Real-Time Water Quality Deployment Report

Iron Ore Company of Canada
Labrador West Network

July 12 to
September 6, 2023

Newfoundland Labrador

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

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General

- The Water Resources Management Division, in partnership with the Iron Ore Company of Canada (IOC) and Environment and Climate Change Canada (ECCC), maintain two real-time water quality (RTWQ) and water quantity stations at Wabush Lake.
- The official name of each station is *Wabush Lake at Dolomite Road* and *Wabush Lake at Lake Outlet*, hereafter referred to as the Dolomite Road station and the Julienne Narrows station.
- These stations are situated upstream (Dolomite Road) and downstream (Julienne Narrows) of the IOC tailings disposal area in Wabush Lake.
- On June 8th, 2016, an additional station was commissioned under this agreement. This station is located at *Dumbell Stream above Dumbell Lake*, hereafter referred to as Dumbell Stream.
- On June 12th, 2017 a new station was commissioned under this agreement. This station is located at *Pumphouse Stream above Drum Lake*, hereafter referred to as Pumphouse Stream.
- Water Resources Management Division staff monitor the real-time graphs regularly. They will inform IOC of any significant water quality events by email notification and by monthly deployment reports.
- Between July 12th and 13th, clean and calibrated real-time water quality-monitoring instruments were deployed at the four IOC stations. The instruments were deployed for a period of 55 days at each station. The instruments were removed on September 5th and 6th. This was the second deployment of 2023 for most of the stations.

Figure 1: RTWQ Monitoring Stations in Labrador West

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 each deployment period. The procedure is based on the approach used by the United States Geological Survey.

  At deployment and removal, a QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. 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 Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

Table 1: Ranking classifications for deployment and removal

	Rank				
Parameter	**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 sonde 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 sonde, the entire sonde 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 IOC water quality stations deployed between July 12-13 and September 5-6, 2023 are summarized in Table 2.

Table 2: QA/QC comparison rankings for IOC stations between July 12-13 and September 5-6, 2023.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Dolomite Road	Jul 13, 2023	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Sept 6, 2023	Removal	Excellent	Excellent	Excellent	Excellent	Good
Julienne Narrows	Jul 13, 2023	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	Sept 6, 2023	Removal	Excellent	Good	Excellent	Excellent	Good
Dumbell Stream	Jul 12, 2023	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	Sept 5, 2023	Removal	Excellent	Good	Excellent	Excellent	Excellent
Pumphouse Stream	Jul 13, 2023	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	Sept 6, 2023	Removal	Excellent	Good	Excellent	Excellent	Excellent

- All parameters ranked either ‘excellent’ or ‘good’ at all stations, for both deployment and removal.

Data Interpretation

- The following graphs and discussion illustrate water quality-related events from July 12-13 to September 5-6, 2023 at the IOC RTWQ monitoring stations in Labrador West.
- 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 this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Wabush Lake Network

- Water temperature ranged from 13.70 to 22.40°C at Dolomite Road and 12.20 to 22.30°C at Julienne Narrows during this deployment period (Figure 2).
- Water temperature at both stations decreased during this deployment period, as water temperature cooled into the fall. Water temperature corresponded to increases/decreases in ambient air temperature trends (Figure 2).

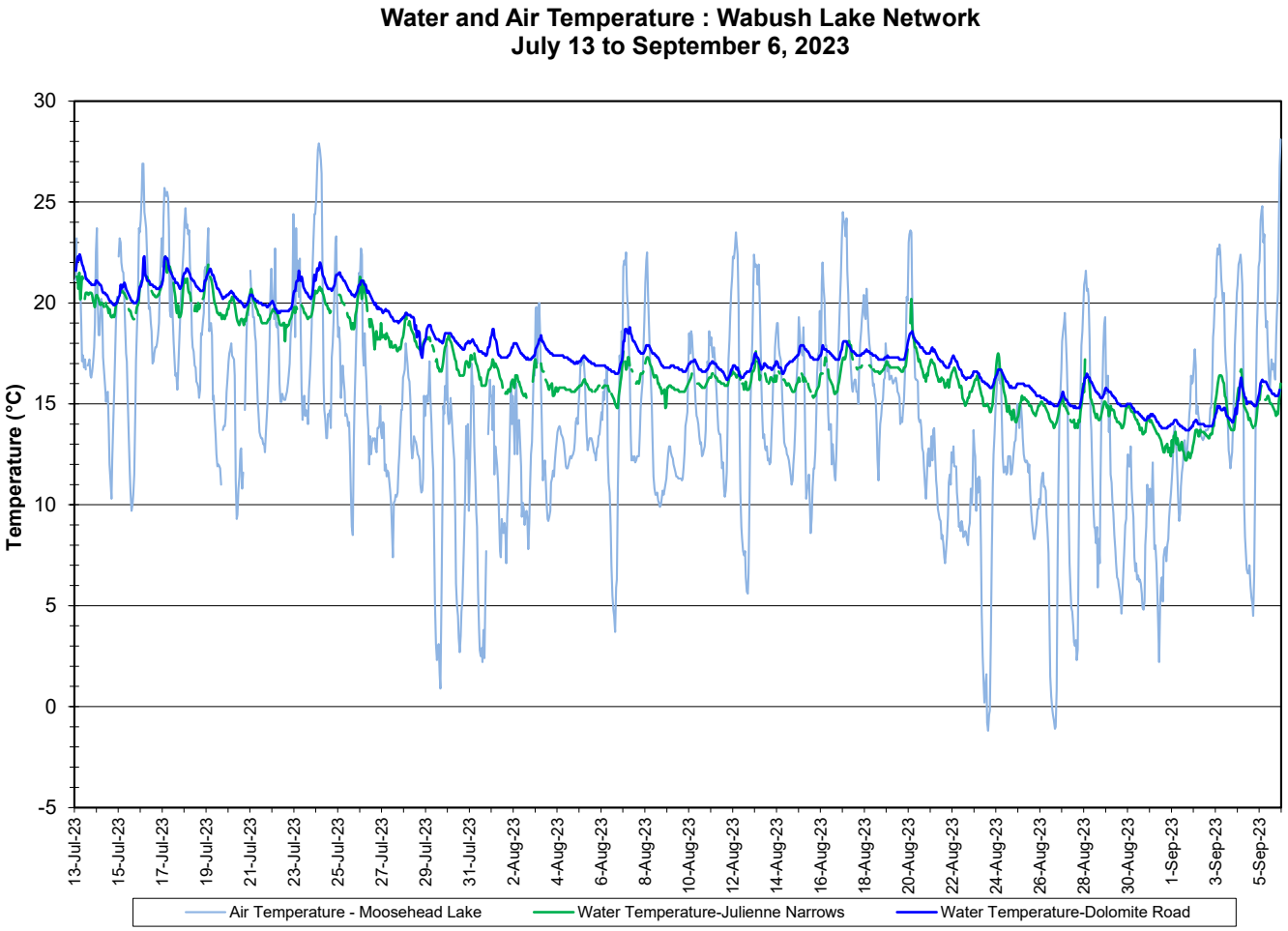

Figure 2: Water and Air Temperature - Wabush Lake network

(Weather data collected from climate station near Moosehead Lake)

- pH ranges from 7.33 to 8.14 pH units at Dolomite Road, and from 7.93 to 8.55 pH units at Julienne Narrows throughout the deployment period (Figure 3). The median pH is 7.63 and 8.17 units respectively.
- At Julienne Narrows and Dolomite Road, all values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly throughout the day and night.
- Overall, pH decreases slightly at Dolomite Road and Julienne Narrows over the course of the deployment period. There is a notable increase in pH at Dolomite Road during the middle of August, corresponding with an increase in stage.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

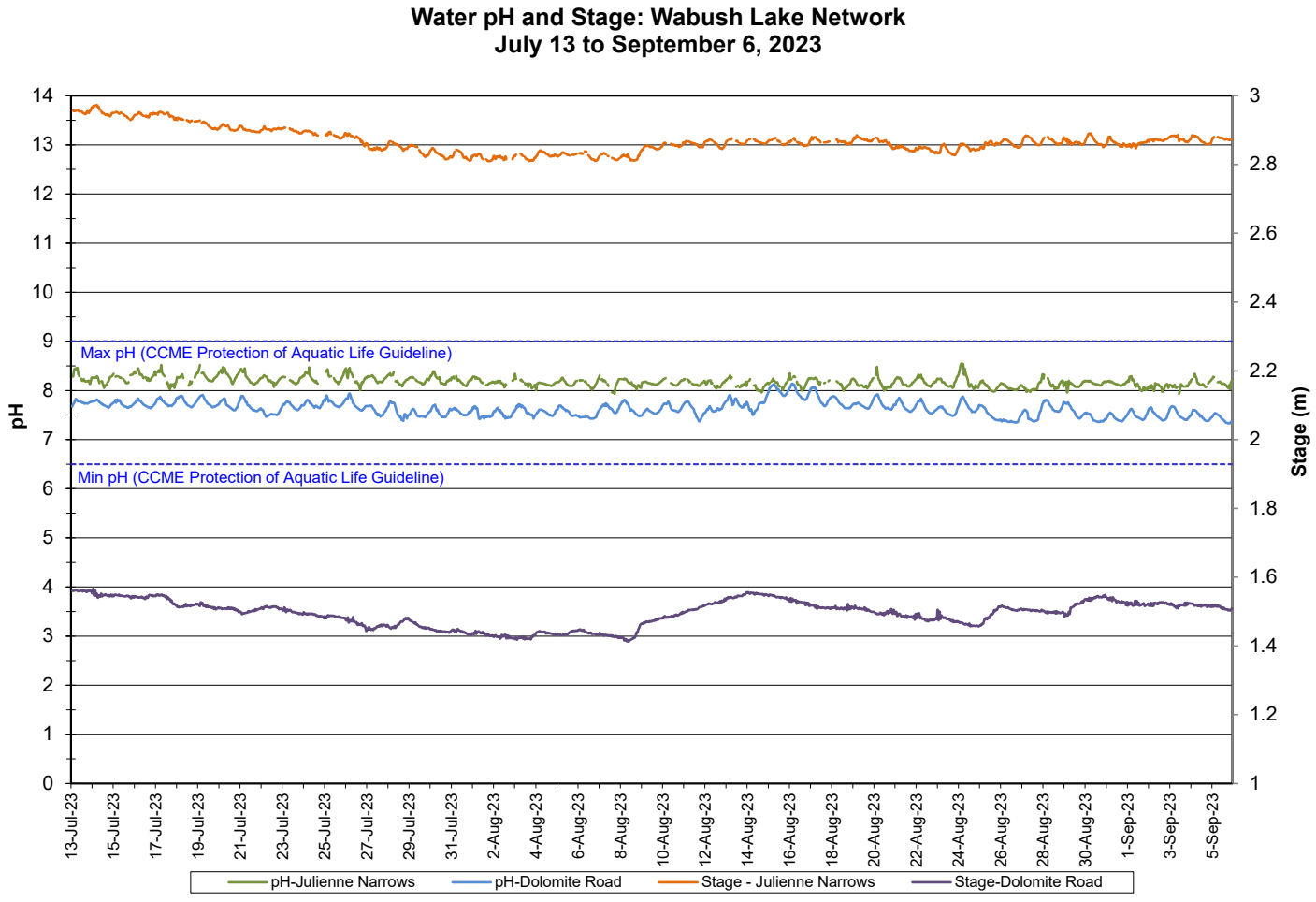

Figure 3: Water pH and Stage– Wabush Lake network

- Specific conductivity ranged from 61.9 to 79.1 µs/cm at Dolomite Road and from 74.2 to 119.1 µs/cm at Julienne Narrows throughout the deployment period (Figure 4).
- Daily fluctuations are evident at the Julienne Narrows station. This can be attributed to varying contributions of iron ore tailings deposited into Wabush Lake upstream of Julienne Narrows and downstream of Dolomite Road. This can also explain the difference in specific conductivity levels between the two stations, as conductance values are generally higher at Julienne Narrows.
- Specific conductivity values at Julienne Narrows trended slightly upwards, while values at Dolomite Road decreased slightly at the end of the deployment period.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

