

Real-Time Water Quality Deployment Report

Mobile Environmental Monitoring Platform (MEMP)

**Kelligrews River at Kelliview Crescent, CBS
September 12, 2024 to November 21, 2024**



**Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada**

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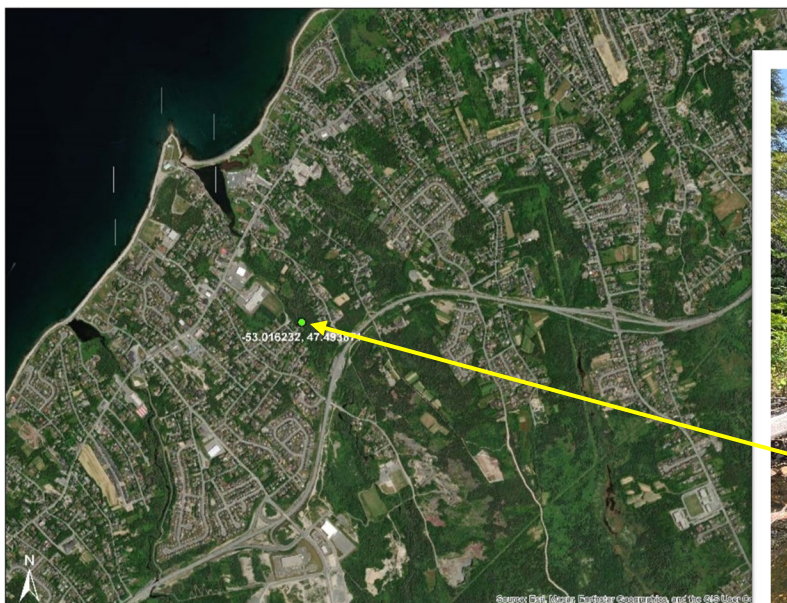
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General

The Mobile Environmental Monitoring Platform (MEMP) was deployed by the Water Resources Management Division (WRMD) within the town of Conception Bay South (CBS), in Kelligrews River (47.493636N, 53.016129W) for 71 days from September 12 to November 21, 2024.

This site was selected in collaboration with the Town of CBS in response to historical public complaints regarding sporadic siltation events of the waterbody. In addition to assisting in determining the functional capacity of the monitoring unit and the MEMP's instrumentation and equipment, the installation of the MEMP in the town of Conception Bay South (CBS) is an integral initiative for safeguarding the water quality, water quantity, and climate within the 13.27 sq.km Kelligrews River watershed. This program addresses the environmental challenges posed by ongoing residential, commercial, and industrial development in the area, including two (2) quarries approved through the Mineral Lands Division – Department of Industry, Energy and Technology. As CBS continues to experience growth, there is a need for comprehensive monitoring to manage the potential impacts of urbanization and industrialization on natural ecosystems.



Water quality monitoring utilizing the MEMP will focus on key parameters such as water temperature, pH, turbidity, dissolved oxygen, and conductivity. These variables are essential for detecting pollutants from surface runoff, which may carry contaminants like heavy metals, hydrocarbons, and increased sediment from surrounding developments into the Kelligrews River.

Additionally, the program will monitor nutrient levels to track potential eutrophication caused by fertilizers and other chemical inputs from residential and commercial areas upstream.

