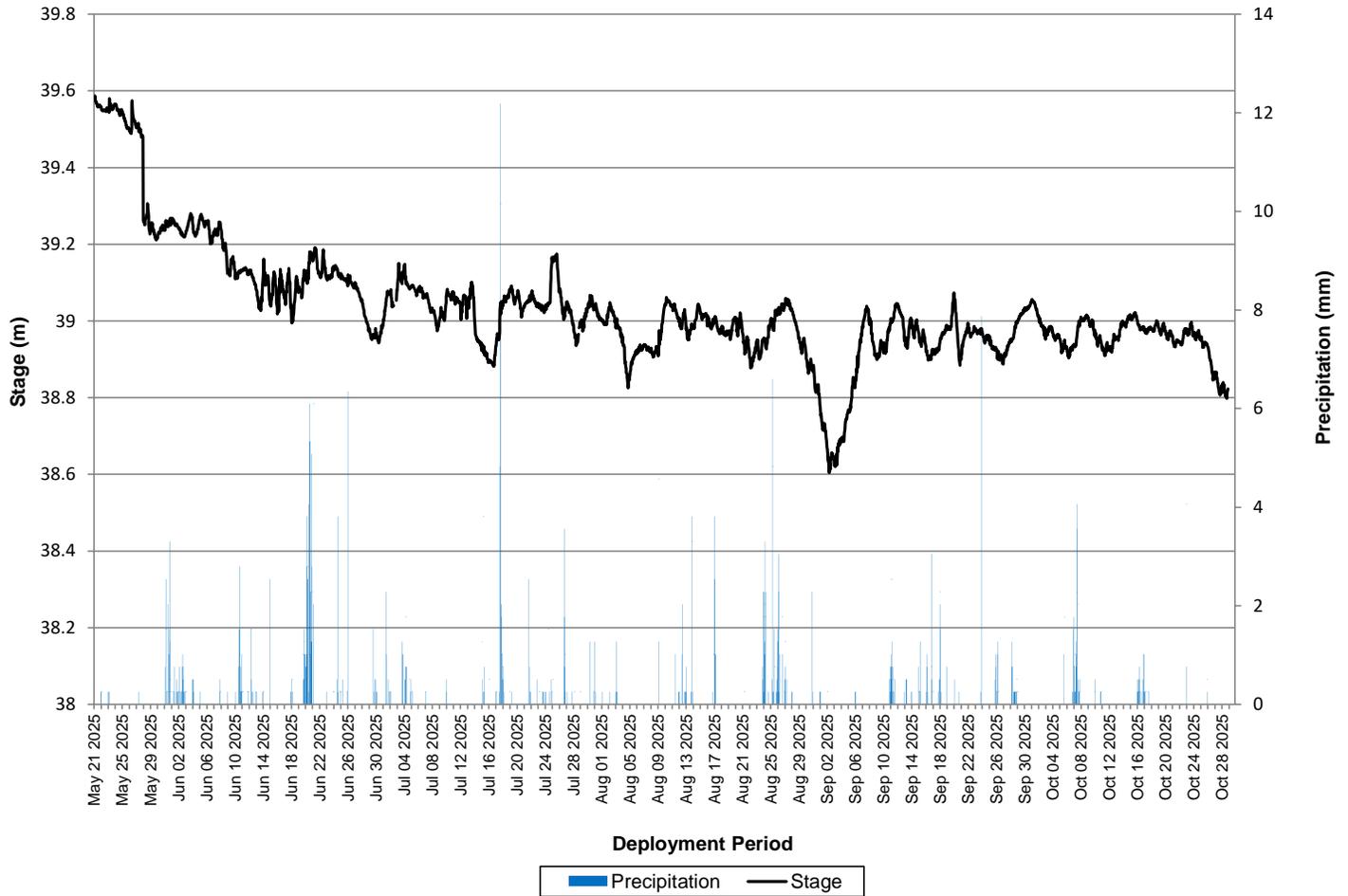
**Figure 15: Turbidity, Stage & Precipitation at Churchill River above Grizzle Rapids**

Turbidity (NTU)	2025	2024	2023
Min	0	0	0
Max	8.6	1.0	2.2
Median	0	0	0

### Stage

- Over the 2025 deployment season, stage ranged from 38.604m to 39.587m, with a median value of 39.004m (Figure 16), which was similar to previous years. Water levels were very low in 2025 and steadily decreased through the season.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data (stage and flow). Corrected data can be obtained upon request.

**Stage & Precipitation at Churchill River above Grizzle Rapids**



**Figure 16: Stage & Flow at Churchill River above Grizzle Rapids**

Stage (m)	2025	2024	2023
Min	38.604	38.775	38.757
Max	39.587	39.253	39.636
Median	39.004	38.971	39.08

## Churchill River below Muskrat Falls

### Temperature

- Over the 2025 deployment season, water temperature ranged from 1.8°C to 19.9°C, with a median value of 14.0 °C (Figure 17), which was similar to the median values from previous years.
- Water temperatures followed typical seasonal trends; temperatures increased steadily from initial deployment through mid-August, after which they steadily declined again through September and October. Instances of increased fluctuation in water temperature in June and September are likely attributable to the instrument being located out of, or in very little water. Data that is likely erroneous during these periods has been removed.

Water Temperature & Stage at Churchill River below Muskrat Falls

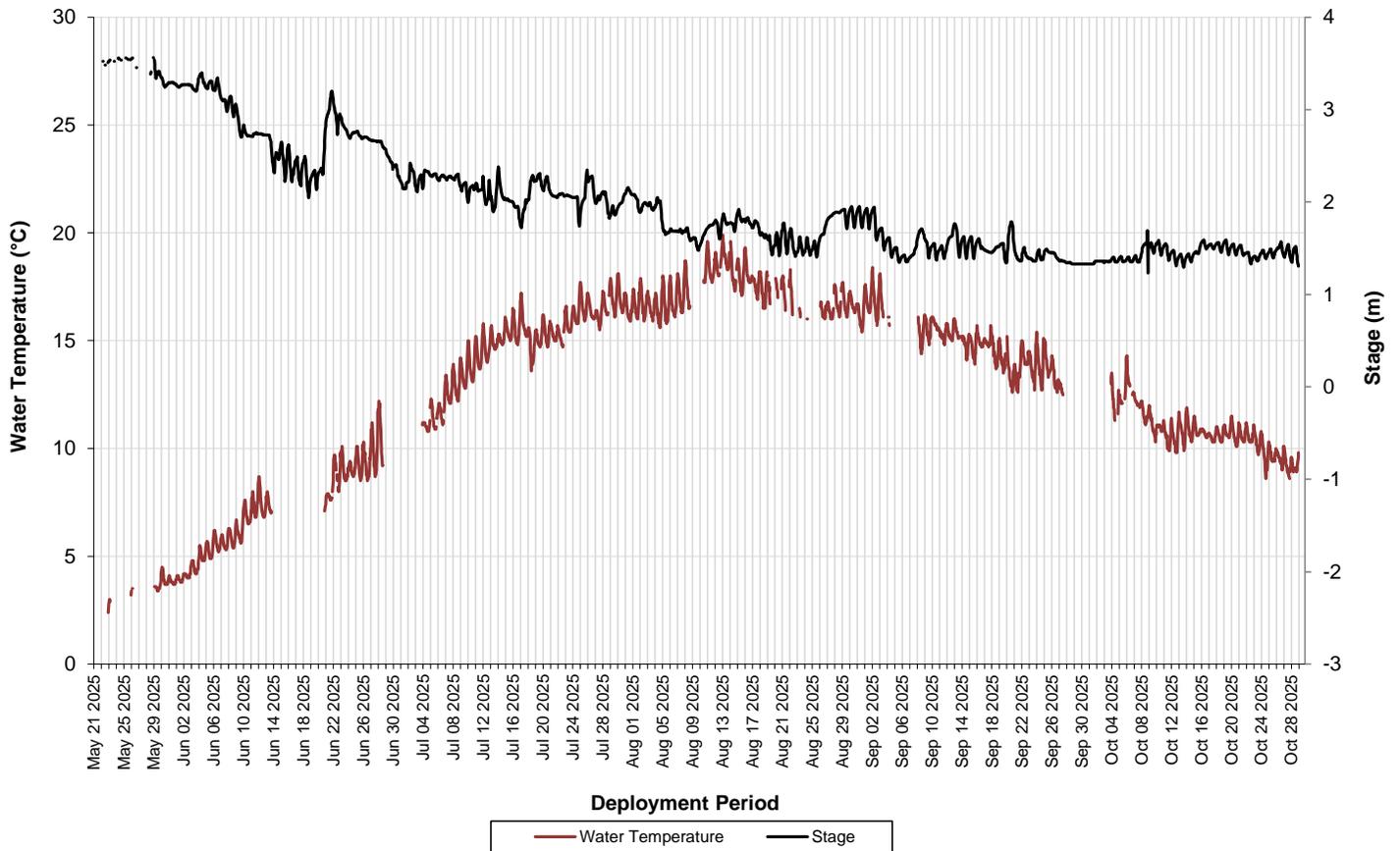
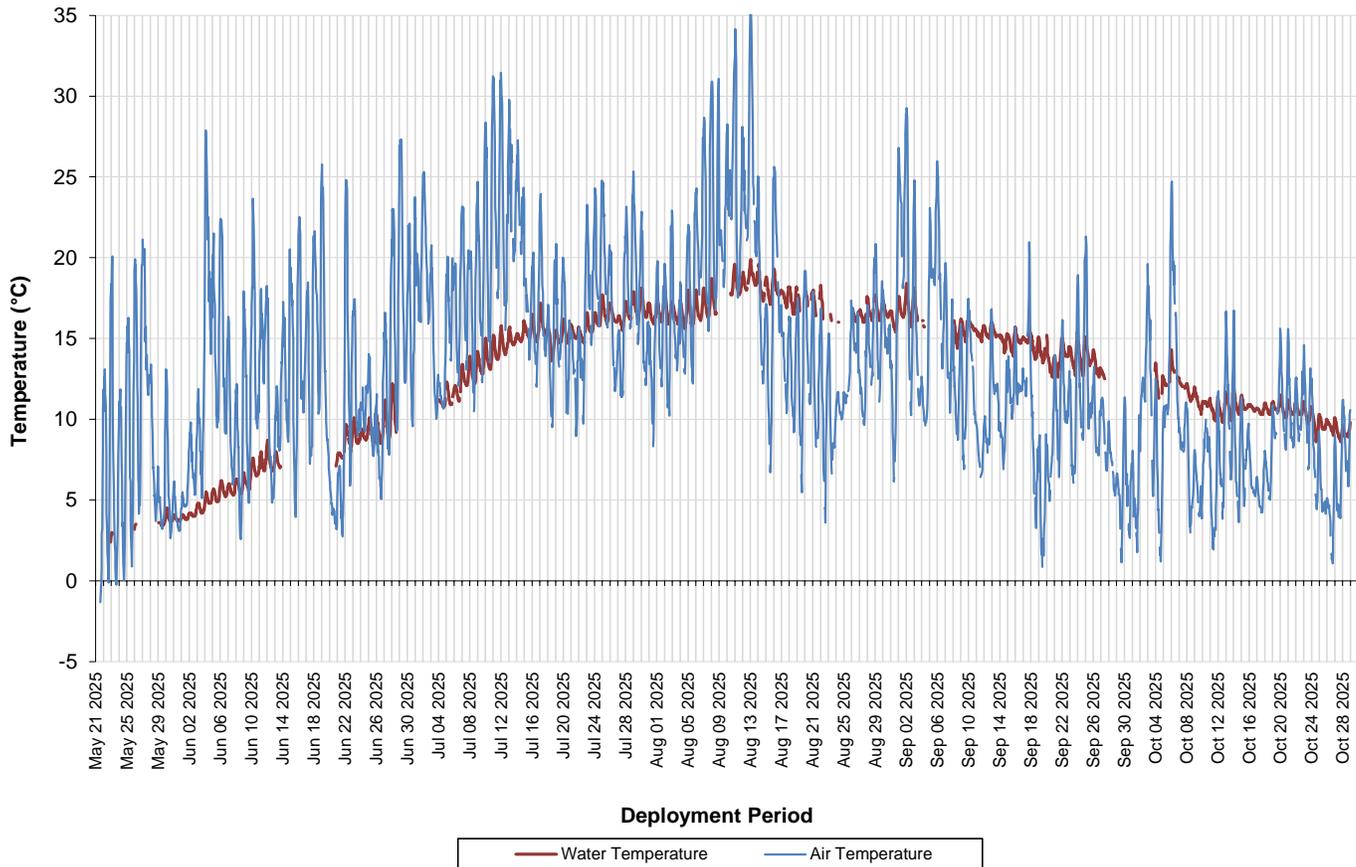


Figure 17: Water Temperature & Stage at Churchill River below Muskrat Falls

Temperature (°C)	2025	2024	2023
Min	1.8	0.9	3.3
Max	19.9	28.8	21.2
Median	14.0	15.9	14.1

- Water temperature values correlated closely with air temperatures; both increased through the summer months and then gradually decreased again into the fall season. Air temperature data was obtained from the Muskrat Falls MET weather station.