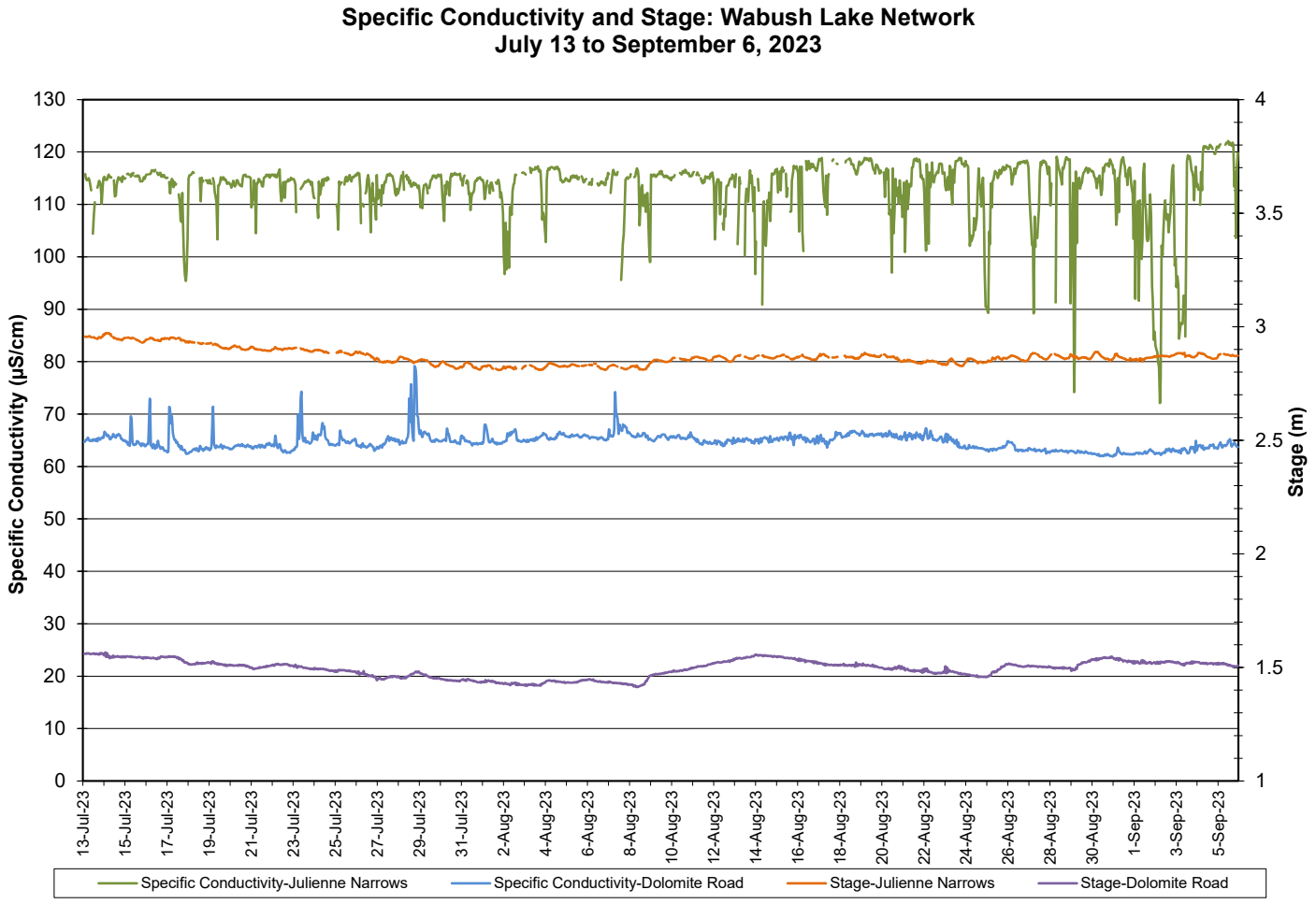

Figure 4: Specific Conductivity and Stage – Wabush Lake network

- At the Dolomite Road station, the saturation of dissolved oxygen ranged from 86.9 to 103.7% while the dissolved oxygen content ranged from 8.13 to 10.06 mg/l with a median value of 9.11 mg/l (Figure 5).
- At the Julienne Narrows station, the saturation of dissolved oxygen ranged from 86.7 to 106.9% while the dissolved oxygen content ranged from 8.11 to 10.16 mg/l with a median value of 9.02 mg/l (Figure 5).
- All values recorded at Julienne Narrows and Dolomite Road were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l. The majority of the values were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/l. The guidelines are indicated in blue on Figure 5.
- Dissolved oxygen increased gradually over this deployment period due to decreasing water temperatures. Dissolved oxygen fluctuated daily with decreases observed at night.

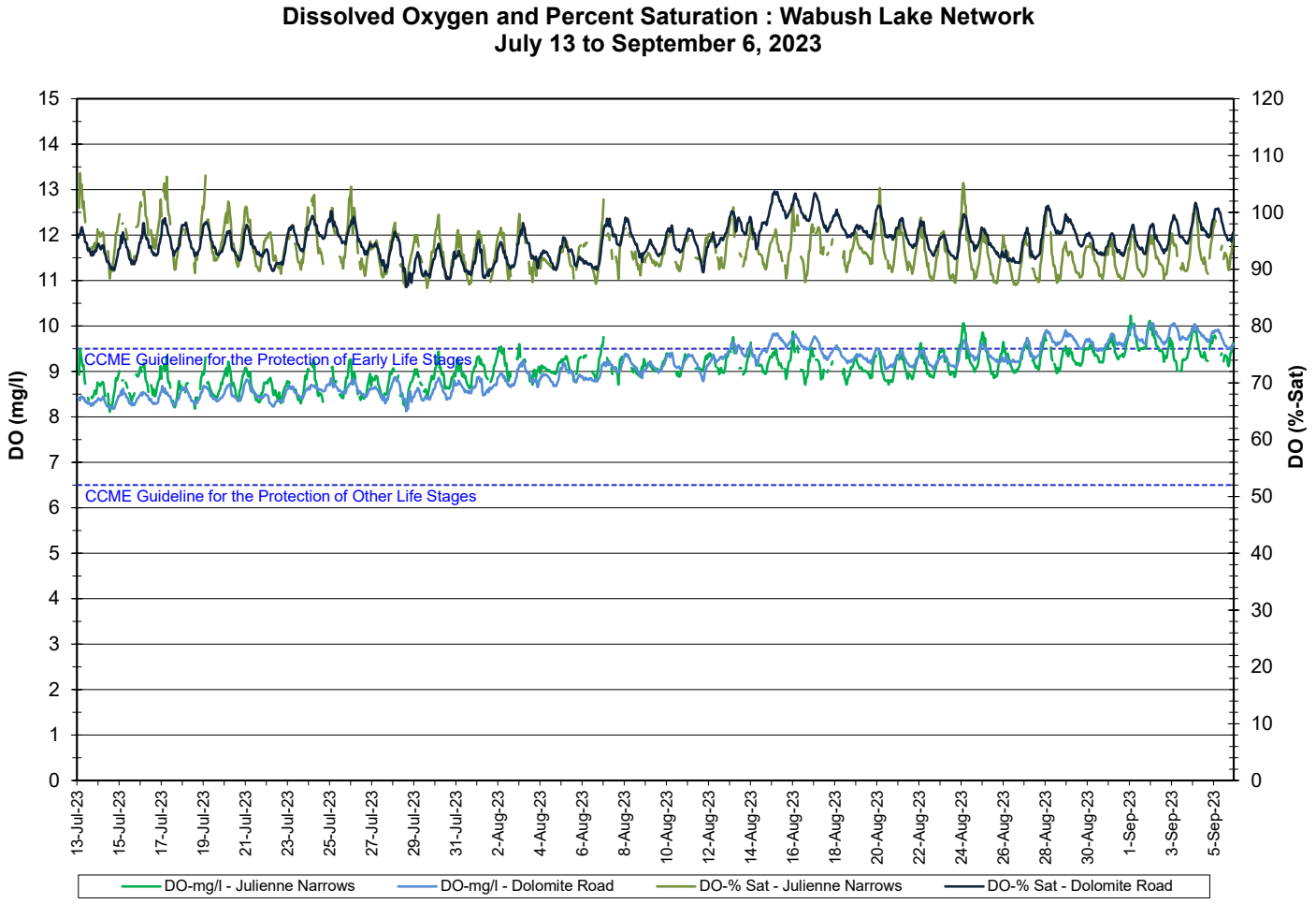

Figure 5: Dissolved Oxygen and Percent Saturation – Wabush Lake Network

- At the Julienne Narrows station, turbidity values range from 0.0 NTU to 99.9 NTU throughout the deployment period (Figure 6a & 6b). The median value was 0.0 NTU, indicating low background turbidity levels.
- Turbidity spikes occur infrequently and for short periods of time.

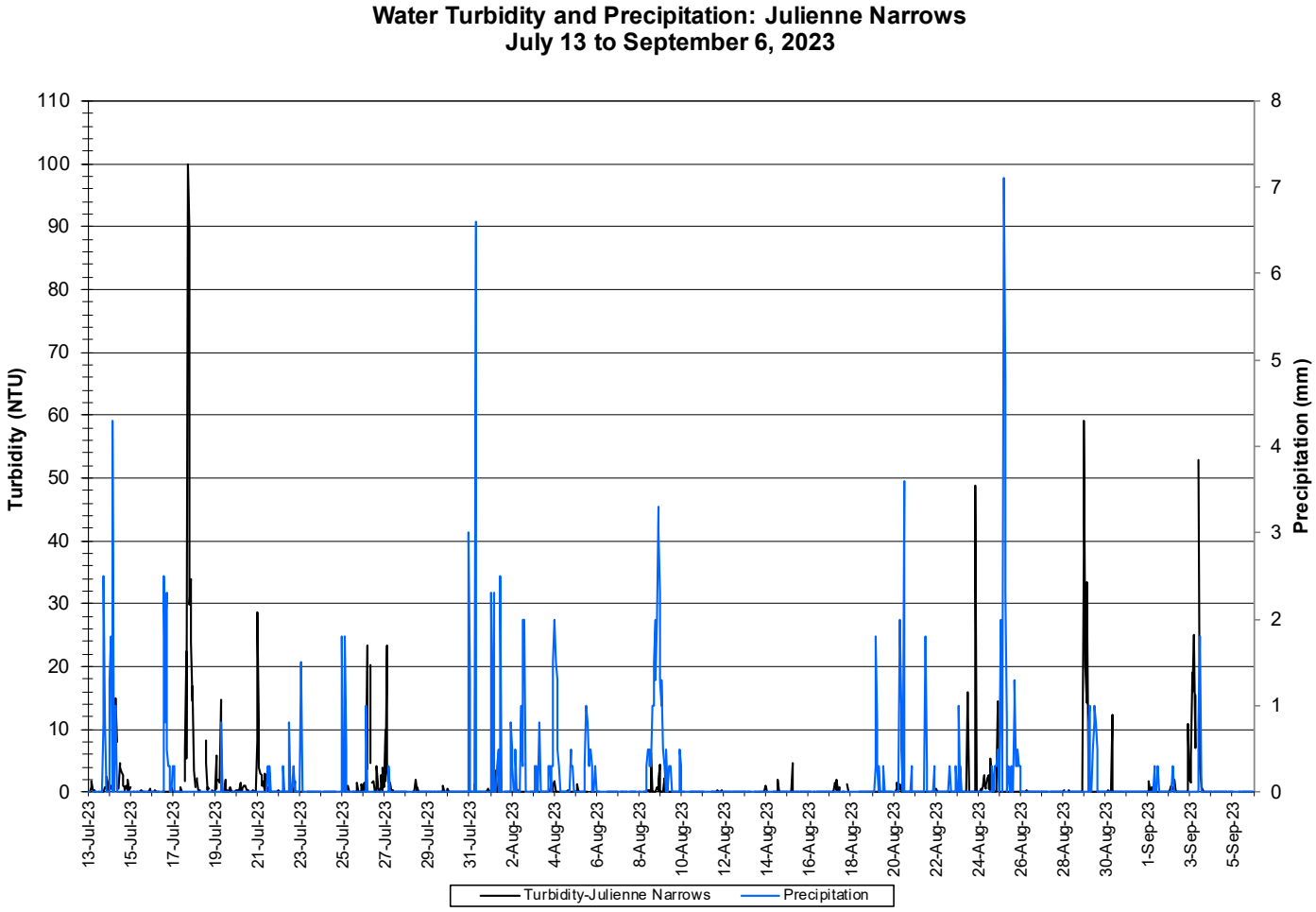

Figure 6a: Turbidity and Precipitation – Julienne Narrows

(Weather data collected from climate station near Moosehead Lake)