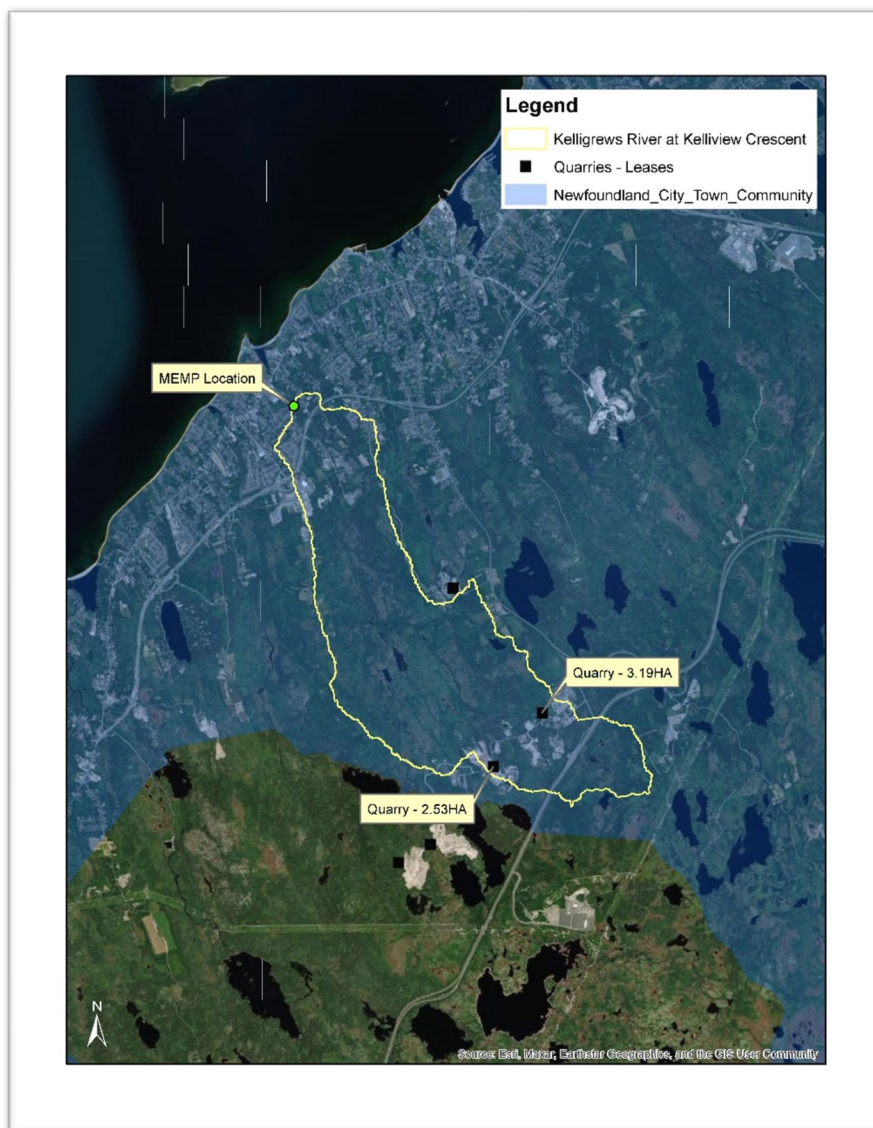
Water quantity monitoring will be equally important, given that increased urbanization and quarrying activities can alter drainage patterns and exacerbate stormwater runoff. The program will track river discharge to assess the risk of flooding and evaluate the effectiveness of stormwater management practices.

Climate monitoring, including measurements of precipitation, temperature, relative humidity and wind direction and speed, will provide valuable insights into how local weather patterns influence water quality and quantity. The installation of a climate station near the river will allow for the collection of real-time data, supporting efforts to better understand the effects of climate variability on the Kelligrews River ecosystem.

Quarry operations can increase sedimentation in waterbodies, degrading water quality and affecting aquatic habitats. The MEMP will monitor sediment loads and other impacts from quarrying, helping to ensure that environmental regulations are followed, and that buffer zones and sediment control measures are effective.

The installation, of the MEMP, although temporary, offers numerous benefits, including real-time data collection, which allows for immediate detection of environmental hazards. This enables timely responses and supports informed decision-making. Furthermore, the program will help CBS maintain the health of the Kelligrews River ecosystem and promote environmental stewardship within the community.

Please note the climate data collected ends on November 15, 2024, due to transmission failure and equipment issues.



Maintenance and Calibration of Instrument

As part of the Quality Assurance and Quality Control protocol (QAQC), 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.

Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.

At the end of a deployment period, a freshly cleaned and calibrated QA/QC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

Table 1: Qualitative QA/QC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Kelligrews River, CBS, NL	2024-09-12	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	2024-1719-00-SI-SP	Grab Sample	N/A	Good	Good	N/A	Excellent
	2024-11-21	Removal	Excellent	Good	Poor	Excellent	Poor

Comparison rankings reflect the accuracy and consistency between the field sonde used in Kelligrews River and a QA/QC sonde and grab sample. On September 12, during deployment, the field sonde's measurements showed a 'Excellent' rankings for all parameters when compared to the QA/QC sonde suggesting strong agreement between the field equipment and the QA/QC checks.