**Water Temperature & Air Temperature at Churchill River below Muskrat Falls**

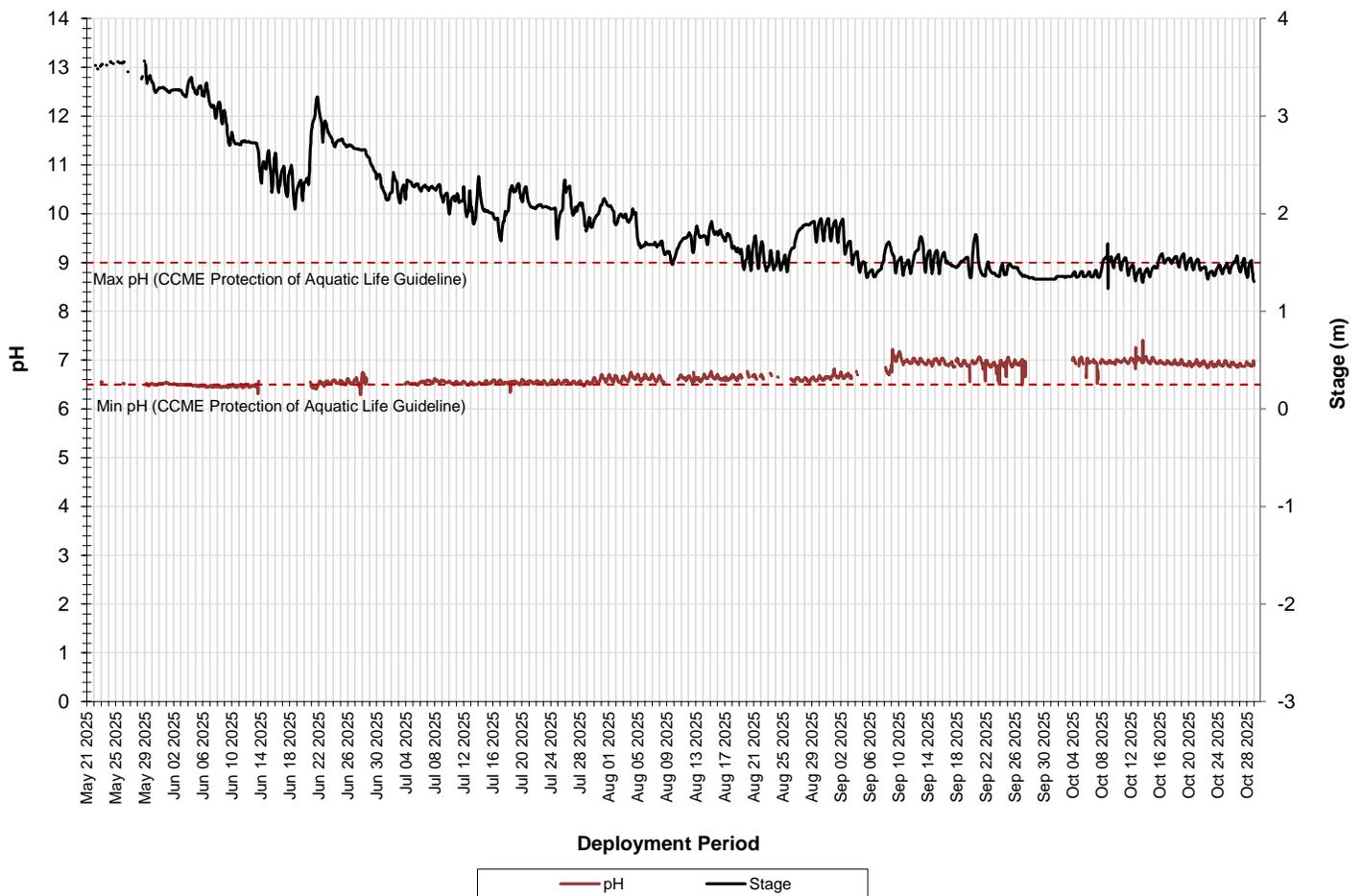


**Figure 18: Water Temperature & Air Temperature at Churchill River below Muskrat Falls**

### pH

- Over the 2025 deployment season, pH ranged from 6.29 to 7.41 pH units, with a median value of 6.62 pH units (Figure 19), which was very similar to the 2023 and 2024 median values.
- pH values were within the CCME’s Guidelines for the Protection of Aquatic Life (>6.5 and <9.0 pH units) for the majority of the deployment season. Instances of increased fluctuation in pH values are likely attributable to the instrument being located out of, or in very little, water. During these periods, data that is likely erroneous and has been removed.

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



**Figure 19: pH & Stage at Churchill River below Muskrat Falls**

pH (units)	2025	2024	2023
Min	6.29	0	6.24
Max	7.41	14.0	7.08
Median	6.62	6.74	6.86

### Specific Conductivity

- Over the 2025 deployment season, specific conductivity ranged from 14.1 $\mu$ S/cm to 24.0 $\mu$ S/cm, with a median value of 20.0 $\mu$ S/cm (Figure 20), which was comparable to median values from previous years.
- Specific conductivity increased slowly throughout the spring and summer months before starting a slight decrease at the end of the deployment season. Generally, specific conductivity does not vary greatly in the Lower Churchill River, which is evidenced in the graph below. Increases and decreases in specific conductivity are generally related to fluctuations in stage. As stage decreases, specific conductivity usually increases as the concentration of dissolved solids increases. Inversely, when stage increases, specific conductivity decreases due to dilution of dissolved solids in the water column. Instances of increased fluctuation in conductivity values are likely attributable to the instrument being located out of, or in very little, water. During these periods, data is likely erroneous and has been removed.

Specific Conductivity & Stage at Churchill River below Muskrat Falls

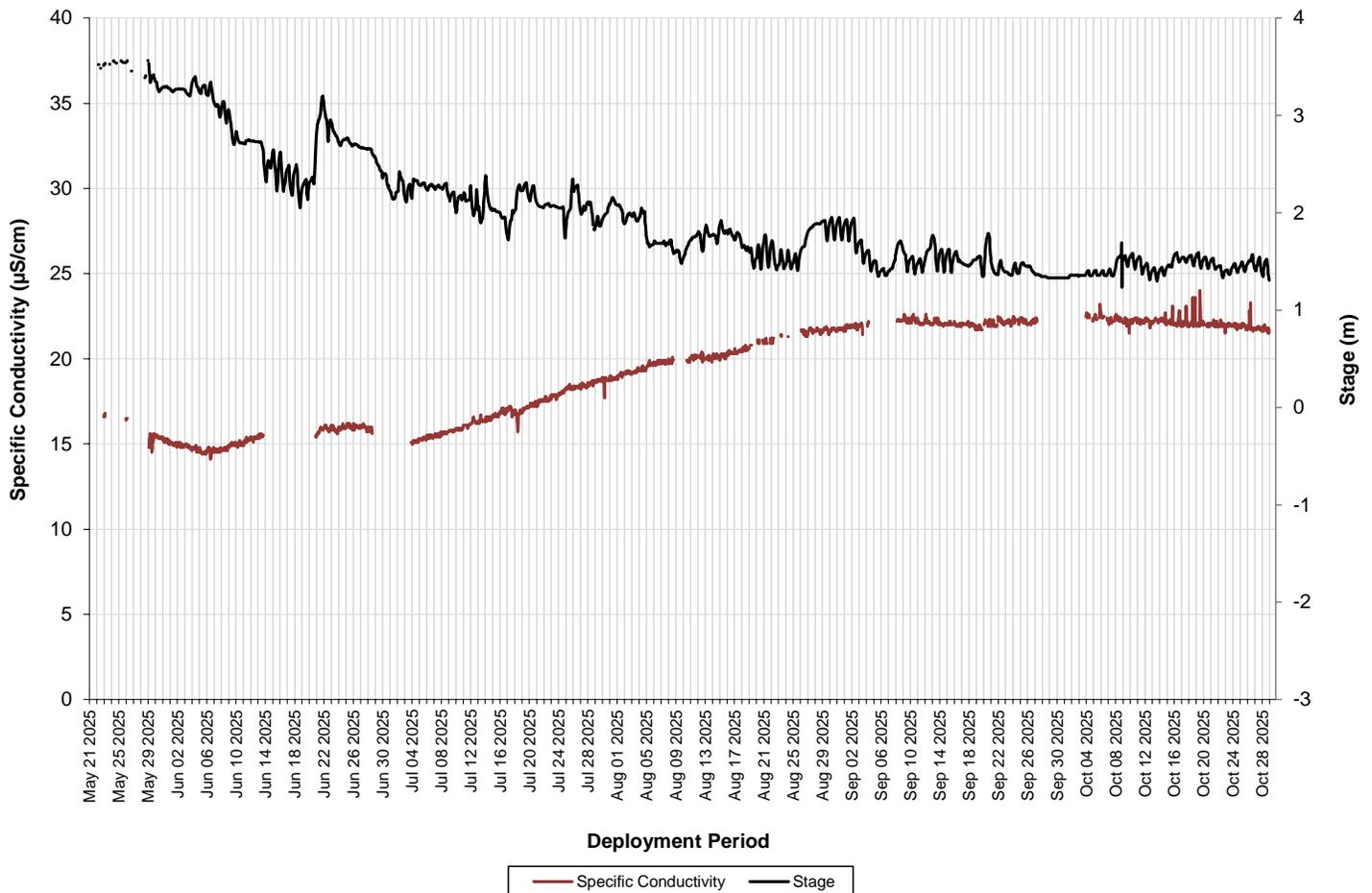


Figure 20: Specific Conductivity & Stage at Churchill River below Muskrat Falls

Specific Conductivity ( $\mu$ S/cm)	2025	2024	2023
Min	14.1	0	12.2
Max	24.0	27.7	23.2
Median	20.0	20.7	19.2

### Dissolved Oxygen

- Over the 2025 deployment season, dissolved oxygen ranged from 8.78mg/L to 13.51mg/L, with a median value of 9.94mg/L, which was similar to previous years. Percent saturation ranged from 90.1% to 105.8%, with a median value of 96.2%, which was also similar to previous years (Figure 21).
- Dissolved oxygen displayed a typical seasonal trend throughout 2025, with the lowest values observed mid to late August. Warmer temperatures decrease the amount of oxygen present in water, and vice versa. Percent saturation remained fairly consistent across the deployment season. Dissolved oxygen levels remained above the CCME’s Guidelines for the Protection of Early and Other Life Stages for the majority of the 2025 deployment season (Figure 21). Instances of increased fluctuation in dissolved oxygen values are likely attributable to the instrument being located out of, or in very little, water. During these periods, data that is likely erroneous and has been removed.