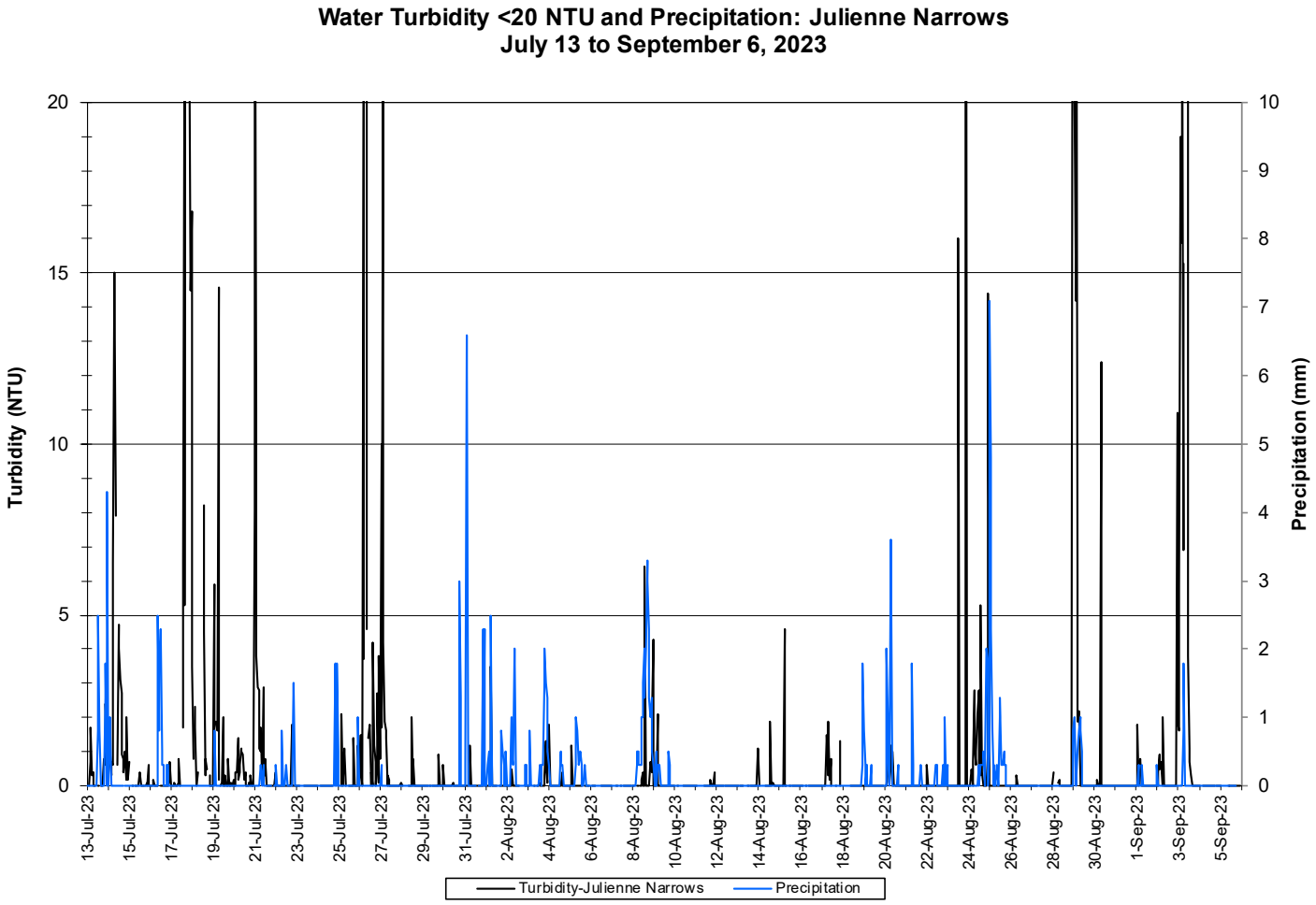

Figure 6b: Turbidity <20 NTU and Precipitation – Julienne Narrows

(Weather data collected from climate station near Moosehead Lake)

- At the Dolomite Road station, turbidity values range from 0.0 NTU to 29.8 NTU throughout the deployment period (Figure 7a & 7b). The median value was 1.1 NTU.
- Data from August 17th and onward is erroneous and likely due to biofouling, it has been removed from the dataset. It is included for graphing purposes only (in red).

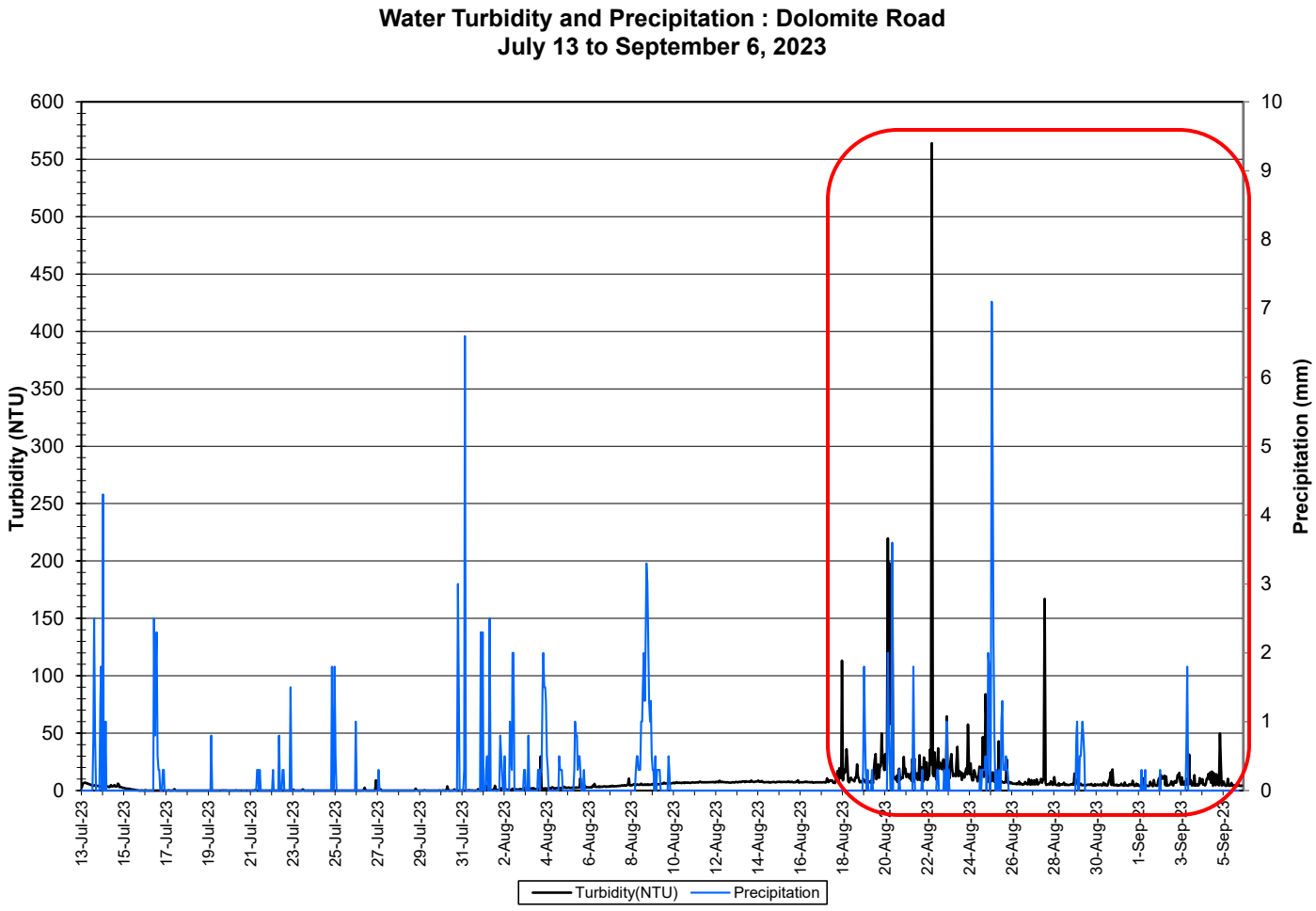

Figure 7a: Turbidity and Precipitation – Dolomite Road

(Weather data collected from climate station near Moosehead Lake)

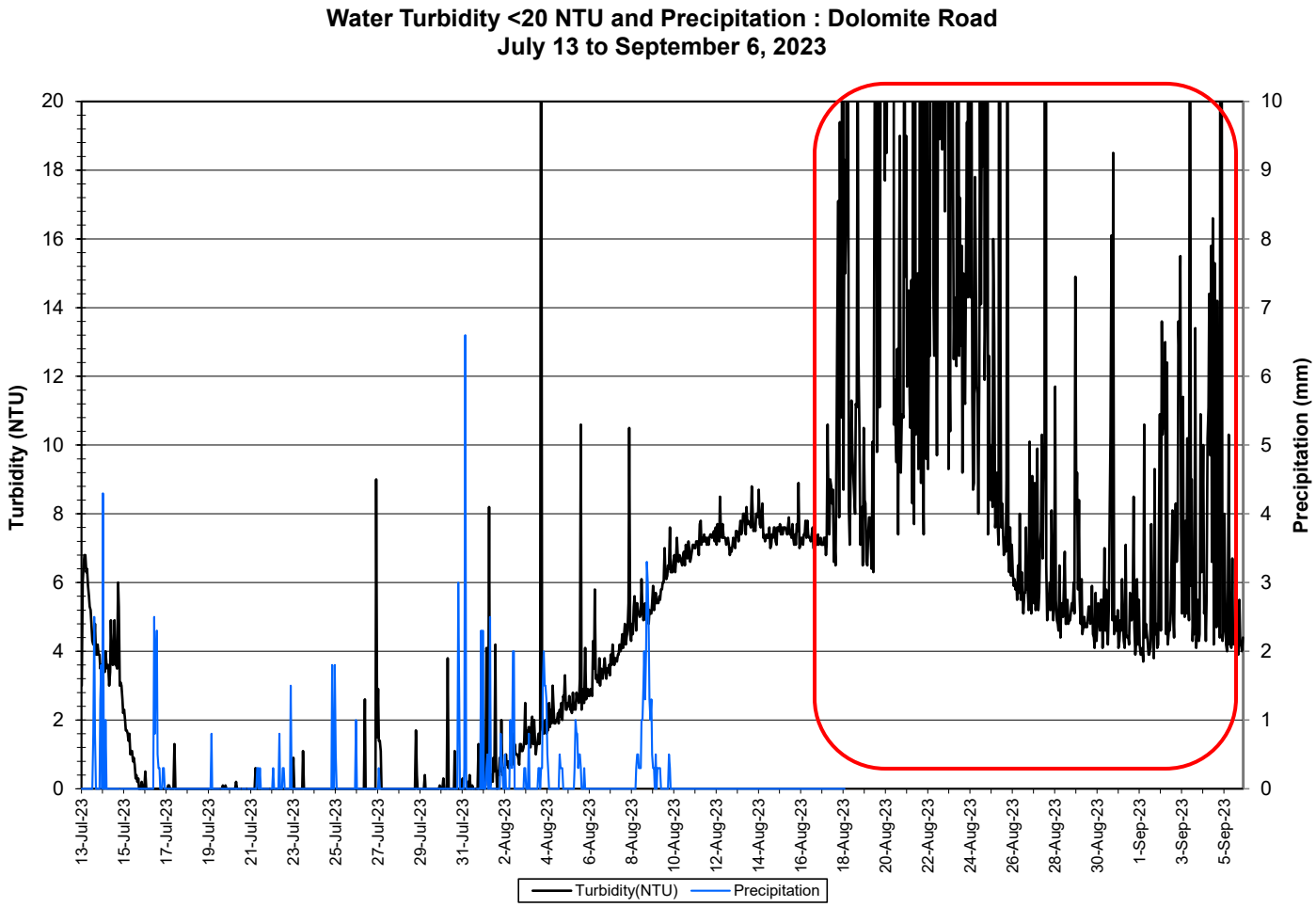

Figure 7b: Turbidity <20 NTU and Precipitation – Dolomite Road

(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Dolomite Road and Julienne Narrows (Figure 8).
- Stage decreased at both Julienne Narrows and Dolomite Road until the end the second week of August, it then increased slightly and stabilized for the remainder of the deployment period.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

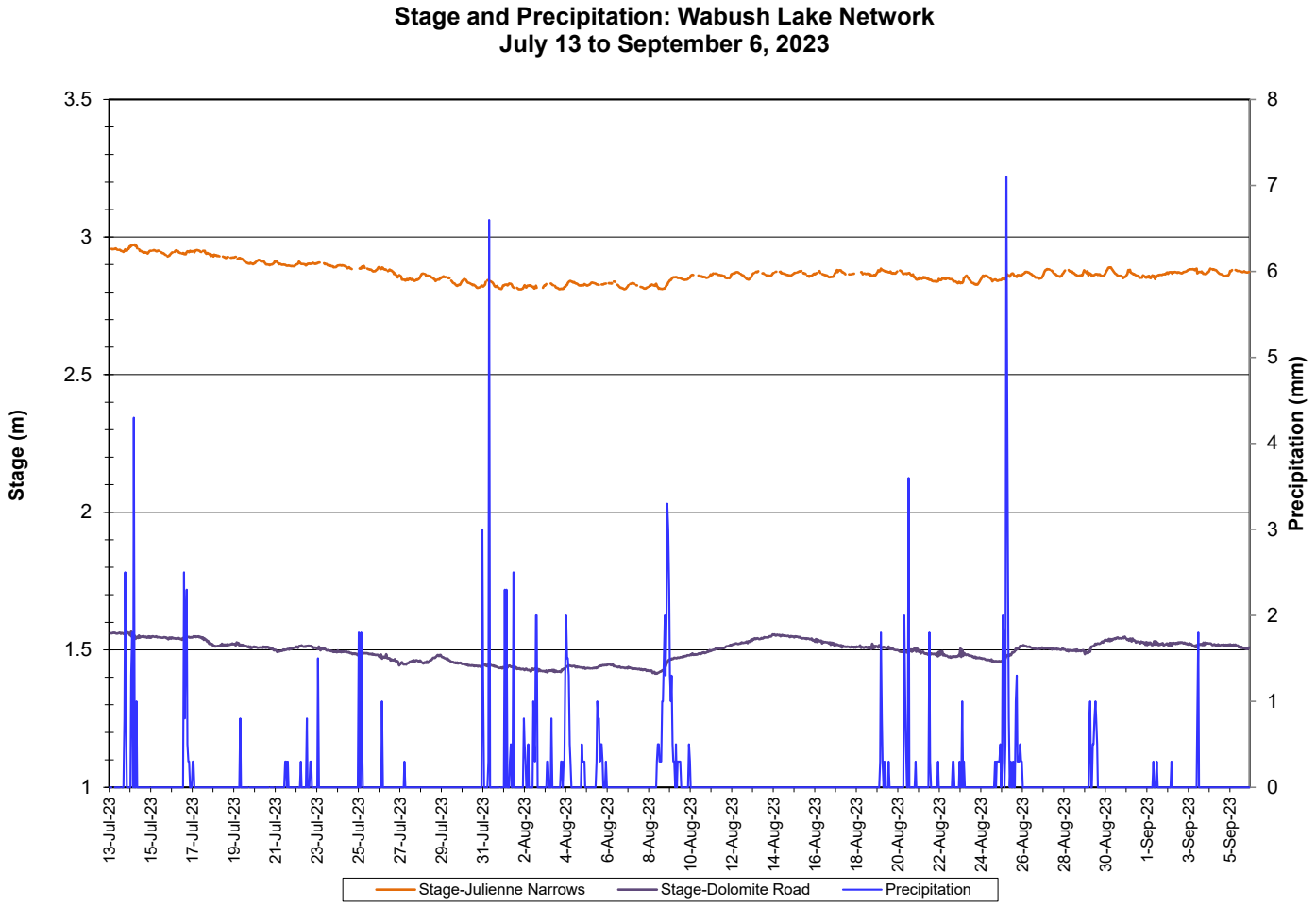

Figure 8: Stage and Precipitation – Wabush Lake Network

(Weather data collected at climate station located near Moosehead Lake)

Dumbell Stream

- Water temperature ranged from 3.35 to 8.47°C during this deployment period (Figure 9).
- Water temperature fluctuated within a small range during this deployment period, with a slight decreasing trend, overall. Water temperature at Dumbell Stream is typically much lower than other stations (Figure 9).