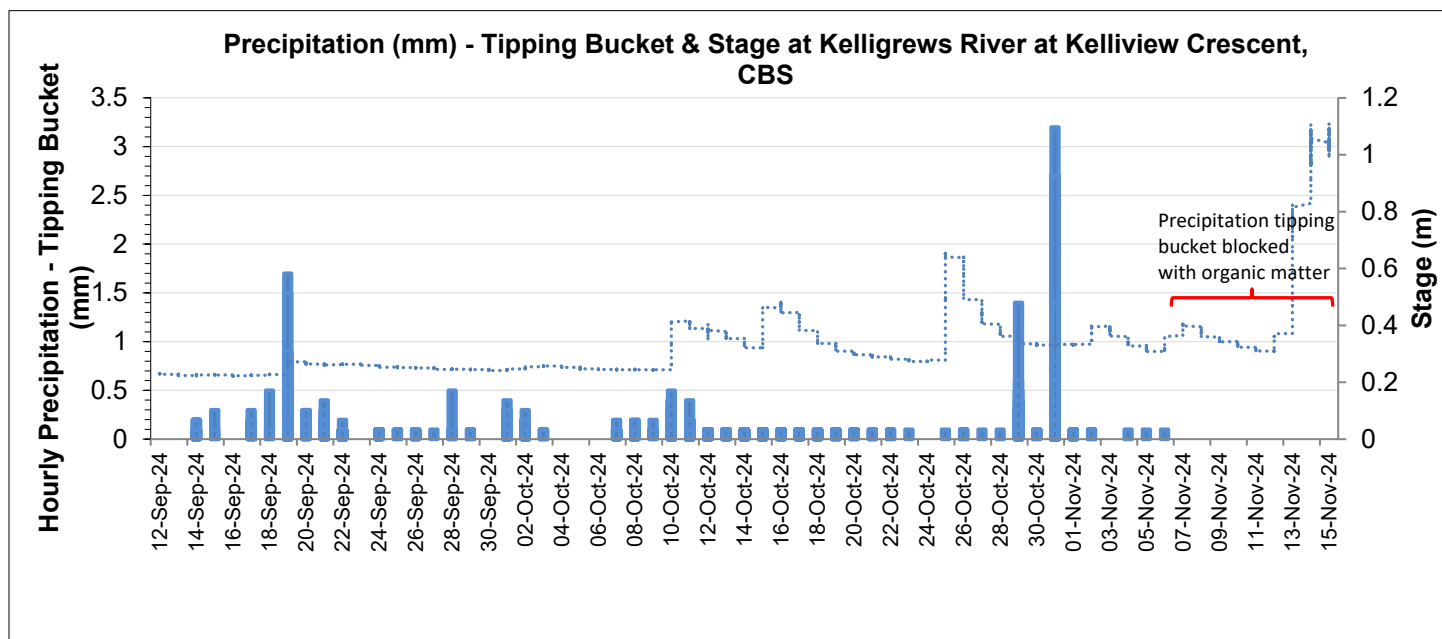
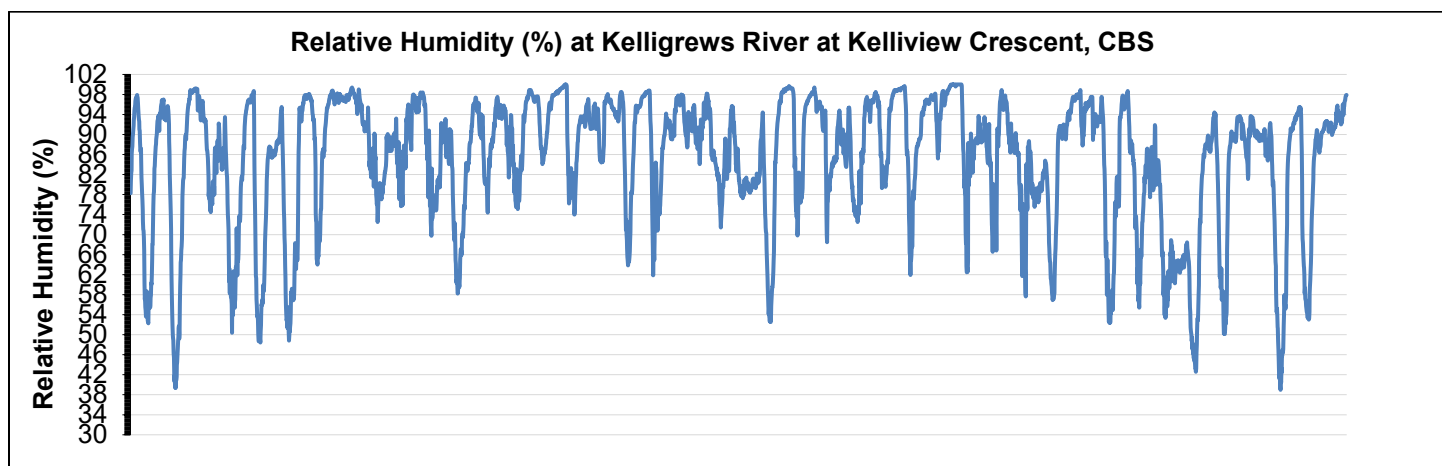
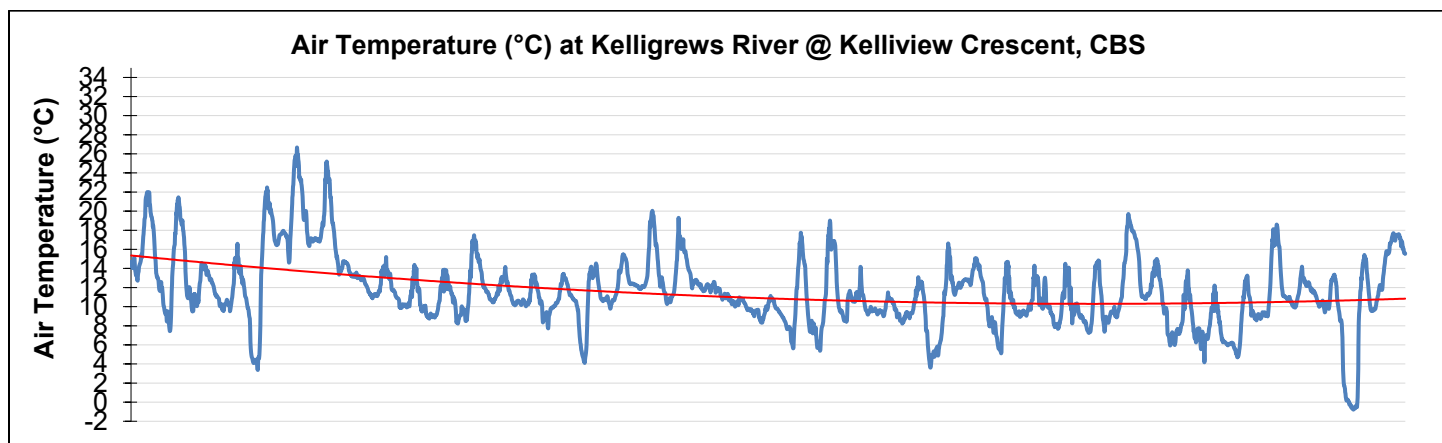
The grab sample 2024-1719-00-SI-SP on September 12, further reinforced the reliability of the pH and conductivity measurements, as both ranked 'Good' and Turbidity ranked 'Excellent'. This suggests that these parameters were well-calibrated between the field sonde and the laboratory grab sample.