Dissolved Oxygen & Water Temperature at Churchill River below Muskrat Falls

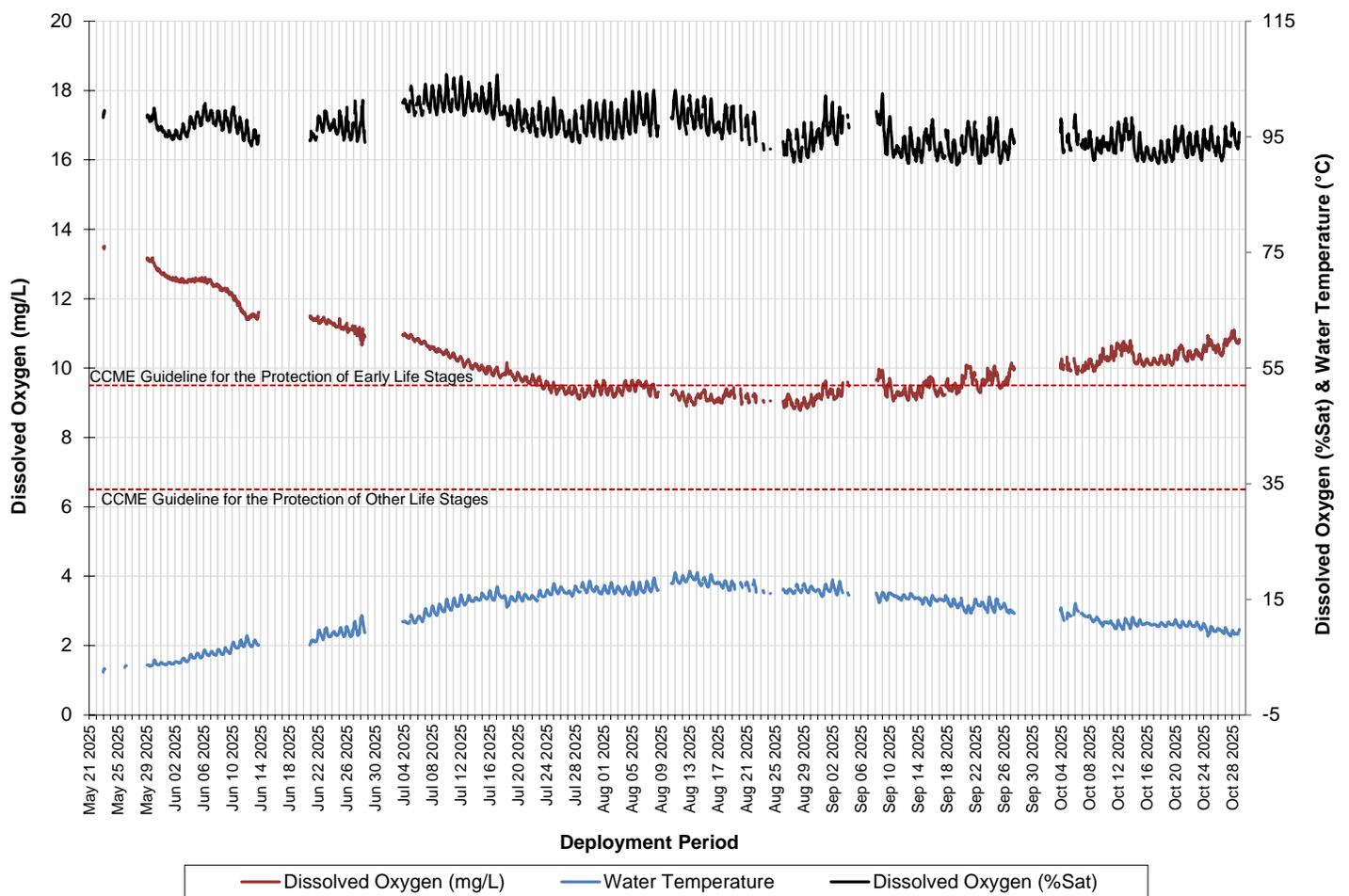


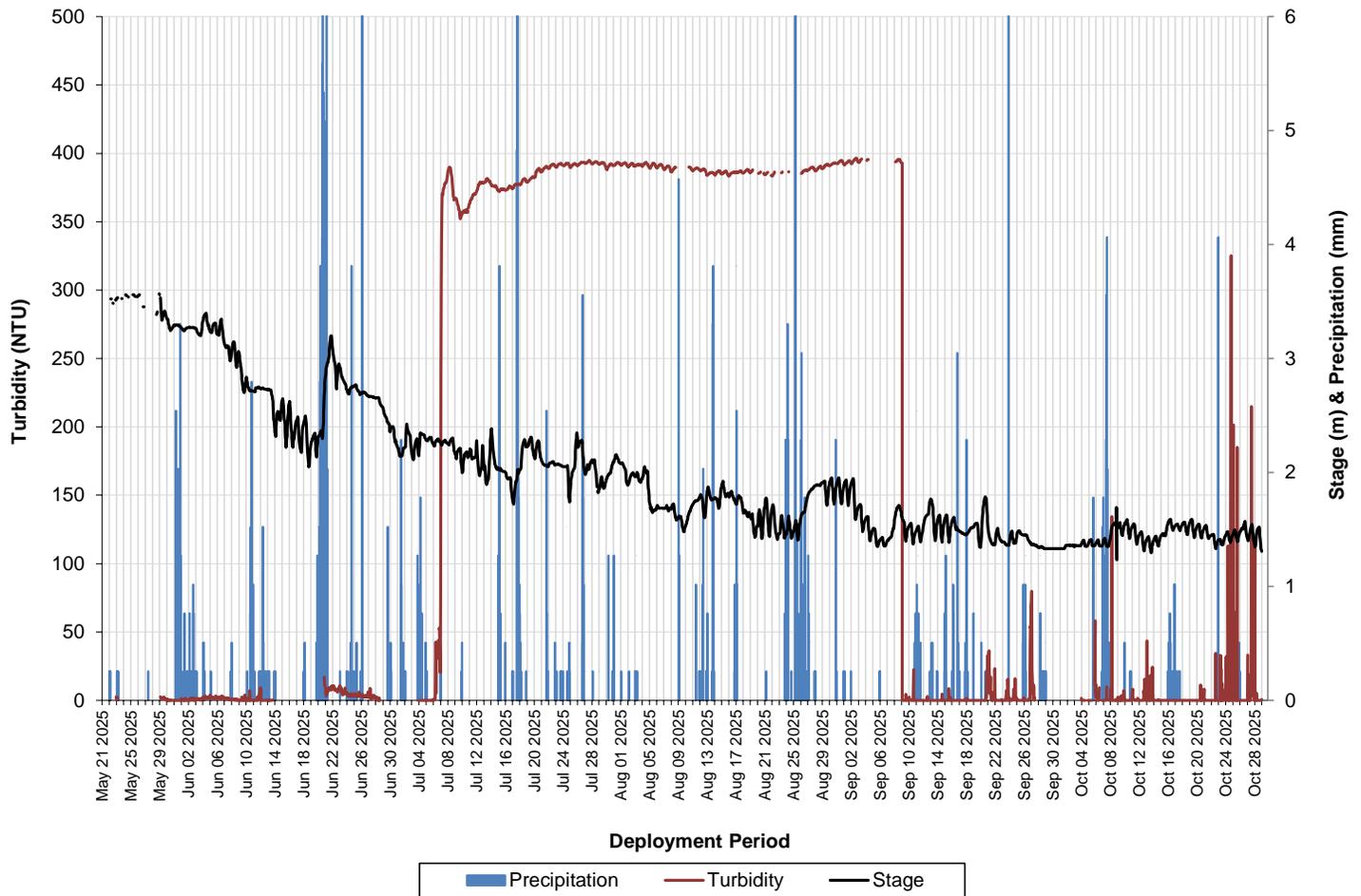
Figure 21: Dissolved Oxygen & Water Temperature at Churchill River below Muskrat Falls

Dissolved Oxygen (mg/L)	2025	2024	2023		Dissolved Oxygen (% Sat)	2025	2024	2023
Min	8.78	0	8.12		Min	90.1	0	87.8
Max	13.51	13.4	12.96		Max	105.8	111.3	110.9
Median	9.94	9.205	10.16		Median	96.2	93.3	97.1

### Turbidity & Precipitation

- Over the 2025 deployment season, turbidity ranged from 0 NTU to 396.6 NTU, with a median value of 4.5 NTU (Figure 22). A median value of 4.5 NTU indicates that there is a small amount of natural background turbidity at this station. This is higher than previous years, likely due to the frequency of the instrument being in shallow water due to extremely low stage levels. During these periods, data is likely erroneous and has been removed.
- The elevated, continuous turbidity values early July to early September are indicative of the instrument being buried in sediment or fouled. Turbidity events throughout the 2025 deployment season correlated somewhat with increases in stage, which were further linked to precipitation events.

**Turbidity, Stage & Precipitation at Churchill River below Muskrat Falls**



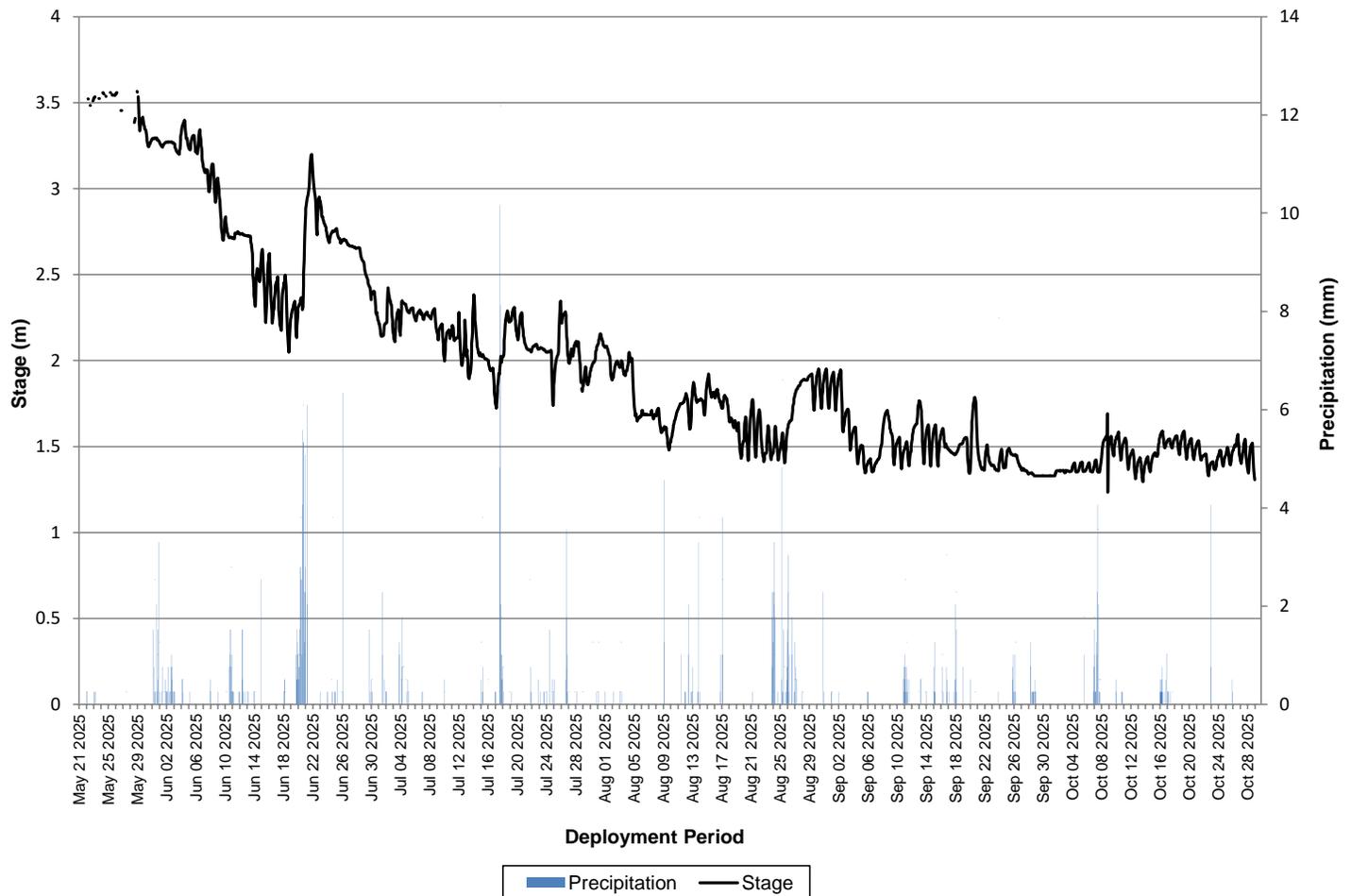
**Figure 22: Turbidity, Stage & Precipitation at Churchill River below Muskrat Falls**

Turbidity (NTU)	2025	2024	2023
Min	0	0	0
Max	396.6	3000	3000
Median	4.5	0	0.9

### Stage

- Over the 2025 deployment season, stage ranged from 1.233m to 3.566m, with a median value of 1.784m (Figure 23). This median value is lower than the previous two seasons and resulted in the field instrument coming out of the water on several occasions or being buried in sediment throughout the deployment season.
- Stage increases generally correlated well with significant precipitation events throughout the 2025 season (Figure 23), though an overall steady stage decrease was observed throughout the season.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage & Precipitation at Churchill River below Muskrat Falls**



**Figure 23: Stage & Precipitation at Churchill River below Muskrat Falls**

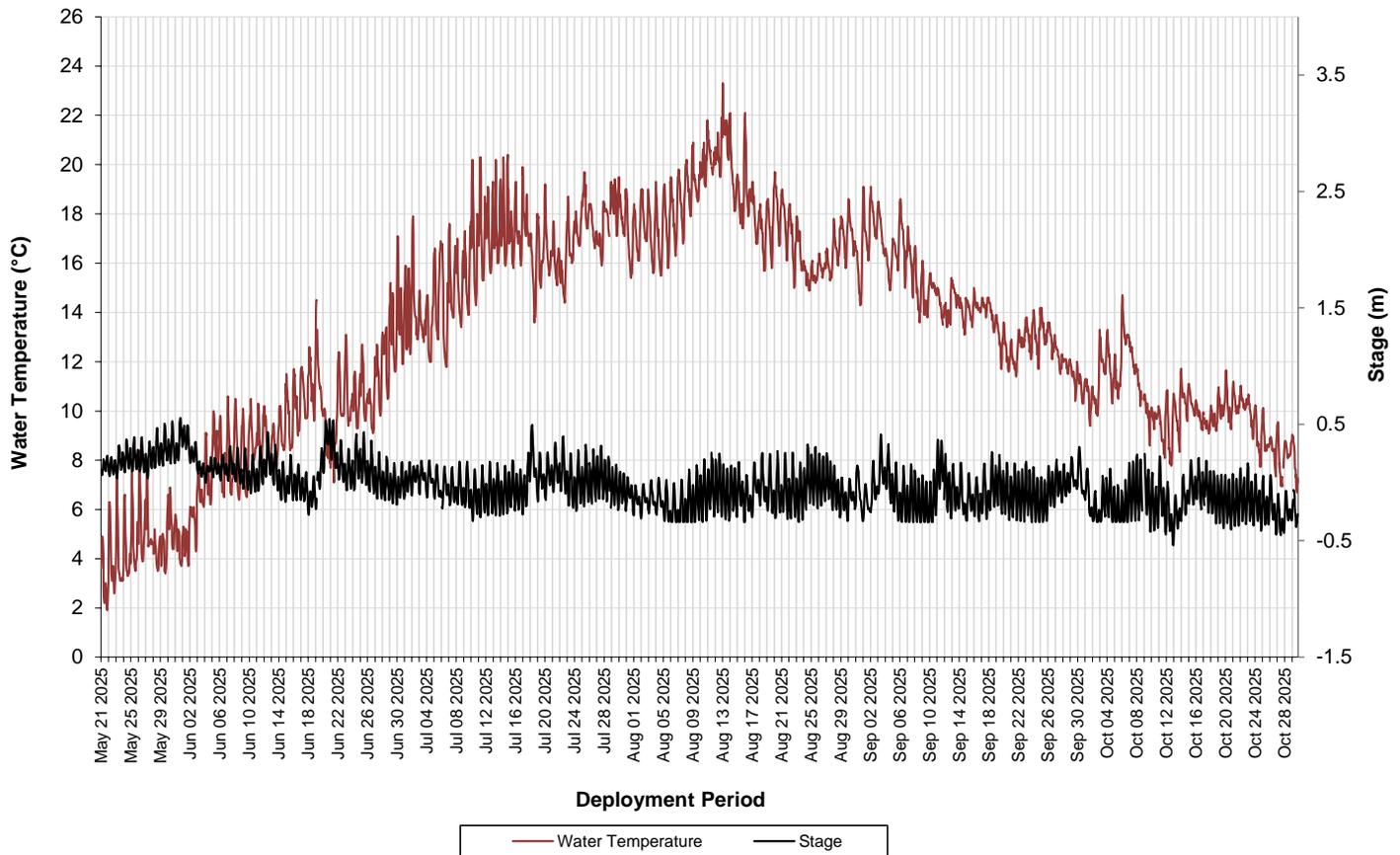
Stage (m)	2025	2024	2023
Min	1.233	-9.191	1.722
Max	3.566	3.769	3.252
Median	1.784	1.9945	2.460

## Churchill River at English Point

### Temperature

- Over the 2025 deployment season, water temperature ranged from 1.9°C to 23.3°C, with a median value of 13.3°C (Figure 24), which was comparable to the previous two seasons.
- Daily fluctuations at this station are far greater compared to the other stations in the Churchill River network due to tidal influences from the Atlantic Ocean and Lake Melville.