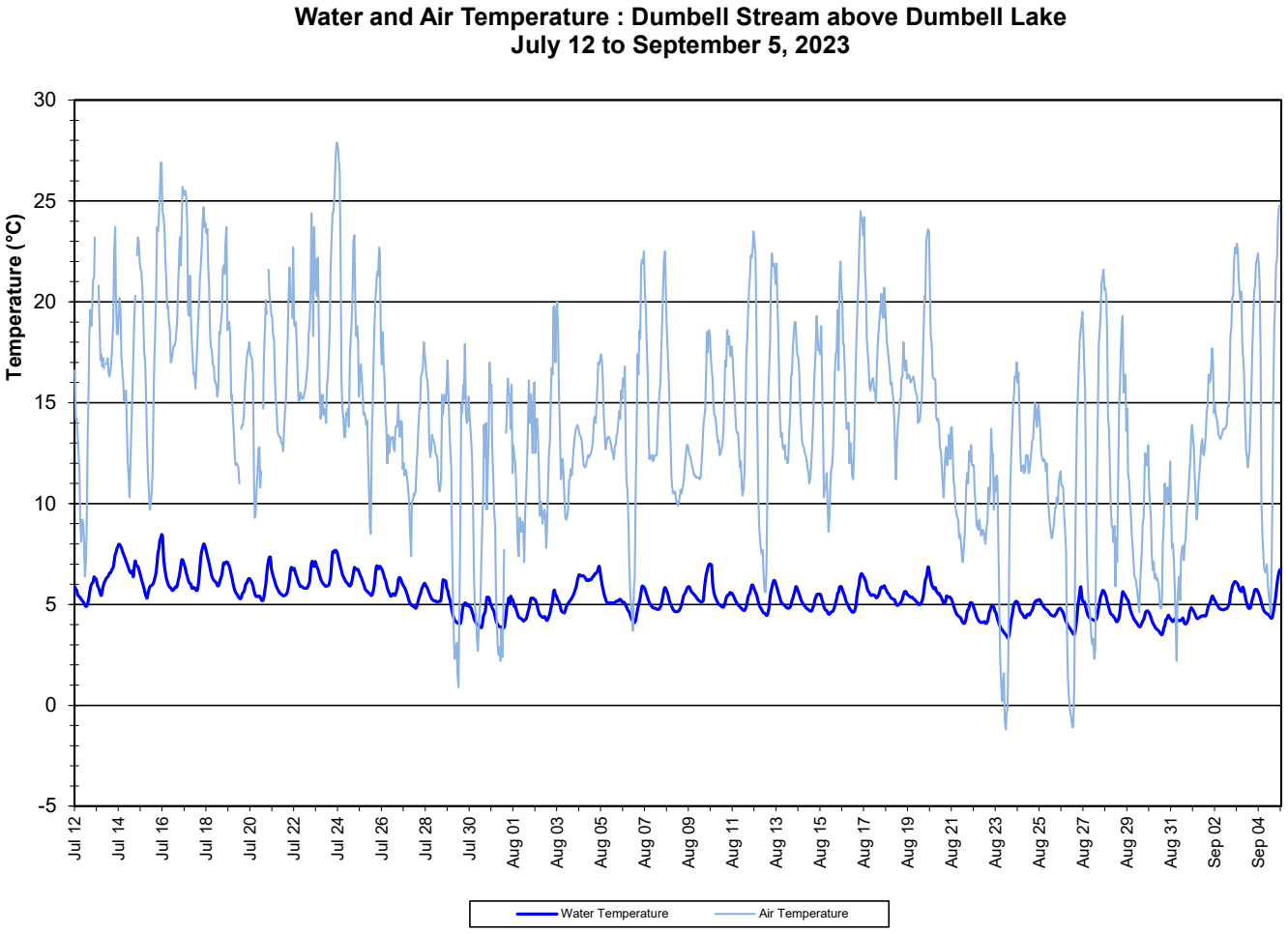

Figure 9: Water and Air Temperature – Dumbell Stream

(Weather data collected from climate station near Moosehead Lake)

- pH ranged from 7.47 to 7.82 pH units (Figure 10). The median pH was 7.64.
- All values are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly throughout the day and night.
- A portion of the data was removed due to sensor drift.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

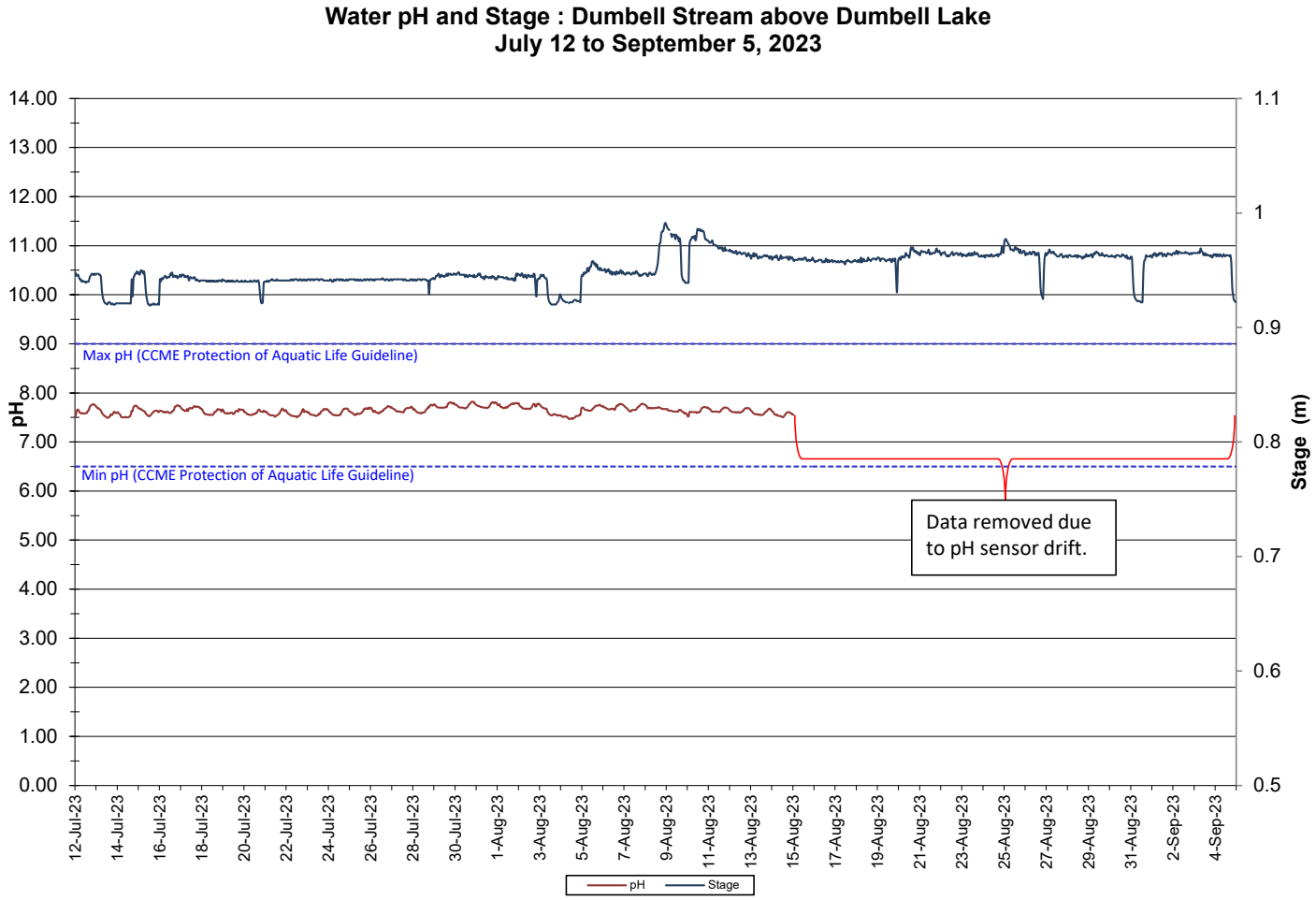

Figure 10: Water pH and Stage – Dumbell Stream

- Specific conductivity ranged from 134.2 to 412.0 µs/cm, throughout the deployment period (Figure 11).
- Specific conductivity increased for two weeks in July, for unknown reasons.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

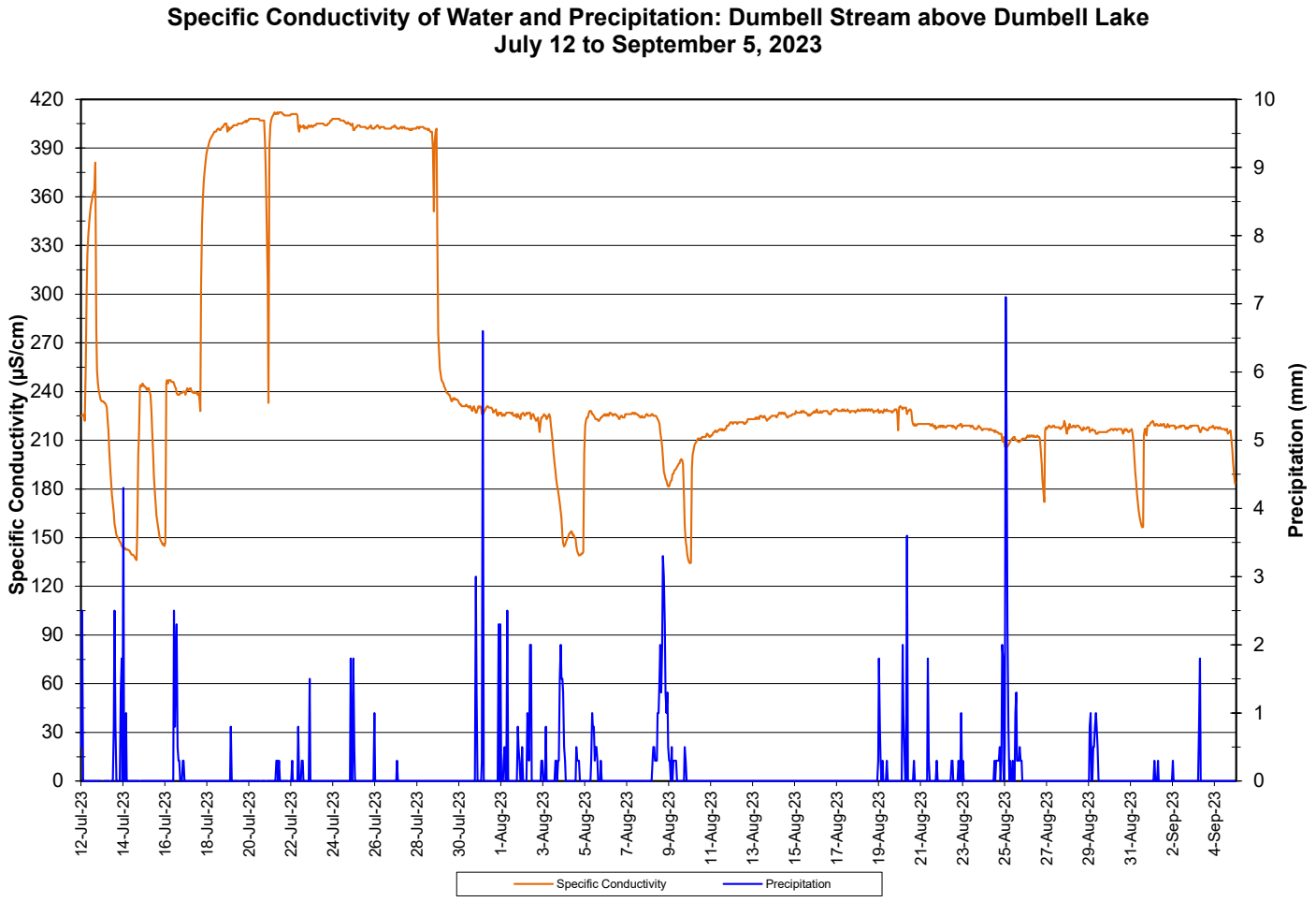

Figure 11: Specific conductivity and stage – Dumbell Stream

(Weather data collected from climate station near Moosehead Lake)

- The saturation of dissolved oxygen ranged from 89.6% to 93.9% while the dissolved oxygen content ranged from 10.75 to 12.36 mg/l with a median value of 11.67 mg/l (Figure 12).
- All values recorded at Dumbell Stream were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l, and the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/. The guidelines are indicated in blue on Figure 12.
- Overall, dissolved oxygen increased slightly over this deployment period. Dissolved oxygen fluctuated daily with decreases observed at night.