At removal, on November 21, the comparison rankings indicated some deterioration, with pH now ranked 'Good', and Conductivity and Turbidity now ranked 'Poor'. Less than optimal rankings are likely the result of sensor drift and the building of sediments and organic matter within the sonde casing. Other parameters remained stable, maintaining 'Excellent' rankings. Overall, this comparison data indicates that the field sonde performed reliably.

This comparison reiterates the importance of routine QA/QC checks and concurrent laboratory analysis to validate and interpret field instrument data, particularly for parameters like conductivity and turbidity, which are more prone to environmental and operational influences.

Data Interpretation

Weather



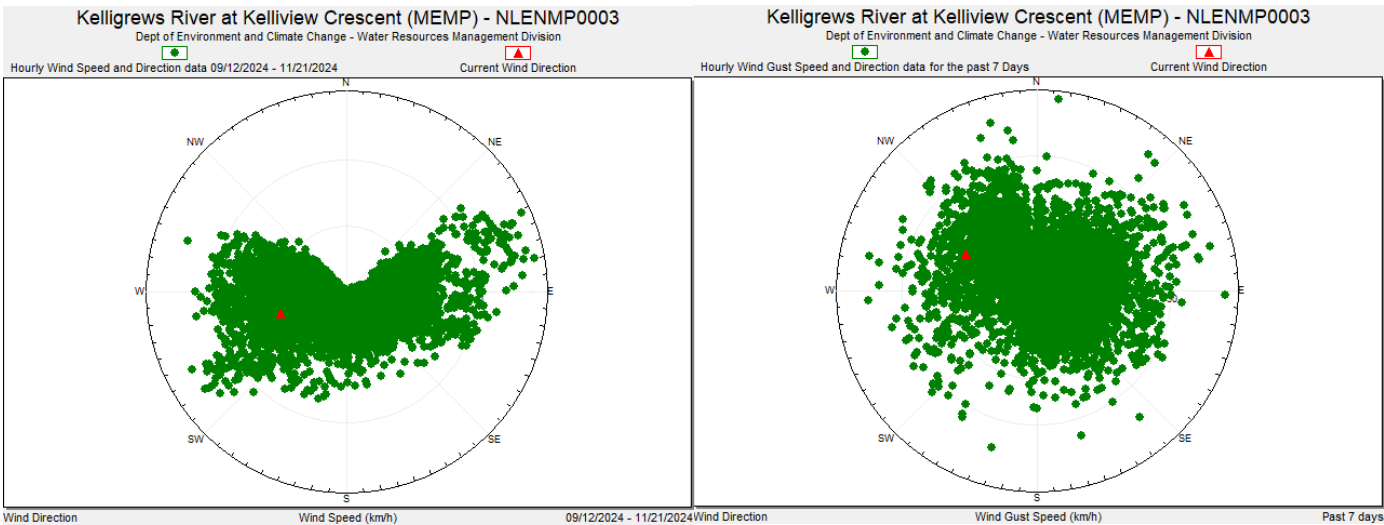
Variable	Mean	Median	Min	Max
Air Temperature (C)	9.96	10.29	-2.613	26.67
Relative Humidity (%-Sat)	85.08	89.20	38.98	100
Precipitation - Rain (mm - water equivalent)	0.0133	0	0	3.2
Snow (mm)		N/A		