**Water Temperature & Stage at Churchill River at English Point**

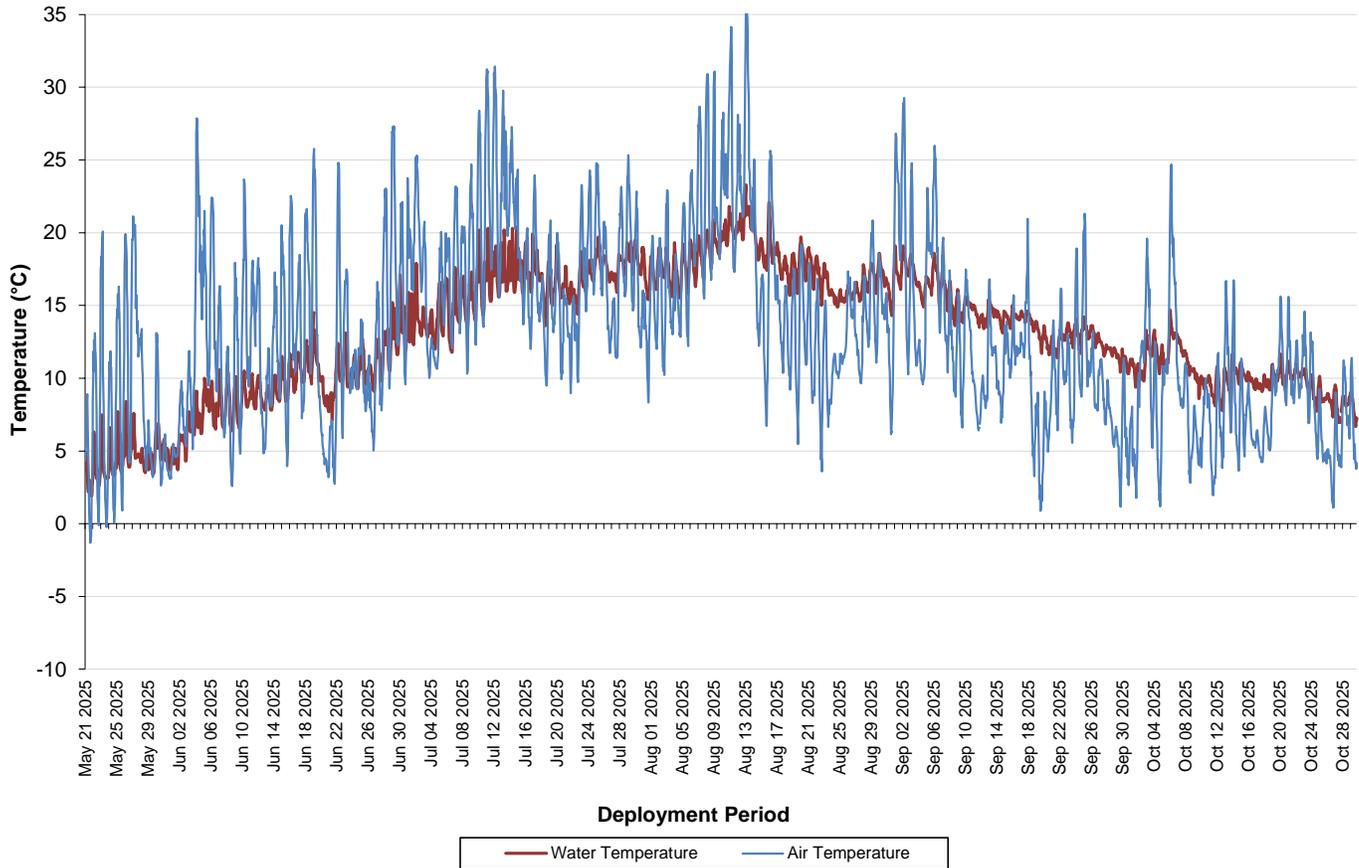


**Figure 24: Water Temperature & Stage at Churchill River at English Point**

Temperature (°C)	2025	2024	2023
Min	1.9	4.3	3.5
Max	23.3	23.2	24.1
Median	13.3	16.1	14.0

- Temperatures followed a typical seasonal trend (Figure 25), where both water and air temperatures increased throughout the spring and early summer with water temperatures peaking in August. Water and air temperatures decreased steadily through September and October. Air temperature data was obtained from the Muskrat Falls MET weather station.

**Water Temperature & Air Temperature at Churchill River at English Point**

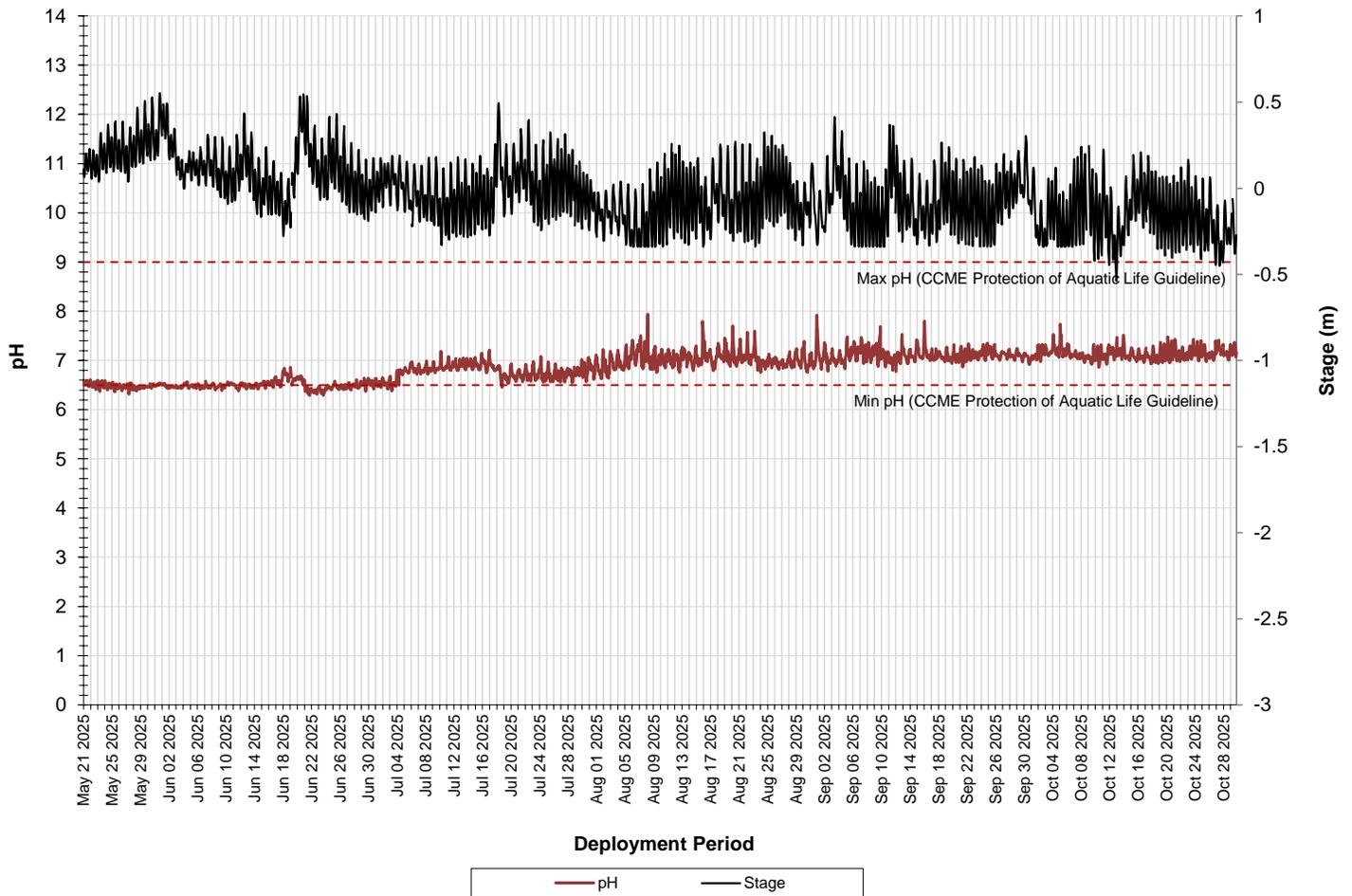


**Figure 25: Water Temperature & Air Temperature at Churchill River at English Point**

**pH**

- Over the 2025 deployment season, pH ranged from 6.29 to 7.94 pH units, with a median value of 6.95 pH units (Figure 26), which was comparable to the previous two seasons.
- pH values were within the CCME’s Guidelines for the Protection of Aquatic Life (>6.5 and <9.0 pH units) for the majority of the deployment season (Figure 26).

**pH & Stage at Churchill River at English Point**



**Figure 26: pH & Stage at Churchill River at English Point**

pH (units)	2025	2024	2023
Min	6.29	6.54	5.56
Max	7.94	8.08	7.49
Median	6.95	7.13	6.69

### Specific Conductivity

- Over the 2025 deployment season, specific conductivity ranged from 15.63 $\mu\text{S}/\text{cm}$  to 117.63 $\mu\text{S}/\text{cm}$ , with a median value of 32.95 $\mu\text{S}/\text{cm}$ , which was comparable to the previous two seasons (Figure 27). An increasing trend was observed throughout the season.
- Specific conductivity is highly variable at this station, fluctuating significantly every day due to tidal influences from the Atlantic Ocean. As the tide comes in, specific conductivity increases as dissolved solids and salinity increase. Similarly, when the tide goes out, specific conductivity decreases as dissolved solids and salinity decrease. This increase and decrease in specific conductivity and stage occurs twice daily.

Specific Conductivity & Stage at Churchill River at English Point

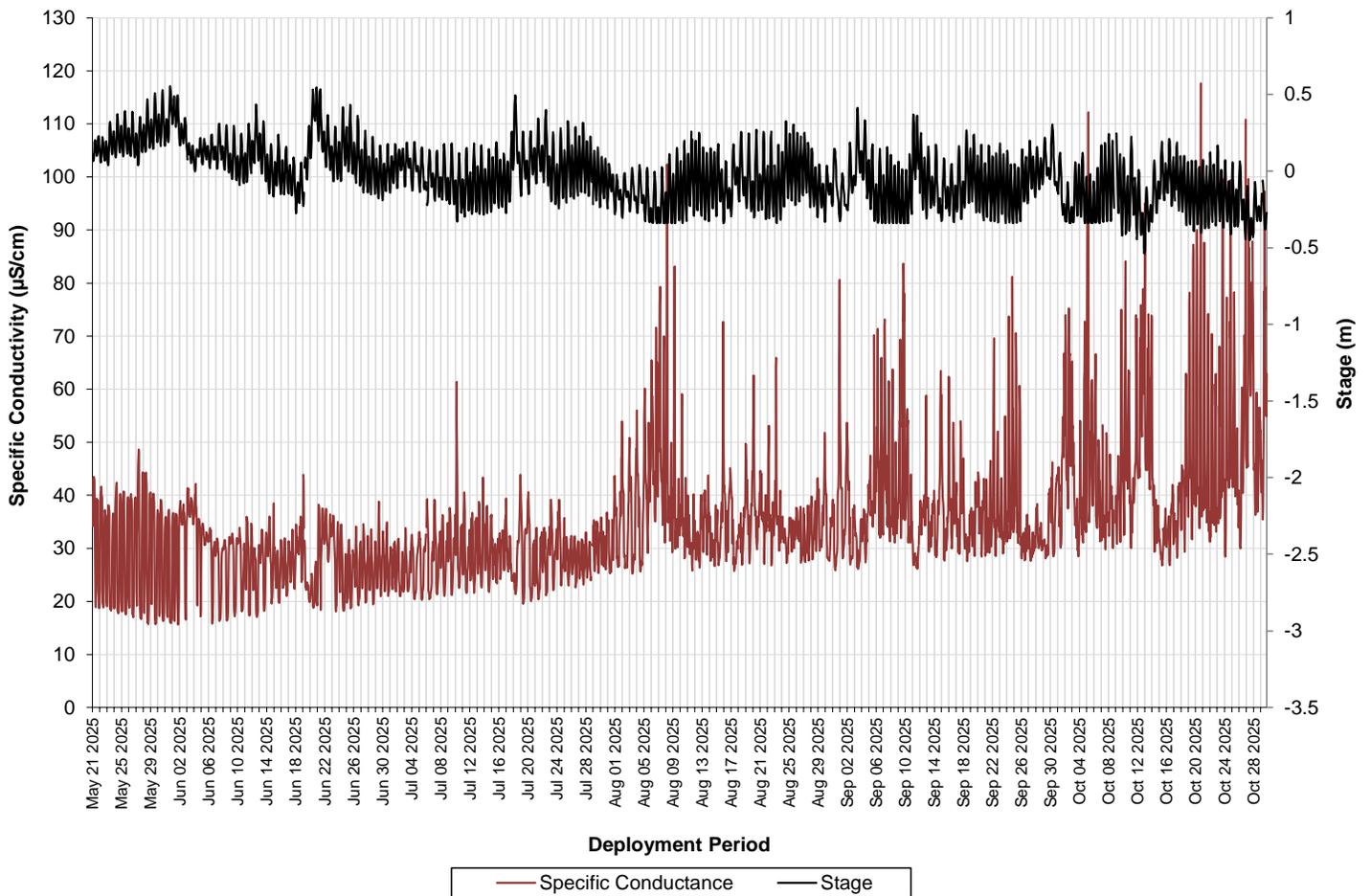


Figure 27: Specific Conductivity & Stage at Churchill River at English Point

Specific Conductivity ( $\mu\text{S}/\text{cm}$ )	2025	2024	2023
<b>Min</b>	15.63	16.93	14.0
<b>Max</b>	117.63	80.47	54.7
<b>Median</b>	32.95	34.73	29.7

### Dissolved Oxygen

- Over the 2025 deployment season, dissolved oxygen ranged from 9.16mg/L to 14.02mg/L, with a median value of 10.37mg/L (Figure 28), which was slightly higher than previous seasons. Percent saturation ranged from 84.2% to 117.4%, with a median value of 100.1% (Figure 28), which was comparable to previous seasons.
- Dissolved oxygen content displayed typical daily and seasonal fluctuations. Percent saturation was generally consistent throughout the deployment season. Dissolved oxygen values were above the CCME’s Guideline for the Protection of Early Life Stages (9.5mg/L) for most of the deployment season; exceptions occurred in July, August and September when water temperatures were highest, which is to be expected. Dissolved oxygen values were above the CCME’s Guideline for the Protection of Other Life Stages (6.5mg/L) for the duration of the deployment season.