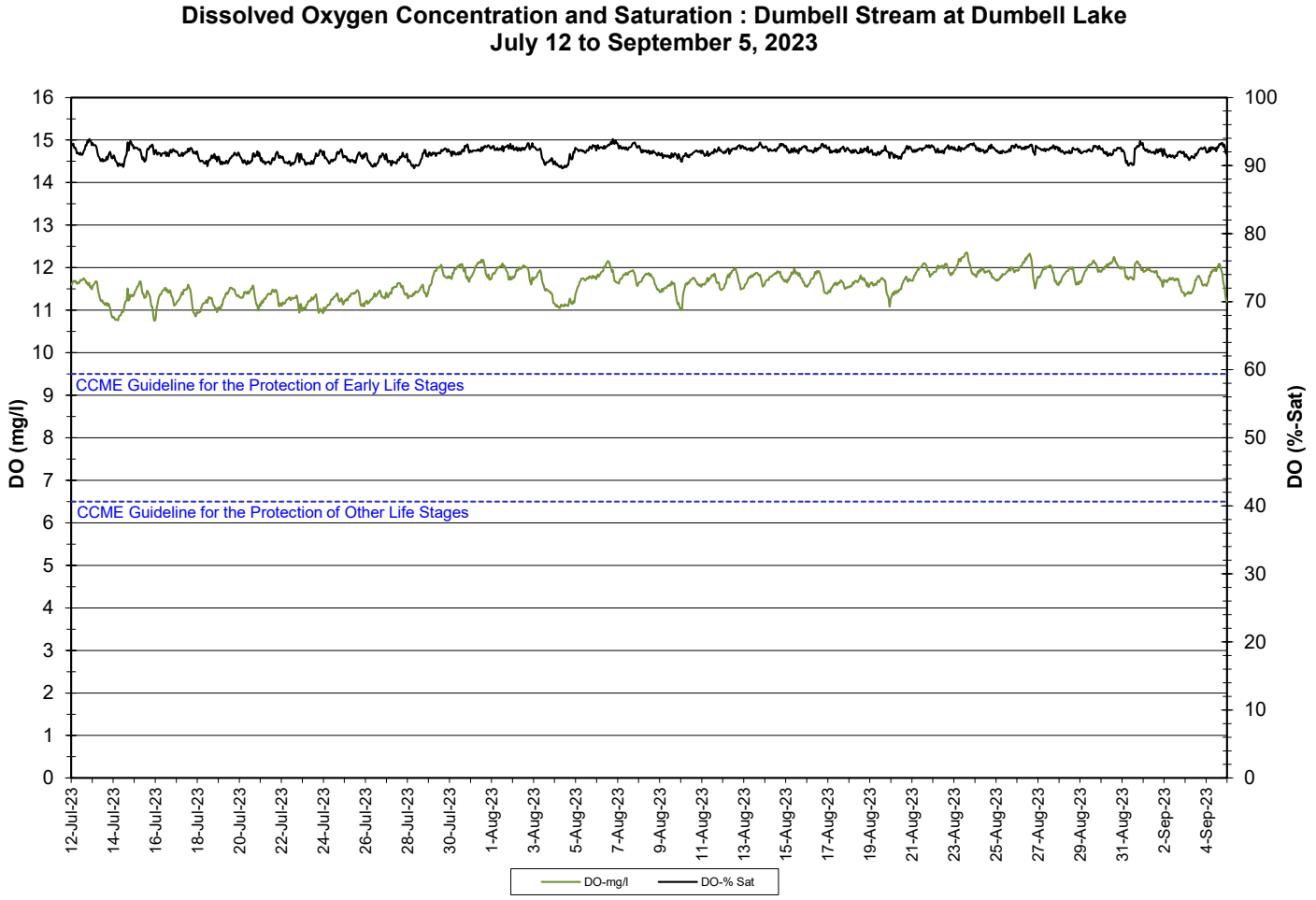

Figure 12: Dissolved oxygen – Dumbell Stream

- Turbidity values ranged from 0.0 NTU to 5.7 NTU throughout the deployment period (Figure 13).

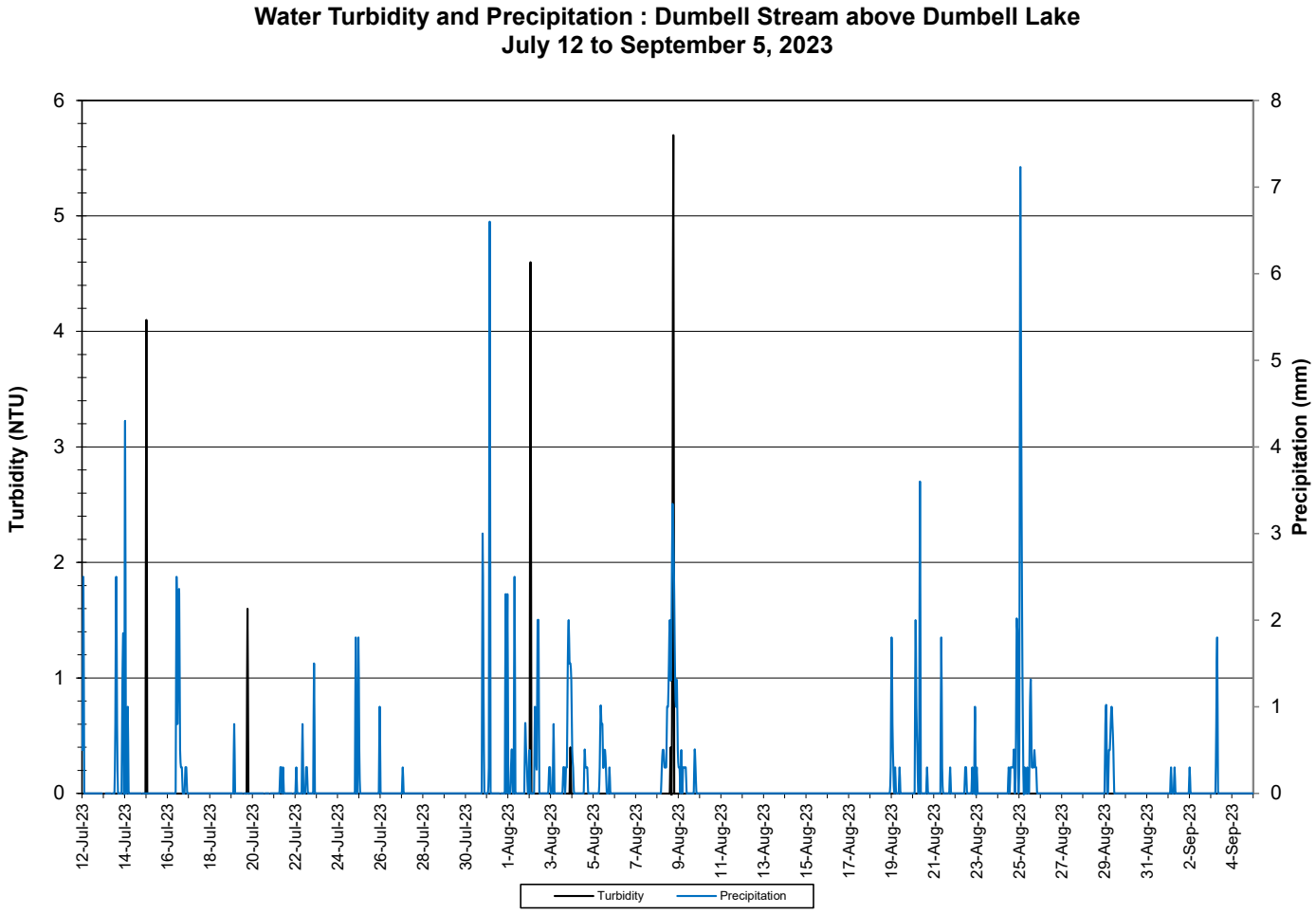

Figure 13: Turbidity and Precipitation – Dumbell Stream

(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Dumbell Stream (Figure 14).
- Overall, stage increased over the course of the deployment period.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

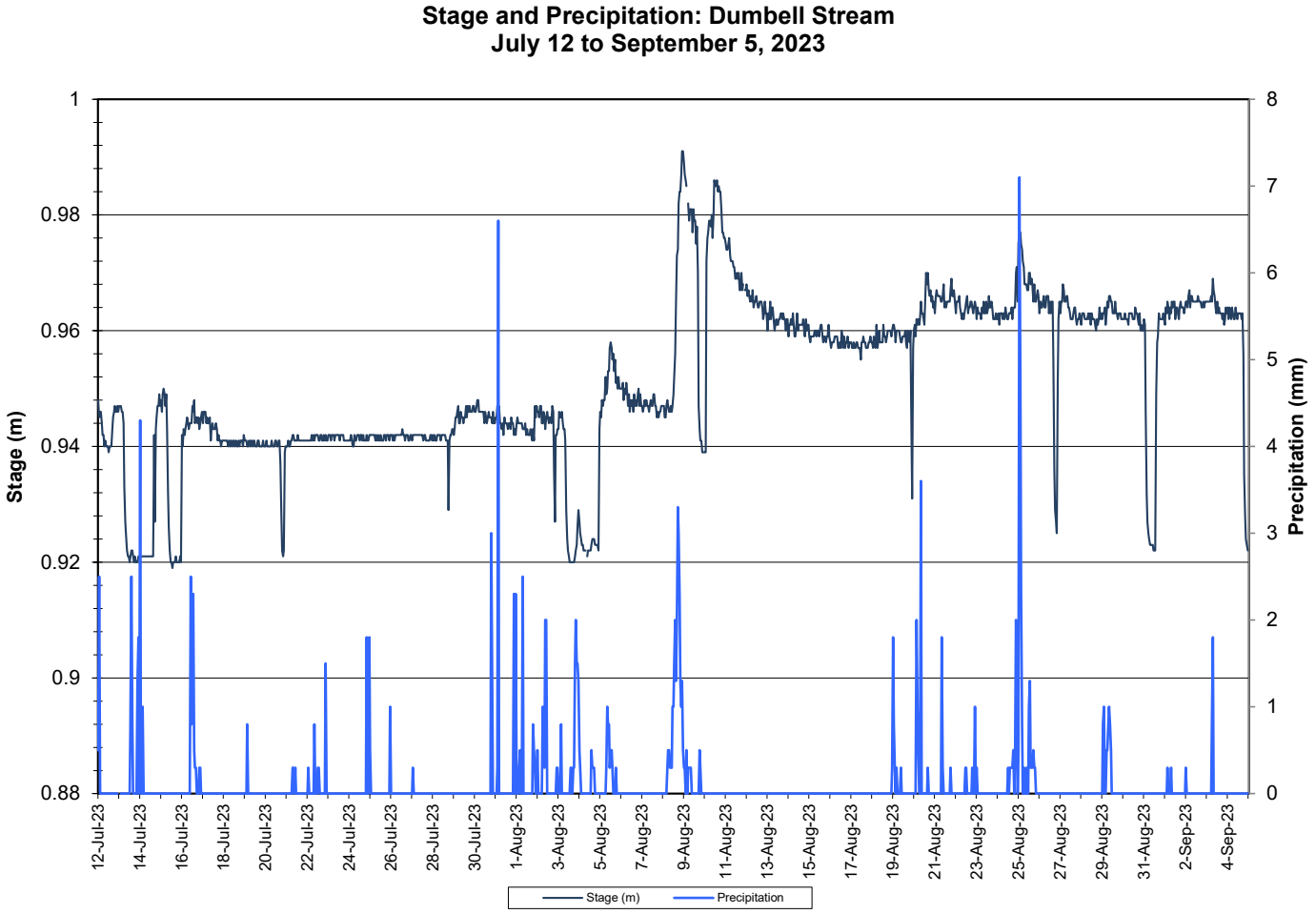

Figure 14: Stage and Precipitation – Dumbell Stream

(Weather data collected from climate station near Moosehead Lake)

Pumphouse Stream

- Water temperature ranged from 9.50 to 21.30°C during this deployment period (Figure 15).
- Water temperature decreased during this deployment period, with some fluctuations. Fluctuations corresponded with increases and decreases in ambient air temperature. (Figure 15).