Dissolved Oxygen & Water Temperature at Churchill River at English Point

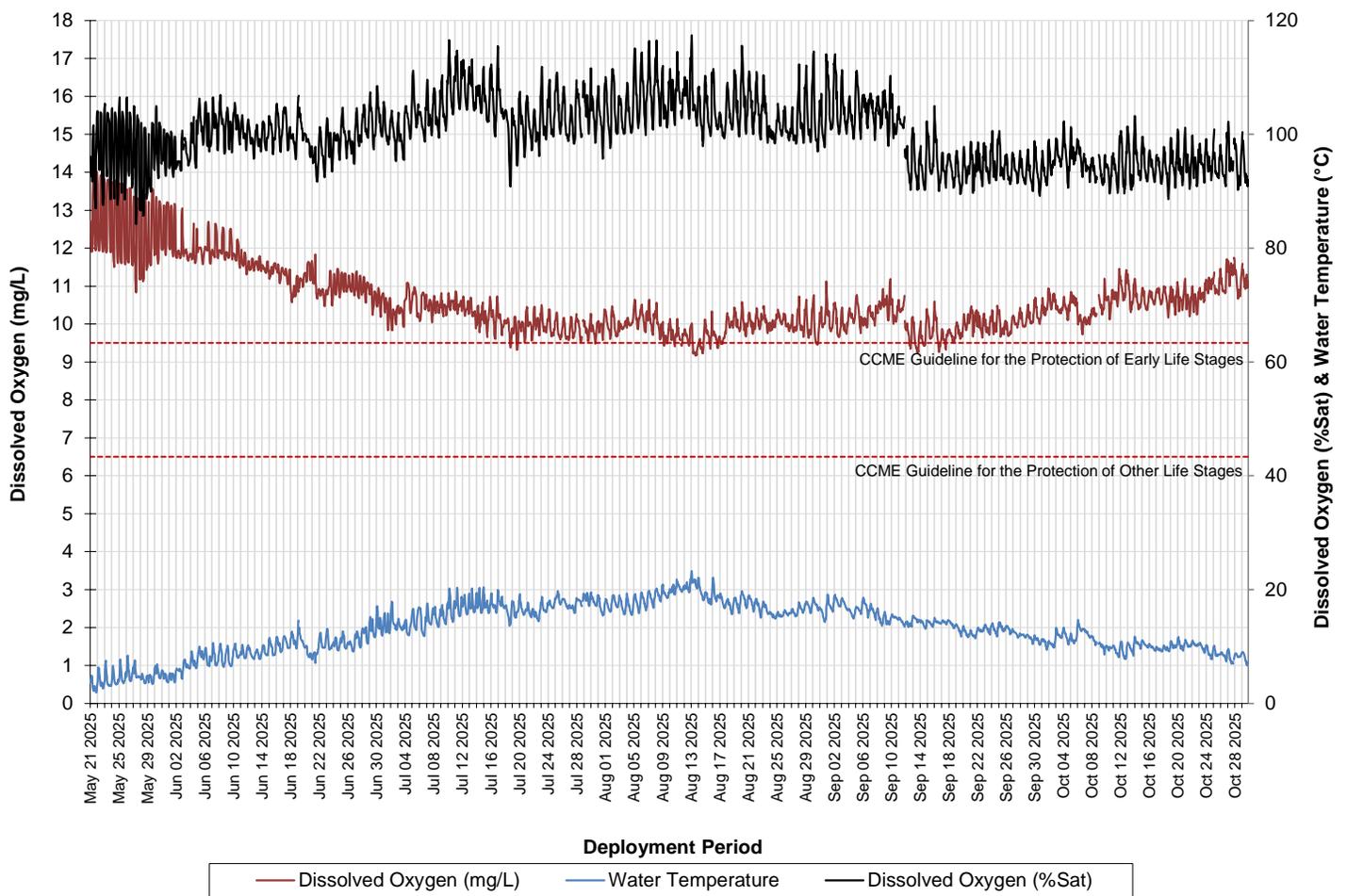


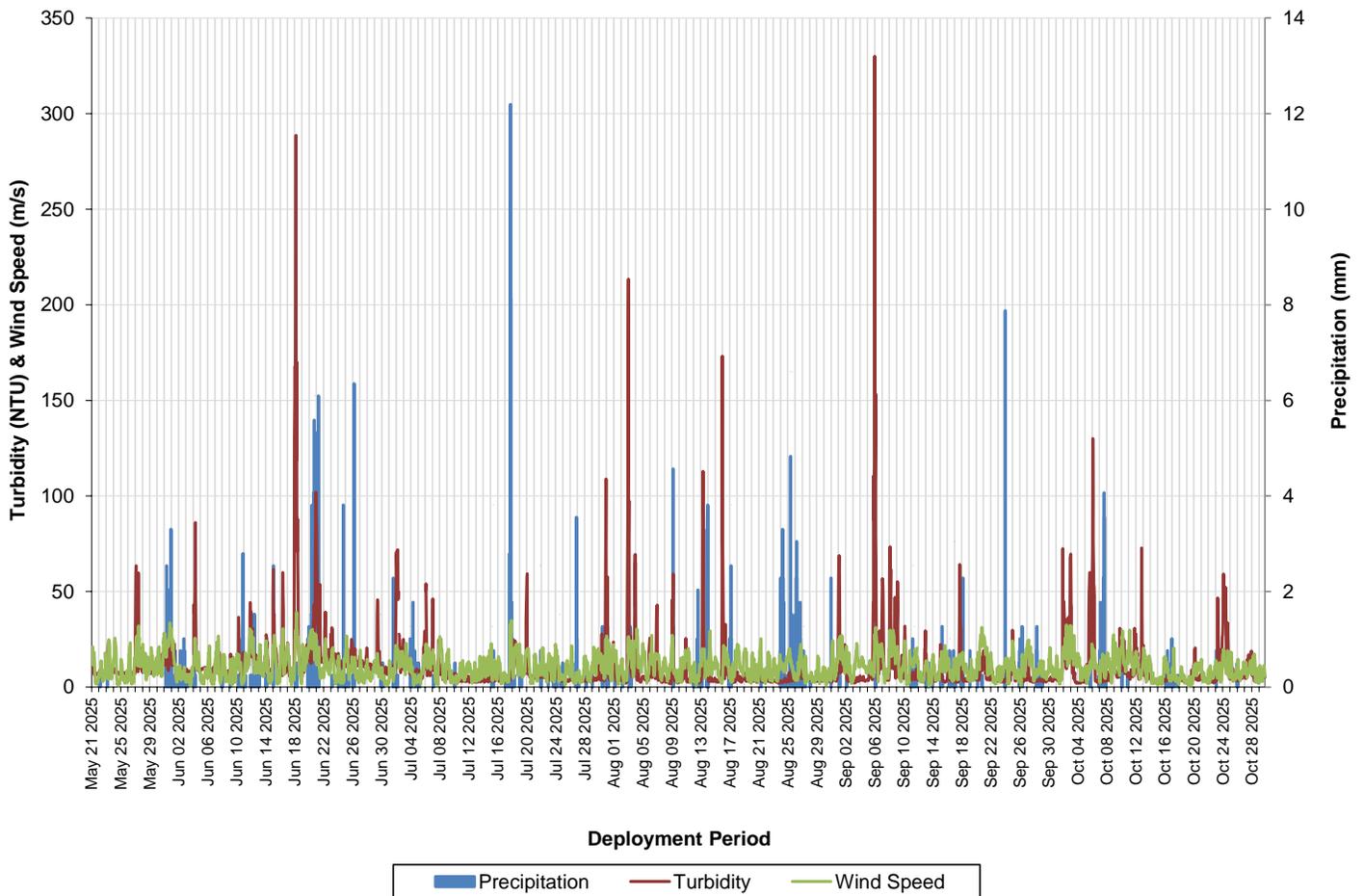
Figure 28: Dissolved Oxygen & Water Temperature at Churchill River at English Point

Dissolved Oxygen (mg/L)	2025	2024	2023		Dissolved Oxygen (% Sat)	2025	2024	2023
Min	9.16	8.48	8.27		Min	84.2	90.5	86.1
Max	14.02	12.59	12.98		Max	117.4	119.4	113.9
Median	10.37	9.83	9.99		Median	100.1	99.5	97.3

### Turbidity & Precipitation

- Over the 2025 deployment season, turbidity ranged from 1.8 NTU to 330 NTU, with a median value of 6.0 NTU (Figure 29). A median value of 6.0 NTU indicates that there is a significant amount of natural background turbidity or debris at this station and is much higher than previous seasons.
- Turbidity increases were often associated with precipitation events; however, high winds and tidal influences at this station also contribute to increased turbidity levels given the sandy nature of the riverbed. Precipitation and wind speed data were obtained from the Muskrat Falls MET weather station.

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



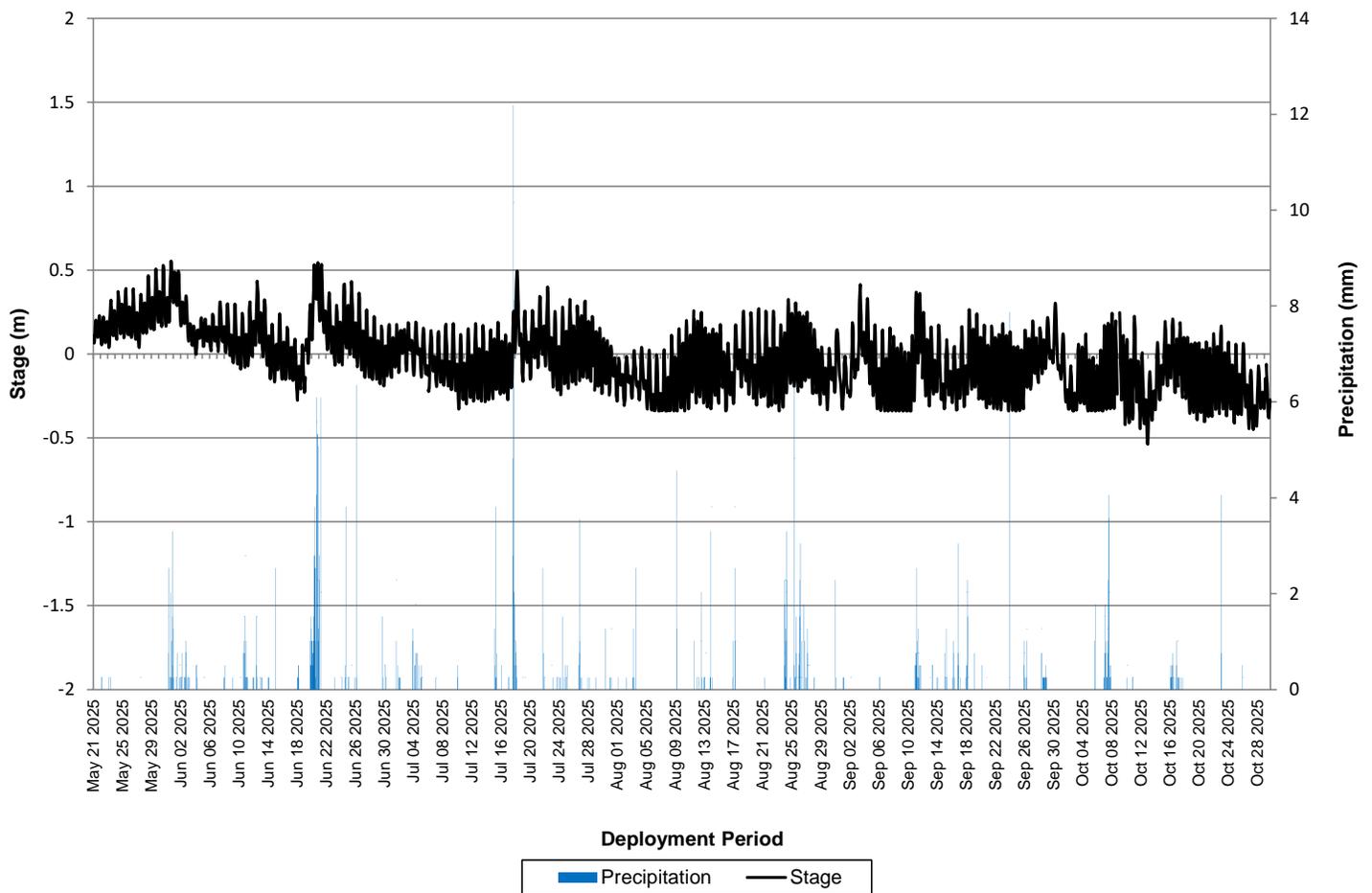
**Figure 29: Turbidity, Stage & Precipitation at Churchill River at English Point**

Turbidity (NTU)	2025	2024	2023
Min	1.8	-1.1	0
Max	330	158.7	202.2
Median	6	3.2	1.0