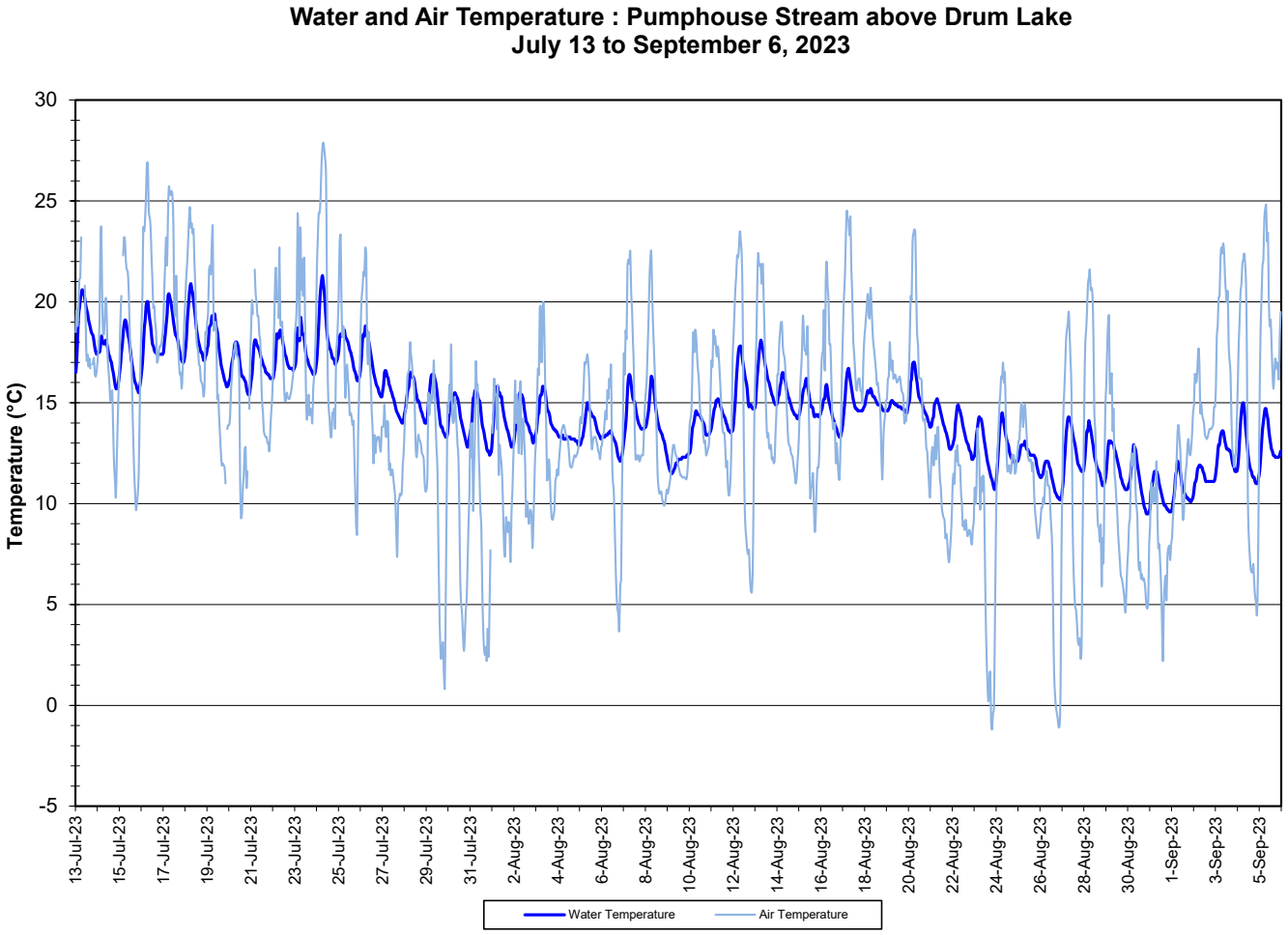

Figure 15: Water and Air Temperature – Pumphouse Stream

(Weather data collected from climate station near Moosehead Lake)

- pH ranged from 7.33 to 7.99 pH units (Figure 16). The median pH was 7.84.
- There are noticeable decreases in pH, corresponding with increases in stage. They are identified on the graph in red.
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units).
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

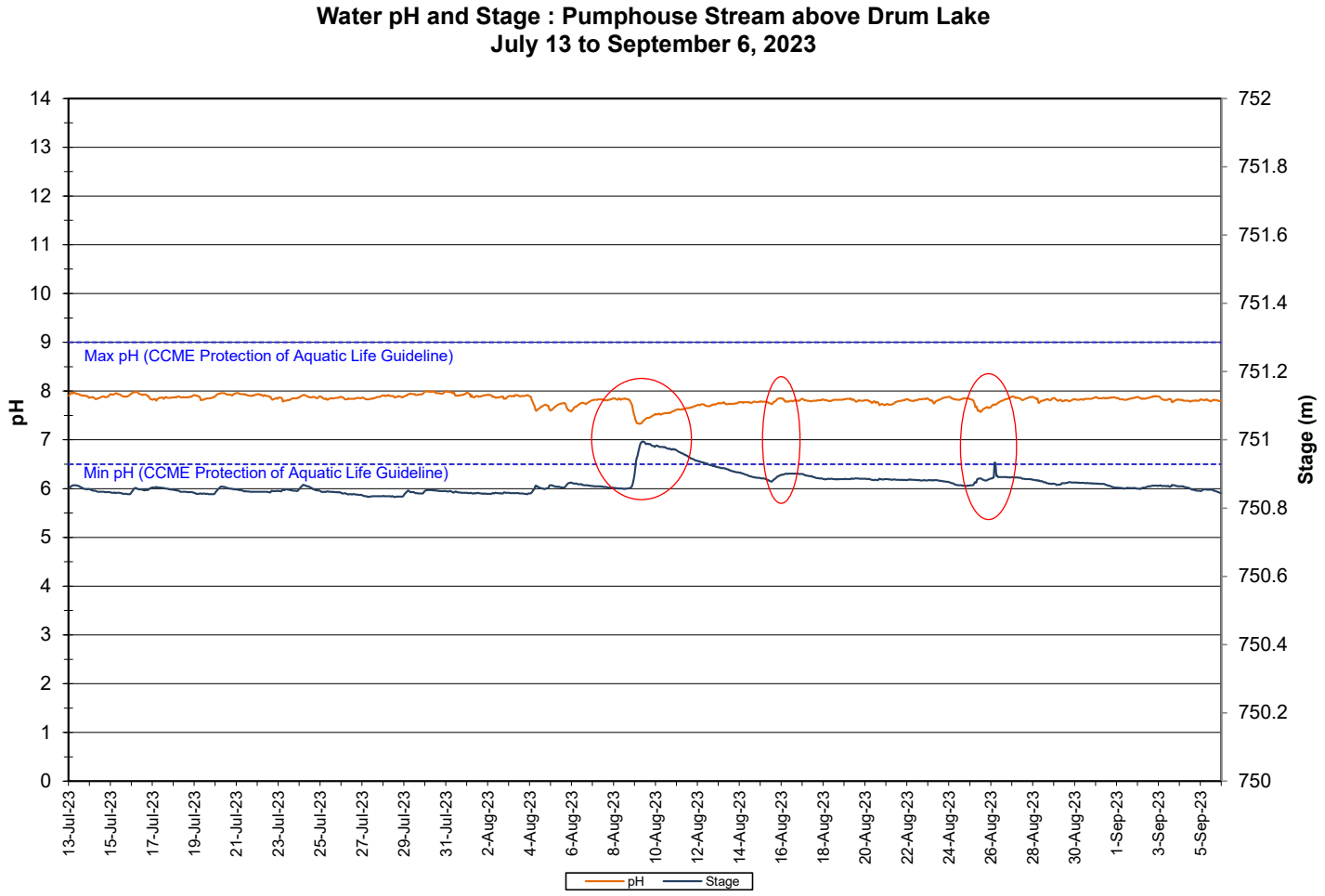

Figure 16: Water pH and Stage – Pumphouse Stream

- Specific conductivity ranged from 158.50 to 368.0 µs/cm, throughout the deployment period (Figure 17).
- The majority of decreases in specific conductivity correspond to increases in stage. As more water is added to the system from precipitation, the solids in the water are diluted, decreasing conductivity. Some correlations are identified on the graph in red.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

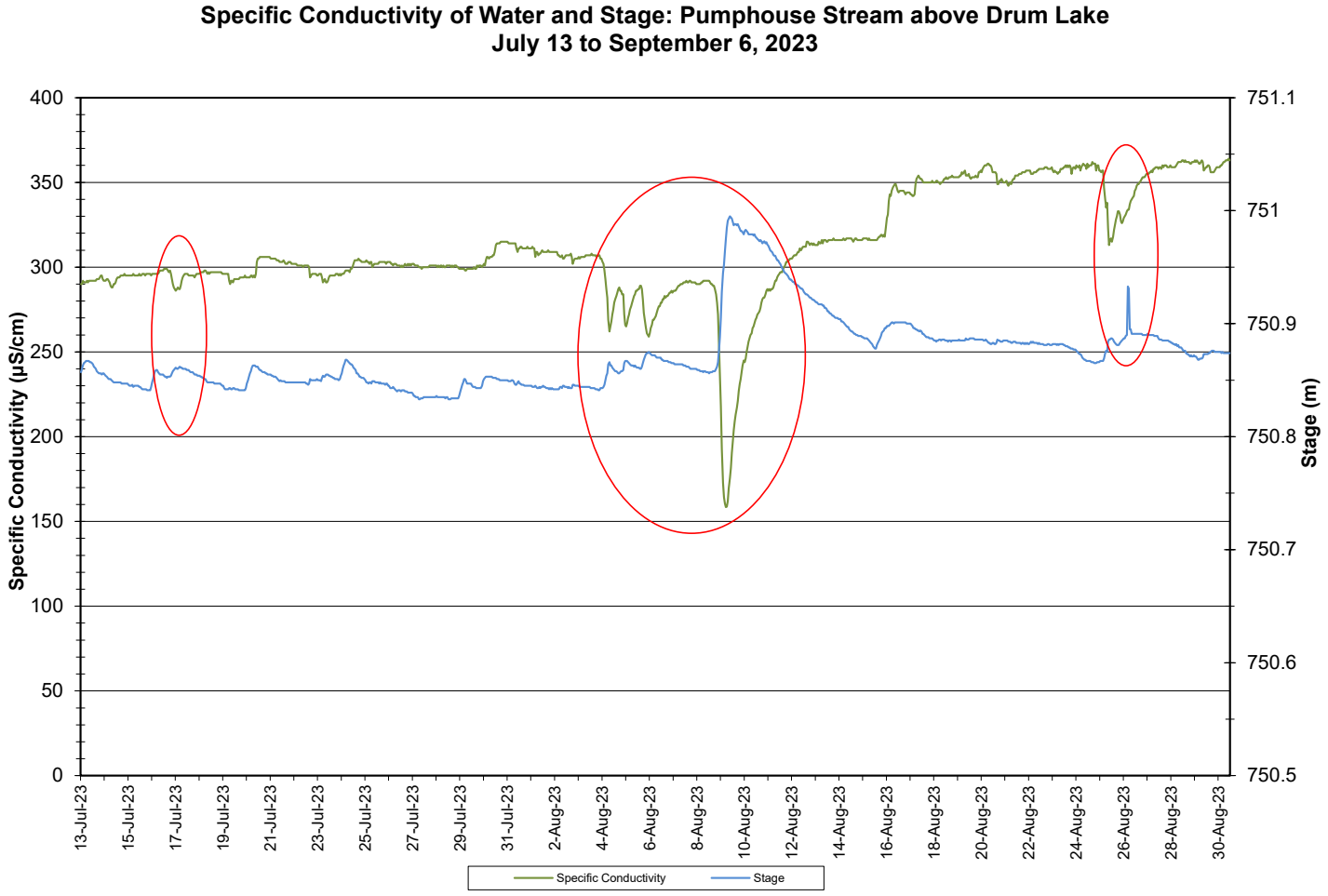

Figure 17: Specific Conductivity and Stage – Pumphouse Stream

(Weather data collected from climate station near Moosehead Lake)

- The saturation of dissolved oxygen ranged from 73.7 to 86.9% while the dissolved oxygen ranged from 7.29 to 9.27 mg/l with a median value of 8.27 mg/l (Figure 18).
- Dissolved oxygen increased during this deployment period, due to decreasing water temperatures.
- All values recorded at Pumphouse Stream were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l. All of the values were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/. The guidelines are indicated in blue on Figure 18.

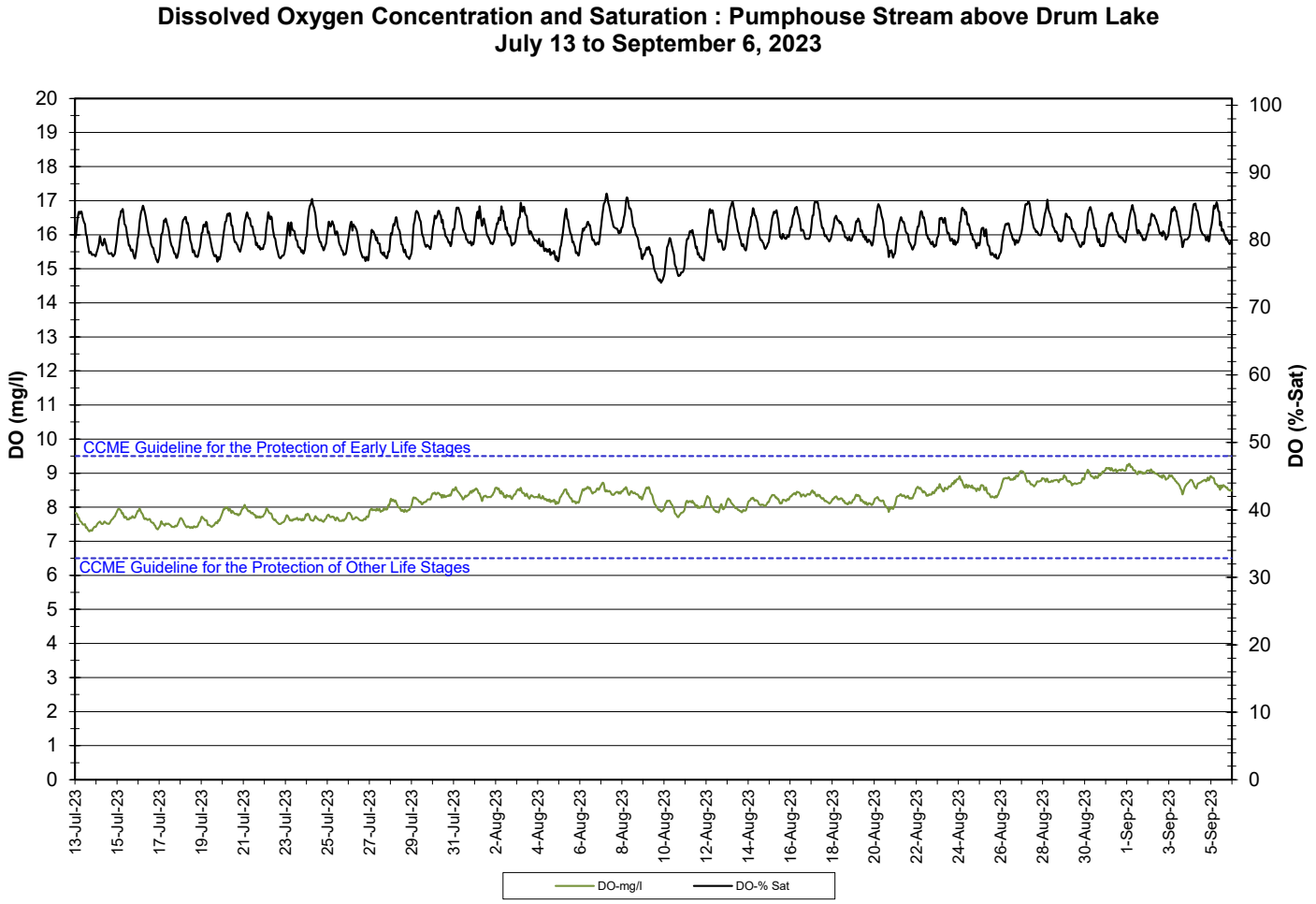

Figure 18: Dissolved Oxygen – Pumphouse Stream

- Turbidity values range from 0.0 NTU to 1229.0 NTU throughout the deployment period (Figure 19). The median value was 0.0 NTU, indicating low background turbidity levels.
- Turbidity spikes occur infrequently and for short periods of time.

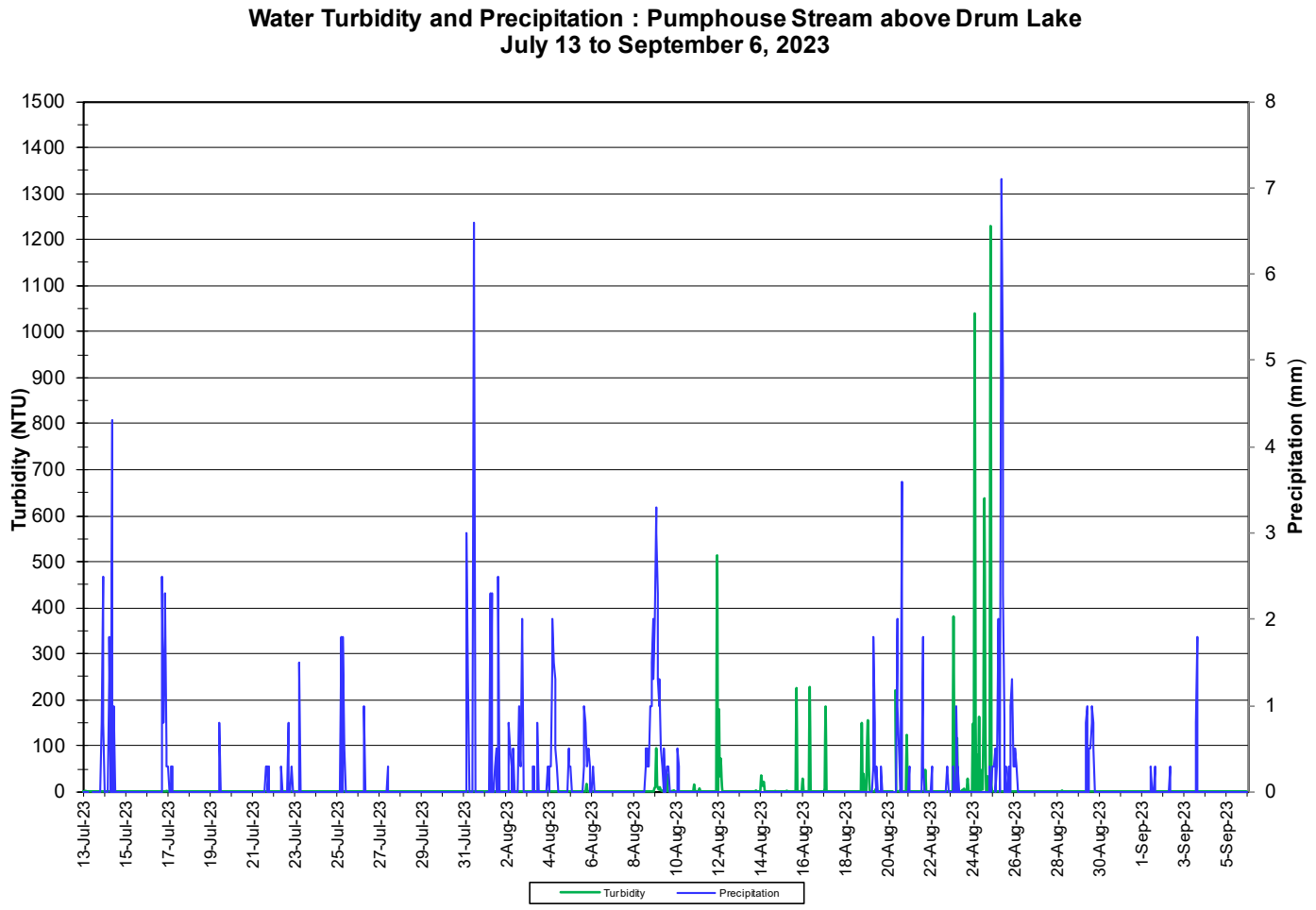

Figure 19: Turbidity and Precipitation – Pumphouse Stream

(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Pumphouse Stream (Figure 20).
- Overall, stage increased during this deployment period. It also showed spikes in levels after precipitation events.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

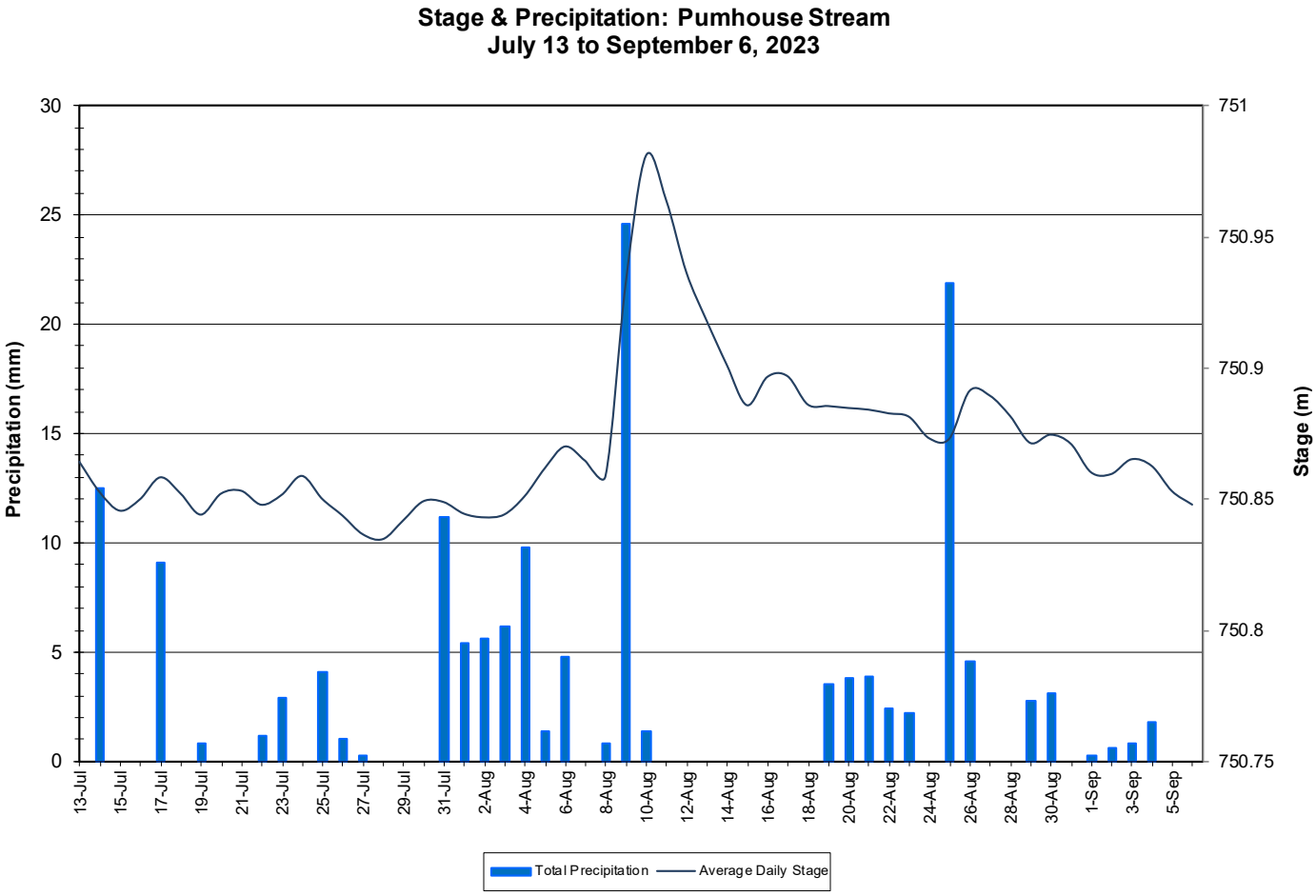

Figure 19: Stage and Precipitation – Pumphouse Stream

(Weather data collected from climate station near Moosehead Lake)

Conclusions

- Instruments were deployed on July 12-13th, 2023, and removed by September 6th, 2023.
- In most cases, precipitation events or increases/decreases in water level could be used to explain the data fluctuations. Most values recorded were within ranges as suggested by the CCME Guidelines for the Protection of Aquatic Life for pH and dissolved oxygen.
- Water temperature corresponded with air temperature at all stations. Temperature ranged between 3.35 and 22.40°C at these stations during deployment.
- All pH values were within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 7.33 and 8.55. Fluctuations were noted between day and night. The pH sensor at dumbbell stream experienced sensor drift, thus a small portion of data was removed.
- Specific conductivity differed between the two Wabush Lake stations. This can be attributed to varying concentrations of iron ore tailings deposited between the stations. Specific conductivity ranged from 61.9 µs/cm to 119.10 µs/cm at the Wabush Lake stations, 134.2 to 412.0 µs/cm at Dumbell Stream and 158.50 to 368.0 µs/cm at Pumphouse Stream.
- At all four stations, all dissolved oxygen values were above the minimum CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Other Life Stages of 6.5 mg/L. When dissolved oxygen values are compared to the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Early Life Stages of 9.5 mg/L, the majority of values at Julienne Narrows and Dolomite Road were below the guideline, all of the values at Dumbell Stream, were above the guideline, and all of the values at Pumphouse Stream were below the guideline.
- Turbidity at Dolomite Road and Julienne Narrows ranged from 0.0 to 99.9 NTU.
- Turbidity at Dumbell Stream ranged from 0.0 NTU to 5.7 NTU.
- Turbidity at Pumphouse Stream ranged from 0.0 NTU to 1229.0 NTU.
- At Julienne Narrows and Dolomite Road, stage decreased until the end the second week of August, it then increased slightly and stabilized for the remainder of the deployment period.
- At Dumbell Stream, stage increased over the course of the deployment period. There were occasional drops in the stage data; these decreases may not be accurate.
- At Pumphouse Stream, overall stage increased over this deployment period, with periodic spikes noted after precipitation events.
- With the exception of of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