### Stage

- Over the 2025 deployment season, stage ranged from -0.539m to 0.554m, with a median value of -0.035m (Figure 30), which was lower than previous seasons.
- While stage is relatively consistent over the course of the deployment season, stage values at this station do fluctuate considerably on a daily basis due to tidal influences from the Atlantic Ocean.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage & Precipitation at Churchill River at English Point**



**Figure 30: Stage & Precipitation at Churchill River at English Point**

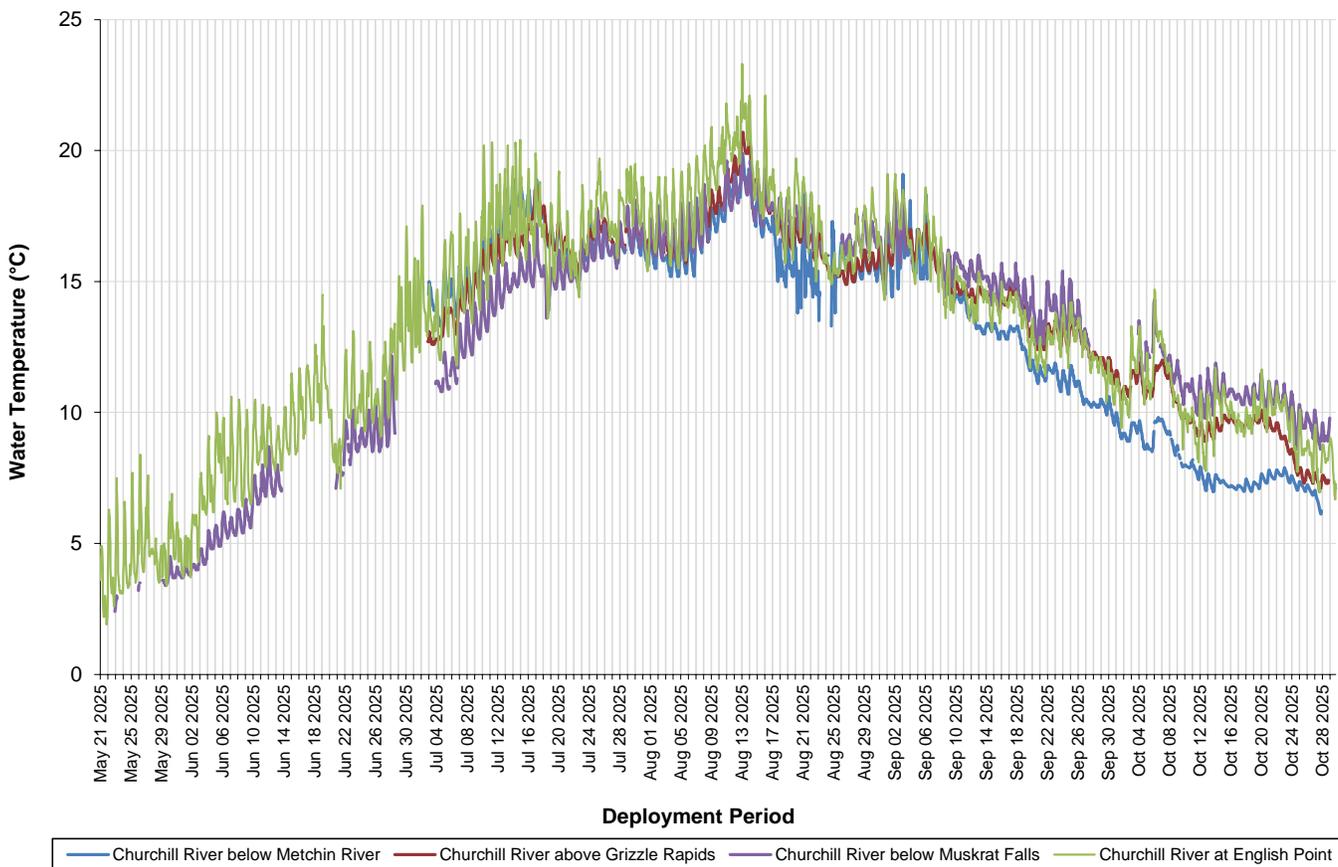
Stage (m)	2025	2024	2023
Min	-0.539	-0.33	-1.075
Max	0.554	1.392	1.197
Median	-0.035	0.823	-0.103

## Station Comparison

### Temperature

- Water temperatures at each of the four stations on the Churchill River displayed a similar trend throughout the 2025 deployment season (Figure 31). Overall, increases and decreases occurred at all stations around the same time, though to different extents.
- Water temperature was generally warmest at English Point, while this station also had the greatest diurnal fluctuations. At the peak of the summer months, the coolest water temperatures were recorded at below Metchin River, while the warmest were recorded at English Point.

**Water Temperature at the Real-Time Water Quality Monitoring Stations**

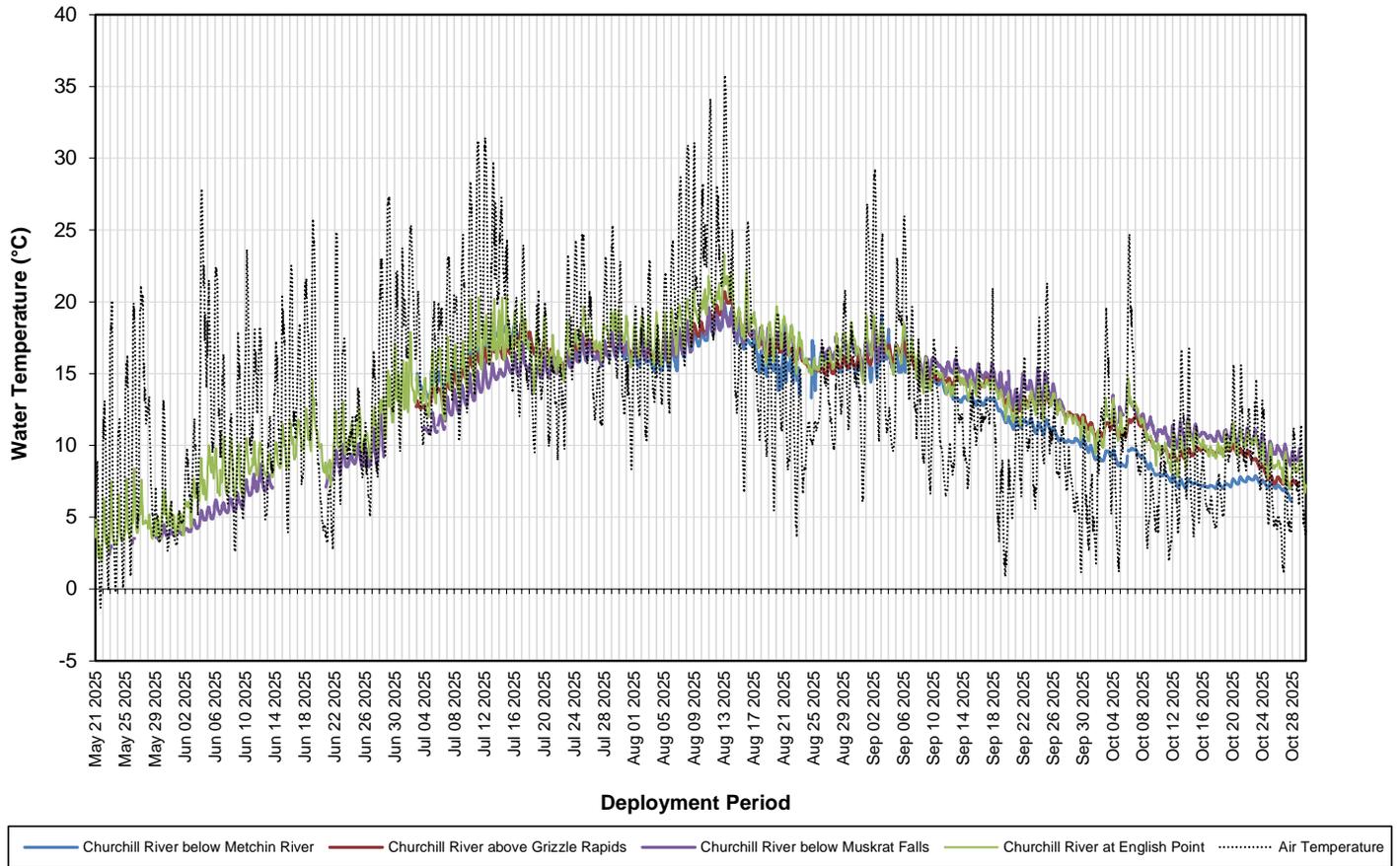


**Figure 31: Water Temperature at all Stations on the Churchill River in 2025**

Temperature (°C)	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
<b>Min</b>	6.13	7.1	1.8	1.9
<b>Max</b>	19.9	20.7	19.9	23.3
<b>Median</b>	15.0	15.3	14.0	13.3

- Water temperatures at each of the four stations on the Churchill River displayed clear seasonal trends in response to changes in ambient air temperatures throughout the deployment season (Figure 32).

**Water Temperature & Air Temperature at the Real-Time Water Quality Monitoring Stations**

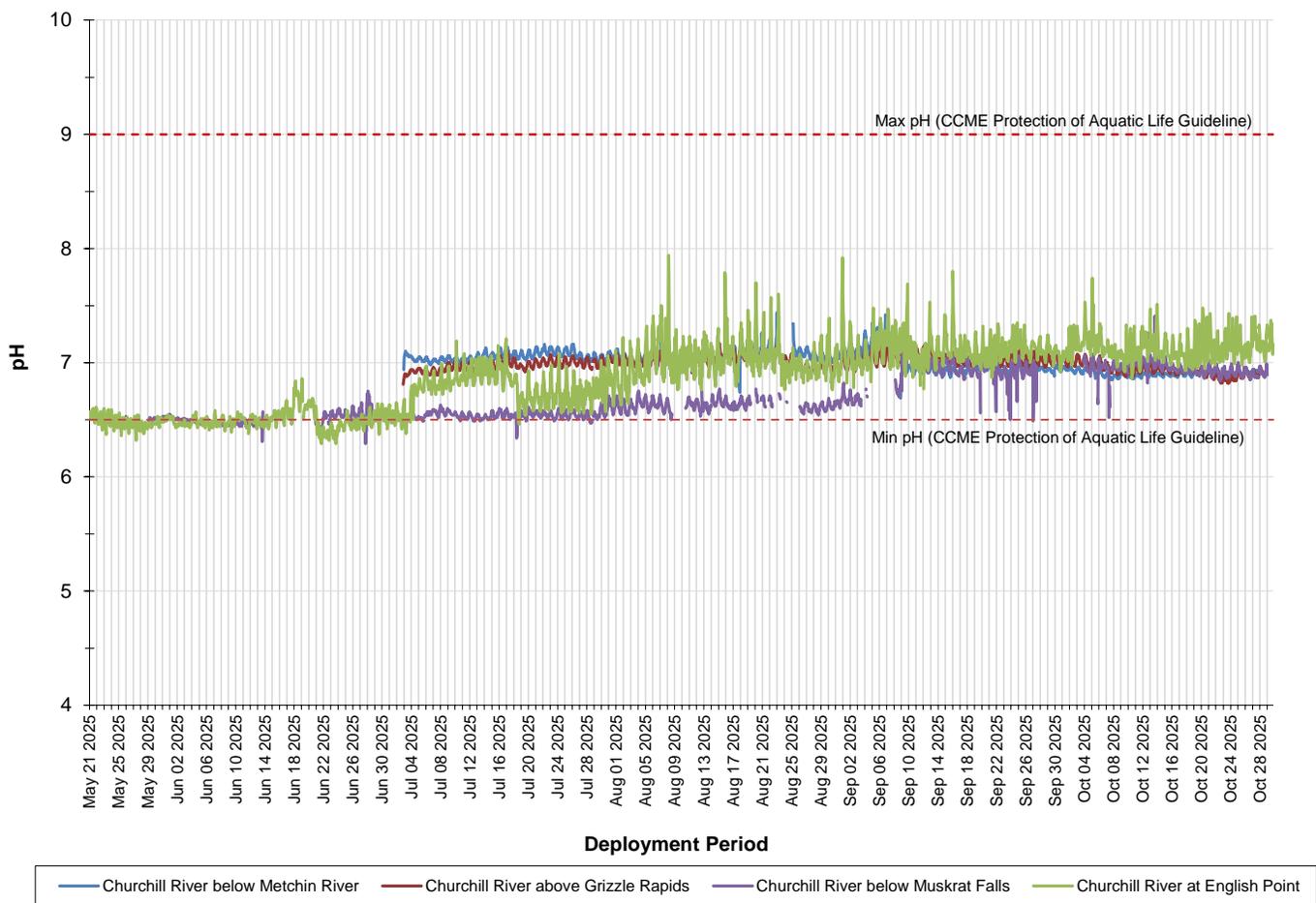


**Figure 32: Water Temperature & Air Temperature at all Stations on the Churchill River in 2025**

### pH

- pH values at each of the four stations on the Churchill River displayed somewhat similar trends throughout the 2025 deployment season (Figure 33).
- Median pH values were similar at all four stations, remaining within the CCME’s Guidelines for the Protection of Aquatic Life for much of the deployment season. All stations, excluding English Point, experienced issues with pH sensors being located out of, or in very little, water. This erroneous data has been removed from the dataset where possible.
- pH values at English Point showed the greatest daily variation throughout the deployment season due to the position of this station at the mouth of the Churchill River and tidal influences from the Atlantic Ocean.