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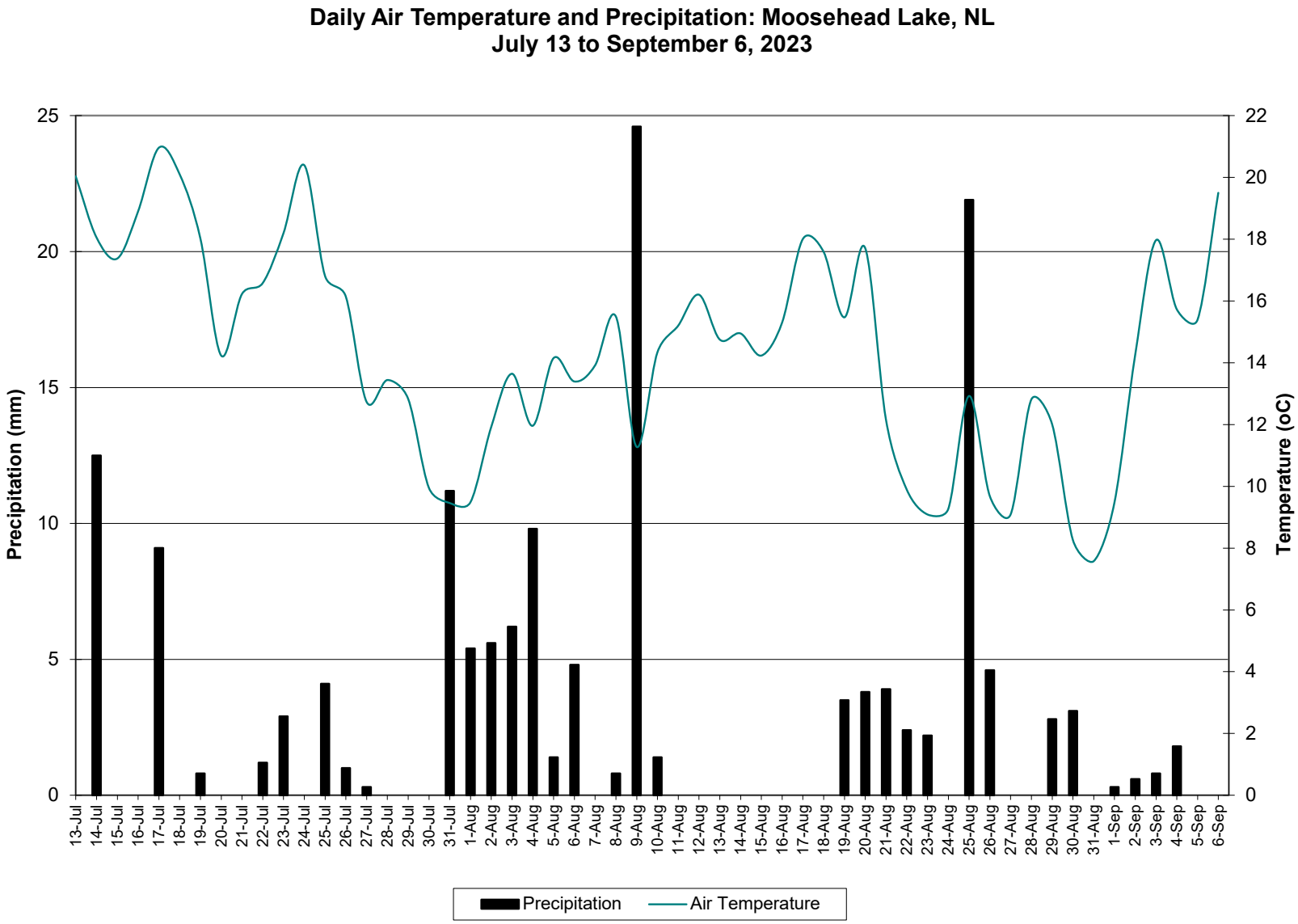
Appendix 1


Daily Air Temperature and Precipitation: Moosehead Lake, NL
July 13 to September 6, 2023
Precipitation (mm)
Temperature (oC)
Precipitation
Air Temperature

Appendix 2
QA/QC Grab Sample Results

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU546 JULIENNE NARROWS								
Sampling Date 2023/07/13 13:00								
Matrix W								
Sample # 2023-6312-00-SI-SP								
Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	57	1.0	mg/L	N/A	2023/08/09		8797883
Nitrate (N)	-	0.59	0.050	mg/L	N/A	2023/08/04		8797888
Total dissolved solids (calc., EC)	-	67	1.0	mg/L	N/A	2023/08/04		8797896
Inorganics								
Conductivity	-	120	1.0	uS/cm	N/A	2023/08/04	LJV	8832113
Chloride (Cl-)	-	1.7	1.0	mg/L	N/A	2023/07/25	SUR	8806696
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/25	SUR	8806696
Sulphate (SO4)	-	3.0	1.0	mg/L	N/A	2023/07/25	SUR	8806696
Total Alkalinity (Total as CaCO3)	-	50	2.0	mg/L	N/A	2023/08/04	LJV	8832118
Colour	-	11	5.0	TCU	N/A	2023/08/04	MCN	8831846
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/08/04	LJV	8832121
Total Kjeldahl Nitrogen (TKN)	-	0.10	0.10	mg/L	2023/07/21	2023/07/24	RTY	8804787
Nitrate + Nitrite (N)	-	0.59	0.050	mg/L	N/A	2023/08/04	MCN	8831861
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/08/03	MCN	8831867
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/08/01	MCN	8825494
Dissolved Organic Carbon (C)	-	3.0	0.50	mg/L	N/A	2023/08/05	CPP	8834211
Total Organic Carbon (C)	-	3.1	0.50	mg/L	N/A	2023/07/28	CPP	8818361
pH	-	7.96		pH	N/A	2023/08/04	LJV	8832103
Total Phosphorus	-	0.005	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Dup.Total Phosphorus	-	ND	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Total Suspended Solids	-	1.4	1.0	mg/L	2023/07/20	2023/07/20	RMK	8800716
Turbidity	-	1.7	0.10	NTU	N/A	2023/08/04	LJV	8833723
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/27	2023/07/28	SGK	8815475
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.025	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Barium (Ba)	-	0.0022	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Boron (B)	-	ND	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Calcium (Ca)	-	14	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Copper (Cu)	-	0.00056	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Iron (Fe)	-	0.064	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Lead (Pb)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Magnesium (Mg)	-	5.5	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136

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Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU546 JULIENNE NARROWS Sampling Date 2023/07/13 13:00 Matrix W Sample # 2023-6312-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.013	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Potassium (K)	-	1.1	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Sodium (Na)	-	1.4	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Strontium (Sr)	-	0.017	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Uranium (U)	-	0.00014	0.00010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136

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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU547 DOLOMITE ROAD Sampling Date 2023/07/13 14:30 Matrix W Sample # 2023-6313-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	32	1.0	mg/L	N/A	2023/08/09		8797883
Nitrate (N)	-	ND	0.050	mg/L	N/A	2023/08/04		8797888
Total dissolved solids (calc., EC)	-	37	1.0	mg/L	N/A	2023/08/04		8797896
Inorganics								
Conductivity	-	67	1.0	uS/cm	N/A	2023/08/04	LJV	8832113
Chloride (Cl-)	-	1.1	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Sulphate (SO4)	-	2.4	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Total Alkalinity (Total as CaCO3)	-	29	2.0	mg/L	N/A	2023/08/04	LJV	8832118
Colour	-	17	5.0	TCU	N/A	2023/08/04	MCN	8831846
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/08/04	LJV	8832121
Total Kjeldahl Nitrogen (TKN)	-	0.13	0.10	mg/L	2023/07/21	2023/07/24	RTY	8804787
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2023/08/04	MCN	8831861
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/08/03	MCN	8831867
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/08/01	MCN	8825494
Dissolved Organic Carbon (C)	-	3.8	0.50	mg/L	N/A	2023/08/05	CPP	8834211
Total Organic Carbon (C)	-	3.8	0.50	mg/L	N/A	2023/07/27	CPP	8816589
pH	-	7.68		pH	N/A	2023/08/04	LJV	8832103
Total Phosphorus	-	0.005	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Total Suspended Solids	-	1.0	1.0	mg/L	2023/07/20	2023/07/20	RMK	8800716
Turbidity	-	1.1	0.10	NTU	N/A	2023/08/04	LJV	8833723
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/27	2023/07/28	SGK	8815475
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.022	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Barium (Ba)	-	0.0094	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Boron (B)	-	ND	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Calcium (Ca)	-	7.4	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Copper (Cu)	-	0.00078	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Iron (Fe)	-	ND	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Lead (Pb)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Magnesium (Mg)	-	3.2	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Manganese (Mn)	-	0.020	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136

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Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU547 DOLOMITE ROAD Sampling Date 2023/07/13 14:30 Matrix W Sample # 2023-6313-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Potassium (K)	-	0.96	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Sodium (Na)	-	0.90	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Strontium (Sr)	-	0.015	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Uranium (U)	-	ND	0.00010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136

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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU549 DUMBELL STREAM								
Sampling Date 2023/07/12 16:55								
Matrix W								
Sample # 2023-6315-00-SI-SP								
Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	100	1.0	mg/L	N/A	2023/08/09		8797883
Nitrate (N)	-	15	0.50	mg/L	N/A	2023/08/04		8797888
Total dissolved solids (calc., EC)	-	130	1.0	mg/L	N/A	2023/08/04		8797896
Inorganics								
Conductivity	-	240	1.0	uS/cm	N/A	2023/08/04	LJV	8832113
Chloride (Cl-)	-	2.7	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Sulphate (SO4)	-	8.9	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Total Alkalinity (Total as CaCO3)	-	31	2.0	mg/L	N/A	2023/08/04	LJV	8832118
Colour	-	ND	5.0	TCU	N/A	2023/08/04	MCN	8831846
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/08/04	LJV	8832121
Total Kjeldahl Nitrogen (TKN)	-	ND(1)	0.50	mg/L	2023/07/21	2023/07/24	RTY	8804787
Nitrate + Nitrite (N)	-	15	0.50	mg/L	N/A	2023/08/04	MCN	8831861
Nitrite (N)	-	0.044	0.010	mg/L	N/A	2023/08/03	MCN	8831867
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/08/01	MCN	8825494
Dissolved Organic Carbon (C)	-	ND	0.50	mg/L	N/A	2023/08/05	CPP	8834211
Total Organic Carbon (C)	-	ND	0.50	mg/L	N/A	2023/07/27	CPP	8816589
pH	-	7.67		pH	N/A	2023/08/04	LJV	8832103
Total Phosphorus	-	0.007	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Total Suspended Solids	-	2.4	1.0	mg/L	2023/07/19	2023/07/24	RMK	8799153
Turbidity	-	0.14	0.10	NTU	N/A	2023/08/04	LJV	8833723
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/27	2023/07/28	SGK	8815475
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.025	0.0050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Barium (Ba)	-	0.0050	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Boron (B)	-	ND	0.050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Calcium (Ca)	-	24	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Copper (Cu)	-	ND	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Iron (Fe)	-	0.074	0.050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Lead (Pb)	-	ND	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Magnesium (Mg)	-	11	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU549 DUMBELL STREAM Sampling Date 2023/07/12 16:55 Matrix W Sample # 2023-6315-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.0086	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Potassium (K)	-	1.8	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Sodium (Na)	-	1.2	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Strontium (Sr)	-	0.029	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Uranium (U)	-	ND	0.00010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/08/08	2023/08/08	JHY	8838136

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Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU855 Pumphouse Stream Sampling Date 2023/07/12 Matrix W Sample # 2023-6316-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	140	1.0	mg/L	N/A	2023/08/09		8797883
Nitrate (N)	-	9.3	0.25	mg/L	N/A	2023/08/04		8797888
Total dissolved solids (calc., EC)	-	170	1.0	mg/L	N/A	2023/08/04		8797896
Inorganics								
Conductivity	-	300	1.0	uS/cm	N/A	2023/08/04	LJV	8832113
Chloride (Cl-)	-	3.3	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Sulphate (SO4)	-	16	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Total Alkalinity (Total as CaCO3)	-	83	2.0	mg/L	N/A	2023/08/04	LJV	8832118
Colour	-	ND	5.0	TCU	N/A	2023/08/04	MCN	8831846
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/08/04	LJV	8832121
Total Kjeldahl Nitrogen (TKN)	-	2.1	0.50	mg/L	2023/07/21	2023/07/24	RTY	8804787
Nitrate + Nitrite (N)	-	9.5	0.25	mg/L	N/A	2023/08/04	MCN	8831861
Nitrite (N)	-	0.12	0.010	mg/L	N/A	2023/08/03	MCN	8831867
Nitrogen (Ammonia Nitrogen)	-	2.2	0.25	mg/L	N/A	2023/08/01	MCN	8825494
Dissolved Organic Carbon (C)	-	1.0	0.50	mg/L	N/A	2023/08/05	CPP	8834211
Total Organic Carbon (C)	-	ND(2)	5.0	mg/L	N/A	2023/07/27	CPP	8816589
pH	-	7.90		pH	N/A	2023/08/04	LJV	8832103
Total Phosphorus	-	0.028	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Total Suspended Solids	-	5.2	1.0	mg/L	2023/07/19	2023/07/24	RMK	8799153
Turbidity	-	3.0	0.10	NTU	N/A	2023/08/04	LJV	8833723
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/27	2023/07/28	SGK	8815475
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.85	0.0050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Barium (Ba)	-	0.019	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Boron (B)	-	ND	0.050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Cadmium (Cd)	-	0.000035	0.000010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Calcium (Ca)	-	31	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Chromium (Cr)	-	0.0025	0.0010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Copper (Cu)	-	0.0022	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Iron (Fe)	-	2.6	0.050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Lead (Pb)	-	0.00092	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Magnesium (Mg)	-	14	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136

(2) Elevated reporting limit due to sample matrix.

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Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU855 Pumphouse Stream Sampling Date 2023/07/12 Matrix W Sample # 2023-6316-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.48	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Nickel (Ni)	-	0.0028	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Potassium (K)	-	1.9	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Sodium (Na)	-	1.3	0.10	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Strontium (Sr)	-	0.042	0.0020	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Uranium (U)	-	0.00049	0.00010	mg/L	2023/08/08	2023/08/08	JHY	8838136
Total Zinc (Zn)	-	0.0072	0.0050	mg/L	2023/08/08	2023/08/08	JHY	8838136

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