**pH at the Real-Time Water Quality Monitoring Stations**



**Figure 33: pH at all Stations on the Churchill River in 2025**

pH	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
<b>Min</b>	6.69	6.81	6.29	6.29
<b>Max</b>	7.44	7.19	7.41	7.94
<b>Median</b>	7.01	6.99	6.62	6.95

### Specific Conductivity

- Specific conductivity values at each of the four stations on the Churchill River displayed similar trends throughout the 2025 deployment season, with the exception of the station at English Point (Figure 34). All stations showed a slight increasing trend over the deployment period.
- Specific conductivity is generally very stable on the Churchill River (above English Point), fluctuating very little over the course of a deployment period. In contrast, specific conductivity at English Point is highly variable, fluctuating significantly twice daily due to the tidal influences of the Atlantic Ocean. Some data has been removed as the instrument was likely out of the water at the time, recording erroneous values.

Specific Conductivity at the Real-Time Water Quality Monitoring Stations

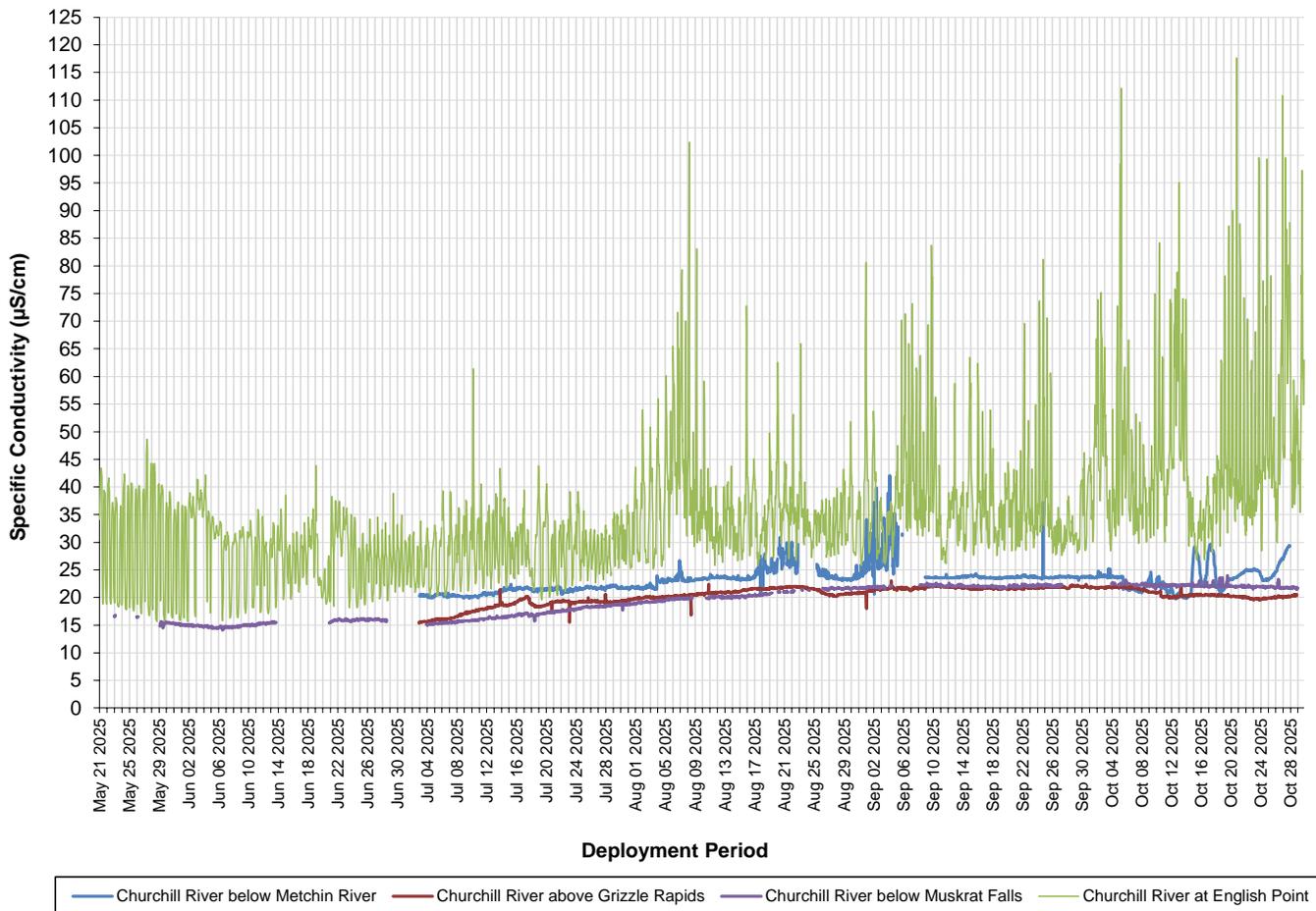


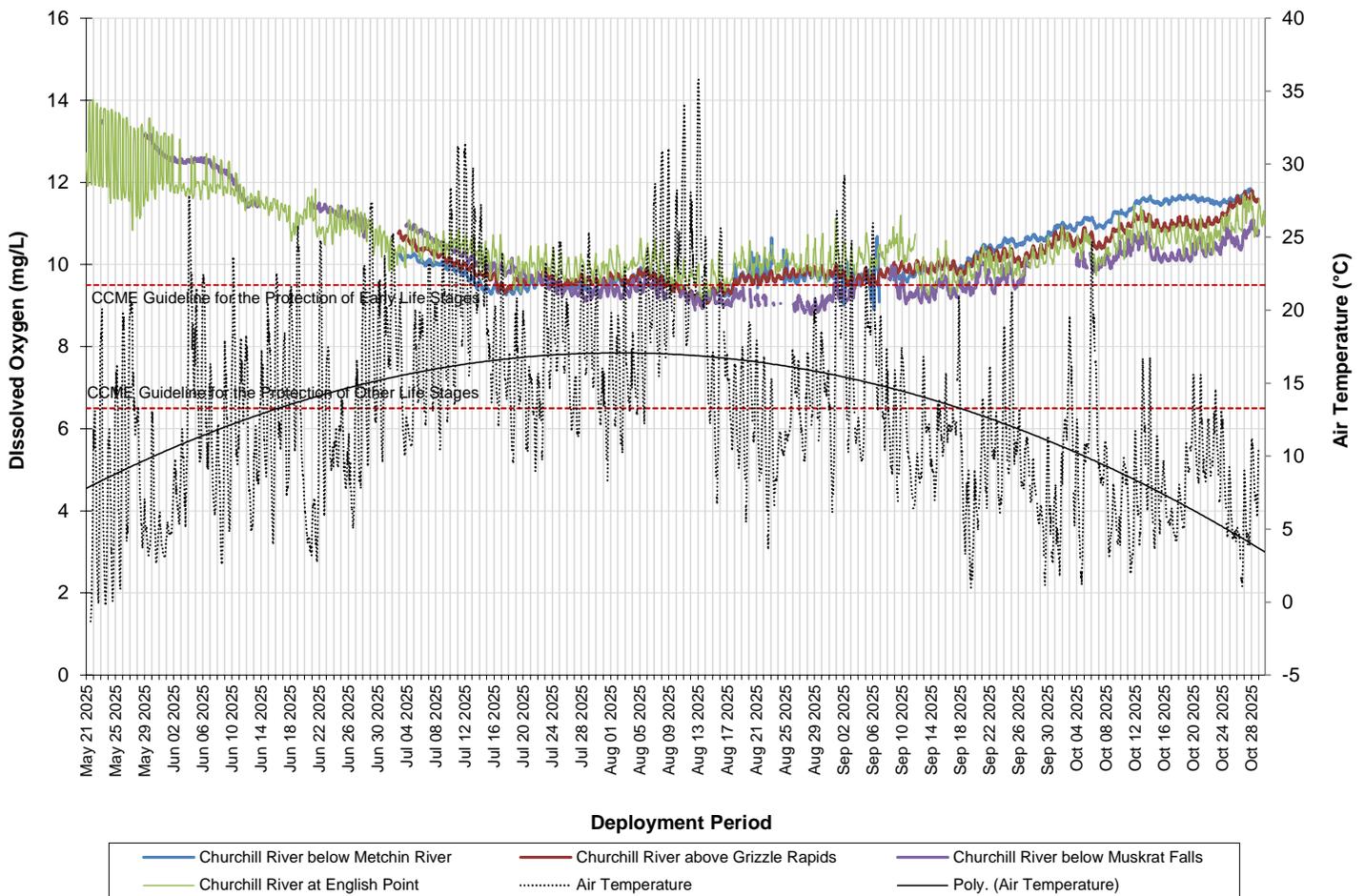
Figure 34: Specific Conductivity at all Stations on the Churchill River in 2025

Specific Conductivity (µS/cm)	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
Min	9.9	15.3	14.1	15.63
Max	42.1	23.0	24.0	117.63
Median	23.4	20.6	20.0	32.95

### Dissolved Oxygen

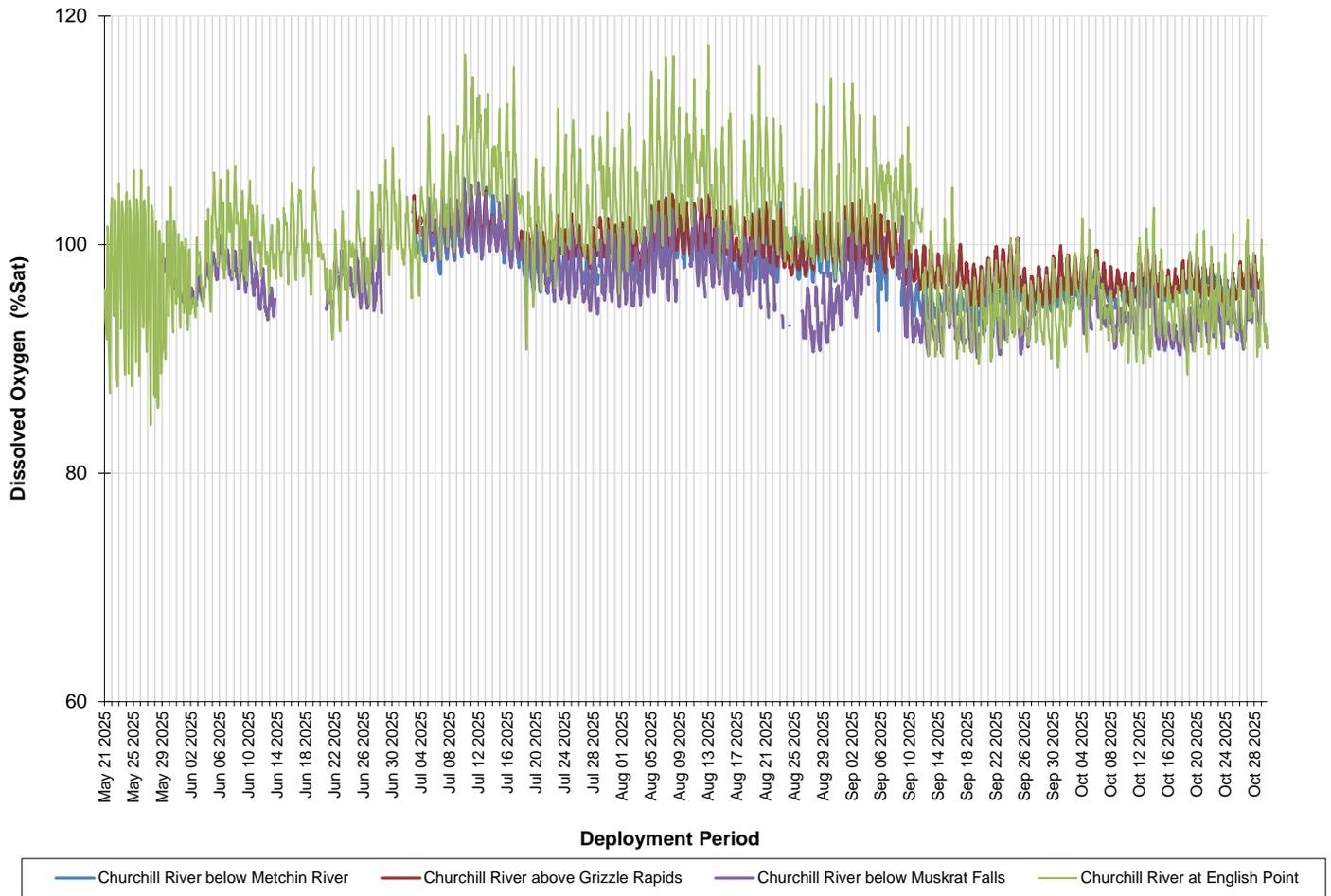
- Dissolved oxygen content and percent saturation values at each of the four stations on the Churchill River were similar throughout the 2025 deployment season (Figure 35a and 35b).
- Dissolved oxygen (mg/L) displayed a very clear inverse relationship with water temperature and followed a distinct seasonal trend. Values decreased through spring and early summer, then increased through late summer into fall (Figure 35a). In contrast, dissolved oxygen (% Sat) remained relatively stable across the deployment season at all stations (Figure 35b).
- In previous years, dissolved oxygen concentration was highest at the station below Muskrat Falls compared to all other stations due to its downstream proximity to Muskrat Falls hydroelectricity facility. In 2025, it recorded the lowest concentrations, likely due to the low water levels, warmer water temperatures and reduced water aeration from the minimal flows. Dissolved oxygen concentrations at all stations remained above the CCME’s Guideline for the Protection of Early Life Stages (9.5mg/L) for much of the 2025 deployment season, with the exception of during the warmer summer months, which is to be expected. All stations remained above the CCME’s Guideline for the Protection of Other Life Stages (6.5mg/L) throughout the 2025 deployment season. Some data has been removed as the instrument was likely located out of, or in very little, water.

**Dissolved Oxygen & Air Temperature at the Real-Time Water Quality Monitoring Stations**



**Figure 35a: Dissolved Oxygen (mg/L) at all Stations on the Churchill River in 2025**

**Dissolved Oxygen at the Real-Time Water Quality Monitoring Stations**



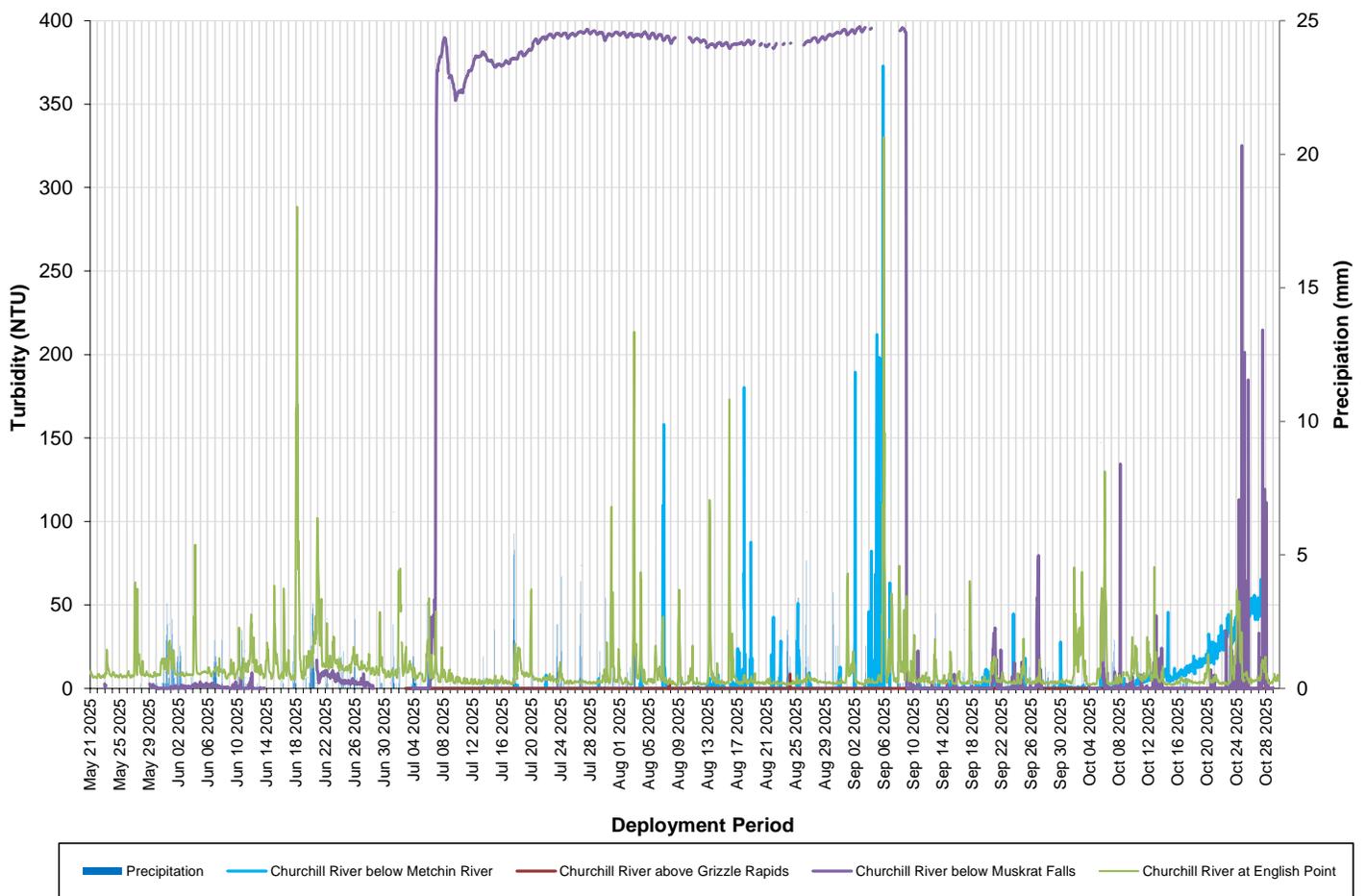
**Figure 35b: Dissolved Oxygen (%Sat) at all Stations on the Churchill River in 2025**

	Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Sat)			
	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt		CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
<b>Min</b>	8.91	8.92	8.78	9.16		92.4	94.2	90.1	84.2
<b>Max</b>	11.85	11.80	13.51	14.02		105.1	104.7	105.8	117.4
<b>Median</b>	9.84	9.88	9.94	10.37		97.4	99.1	96.2	100.1

### Turbidity

- Turbidity values at each of the four stations on the Churchill River were somewhat similar during the 2025 deployment season (Figure 36), with median values ranging from 0 NTU to 6.0 NTU.
- At all stations, turbidity values were likely affected by the low water levels. As stage levels dropped, water quality instruments were in shallower water, with less flushing from water flows to clean the instrument and the water around it. This would have resulted in increased turbidity events or even the instrument being buried, as occurred below Muskrat Falls.

**Turbidity & Precipitation at the Real-Time Water Quality Monitoring Stations**



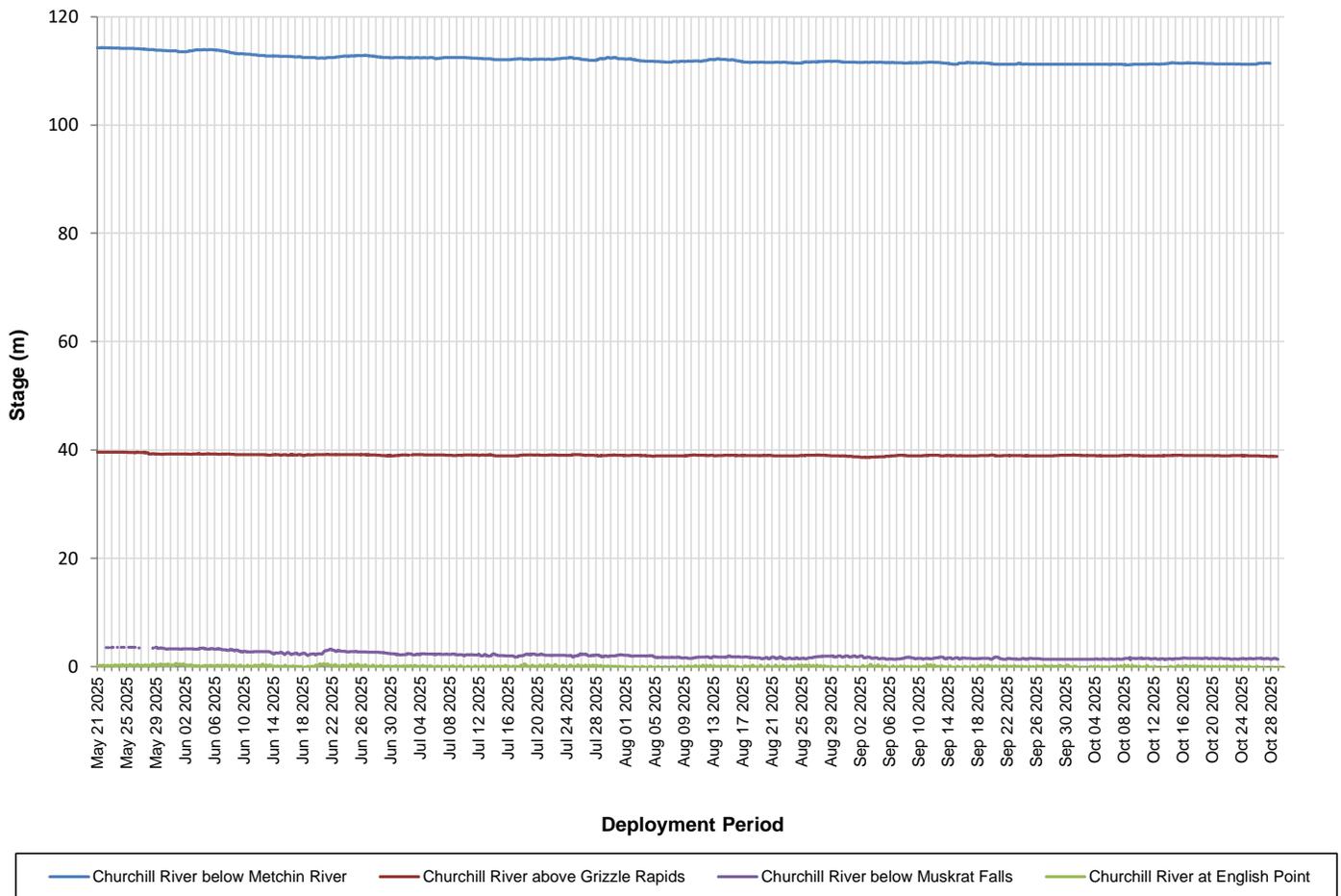
**Figure 36: Turbidity at all Stations on the Churchill River in 2025**

Turbidity (NTU)	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
<b>Min</b>	0	0	0	1.8
<b>Max</b>	372.9	8.6	396.6	330
<b>Median</b>	0	0	4.5	6

### Stage

- Stage values on the Churchill River varied from one station to the next during the 2025 deployment season (Figure 37), as all were affected differently by low precipitation and resultant stage values.
- Stage was generally quite stable and very low at each station across the deployment season. The greatest variability in stage was observed at English Point, where values are greatly affected by tidal influences from the Atlantic Ocean.
- Water Survey of Canada (ECCC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage at the Real-Time Water Quality Monitoring Stations**



**Figure 37: Stage at all Stations on the Churchill River in 2025**

Stage (m)	CRbelowMR	CRaboveGR	CRbelowMF	CRatEngPt
<b>Min</b>	111.113	38.604	1.233	-0.539
<b>Max</b>	114.292	39.587	3.566	0.554
<b>Median</b>	111.818	39.004	1.784	-0.035

## Conclusions

- Water quality monitoring instruments were successfully deployed on the Churchill River for different lengths of time during the spring, summer and fall of 2025.
- In most cases, weather related events can explain fluctuations in water levels. This season saw exceptionally low water levels along the Churchill River, resulting in many instruments being in low water or out of the water for periods of time. The deployed stations continue to perform well at capturing water quality data along different reaches of the river. The English Point station provides a last measurement of water quality in the Lower Churchill River before entering Lake Melville. This station is affected by tidal influences from the Atlantic Ocean.
- Regular visits on a 30-50 day deployment schedule were mostly adhered to for the 2025 deployment season. This has provided good quality data with limited drift. The effects of bio fouling rarely impact the instruments due to the cold pristine nature of the river and regular monthly maintenance. Sediment build-up around the instrument can result in inaccurate data at times given the sandy nature of the riverbed, and instruments sometimes come out of the water due to fluctuating stage levels – as evidenced in 2025 at several stations.
- Instruments generally performed well for much of the deployment season, with limited disruptions to data collection other than when buried or out of the water.
- Data collected in 2025 was comparable with datasets from previous years. Generally speaking, water quality parameters do not tend to vary significantly from year to year.
- Water temperatures followed a typical seasonal trend at all stations in the network, whereby temperatures increased through the early summer and then decreased through late summer into fall.
- The majority of recorded pH values were within the CCME’s Guidelines for the Protection of Aquatic Life.
- During the warmer summer months, dissolved oxygen at all stations fell below the CCME’s Guideline for the Protection of Early Life Stages (9.5mg/L). Dissolved oxygen values at all stations remained above the CCME’s Guideline for the Protection of Other Life Stages (6.5mg/L) throughout the deployment.
- Specific conductivity is generally stable on the Churchill River above English Point, experiencing only minor fluctuations during deployment. In contrast, specific conductivity at English Point is highly variable, experiencing significant daily fluctuations due to tidal influences from the Atlantic Ocean. As the tide comes in, specific conductivity increases as dissolved solids and salinity increase; the opposite is true as the tide goes out. The three stations above English Point all showed a slight increasing trend for specific conductivity due to the low water levels.
- Turbidity was variable along the Churchill River in 2025, with median values ranging from 0 NTU to 396.6 NTU. The stations below Muskrat Falls and at English Point showed frequent turbidity events as expected.
- After a review of the operations and maintenance of the RTWQ network on the Churchill River, it has been determined that the current water quality instruments, having been in use since 2008, are nearing the end of their lifespan. To maintain a fully operational and compliant network, as per the terms of the MOU, it is recommended that water quality instruments be upgraded in advance of the 2026 field season. This upgrade should include water quality instruments for each station along with appropriate length field cabling. As the stations along the Churchill River are only accessible via helicopter, it is advisable to purchase “swap-out” instruments to minimize the amount of time spent in the field and associated helicopter costs, especially as access to helicopters continued to be an issue in 2025, limiting maintenance trips.

## **Path Forward**

For this agreement to be successful, it is essential to continually evaluate and move forward. The 2025 deployment season was successful in providing water quality data for the Churchill River despite the low water levels. The following is a list of planned activities to be carried out in the upcoming year. This list also includes some multi-year activities planned in previous years that are still in progress.

- WRMD staff will deploy RTWQ instruments in spring 2026 when ice conditions allow and perform regular site visits throughout the 2026 deployment season for calibration and maintenance of the instruments.
- ECCC staff will perform regular site visits to ensure water quantity instrumentation is correctly calibrated and providing accurate measurements.
- NL Hydro will continue to be informed of data trends and any significant water quality events in the form of a monthly deployment report when the deployment season begins. NL Hydro will also receive an annual report summarizing the events of the deployment season.
- NL Hydro will continue to receive batch datasets of all RTWQ data if requested. Raw data will be provided if requested.
- Open communication lines will continue to be maintained between WRMD, ECCC and NL Hydro employees involved with the agreement to respond to emerging issues on a proactive basis.
- WRMD will continuously update the TSS-Turbidity model for the stations above and below Muskrat Falls as new grab sample data becomes available. The model will then be tested and validated in consultation with NL Hydro or their consultants as necessary.