Figure 1: Meteorological variable trends and statistical analysis from September 12 to November 15, 2024, at Kelligrews River at Kelliview Crescent, CBS.

Climate data from Kelligrews River indicates a relatively warm and humid period. The mean air temperature was 9.96°C, with temperatures ranging from a low of -2.61°C to a high of 26.67°C, reflecting typical late summer and fall conditions in the region.

Relative humidity, expressed as a percentage of saturation, exhibits a mean of 85.08%, indicating a consistently high level of moisture in the air throughout this period. Relative humidity measures the amount of water vapor present in the air relative to the maximum amount it can hold at a given temperature. The range of relative humidity values from 38.98% (October 22, 2024) to 100% indicates significant variability in moisture levels during this timeframe. At the lower end of the range, relative humidity suggests drier conditions. Relative humidity reaching 100% indicates saturated air, where the atmosphere cannot hold any more moisture, often leading to the formation of dew, fog, or precipitation.

Precipitation was sparse, with an average daily rainfall of just 0.0133 mm. The maximum recorded hourly rainfall during this time was 3.2 mm, indicating that the area experienced light to moderate rainfall events. Snowfall of 0.1mm was recorded on October 21, 2024. These climate conditions highlight a predominantly dry period with high humidity, potentially influencing both water quality and flow conditions in the Kelligrews River during late summer and fall.



Variable	Mean	Median	Min	Max
Wind Speed (km/h)	3.68	3.25	0	14.47
Wind Direction (Deg)	180.6	170.7	43.94	323.2
Wind Gust Speed (km/h)	11.59	10.8	0	42.62
Wind Gust Direction (Deg)	192.37	176.9	0.096	354.3

Figure 2: Wind rose representing wind speed and direction and wind gust speed and direction from September 12, 2024, to November 15, 2024, at Kelligrews River at Killiview Crescent, CBS.

Mild to moderate, predominantly west to southwest winds from 0 to 14.47 km/h were observed, with strongest winds on November 10, 2024. Wind speed and direction may have been influenced by the geographical features of the area, as the MEMP was deployed in an area with natural forest on the northern side. Forested areas can affect wind speed and direction by blocking or slowing down the wind. The wind may also change direction as it flows around the forest, especially if there are gaps or openings in the trees. Forests can create local wind patterns, making wind behavior more unpredictable in those areas. Because of this, wind measurements near a forest might not reflect the typical wind patterns for the location.

Wind gust speed statistics reveal higher values, with a mean of 11.59 km/h and a median of 10.8 km/h, ranging from 0 km/h to 42.62 km/h. Wind gust direction also varies widely, from north to northwest, south and southwest, with a mean of 192.37 degrees and a median of 176.9 degrees, spanning from 0.096 to 354.3 degrees.

The monthly average wind speed and direction data as per Table 2, show a clear increasing trend in wind speed from September to November. The average wind speed was relatively low at 1.96 km/h, with winds predominantly coming from the south-southeast. By October, the wind speed nearly doubled to 3.89 km/h, shifting slightly toward the south-southwest. This trend continued into November, where the average wind speed reached 5.47 km/h, with more variable wind direction averaging 160.06° and indicated in the wind rose above. The average wind speed in September was 1.961 m/s, with winds predominantly coming from a south/southeast direction (169.827°). The increase in wind speed over these months is consistent with seasonal changes in weather patterns, as fall brings stronger winds due to changing atmospheric pressure systems.

Table 2: Monthly average wind speed (km/h) and wind direction (degrees).

MONTH	Average WIND_SPEED	Average WIND_DIR
September	1.961	169.827
October	3.894	196.887
November	5.472	160.063

Water Quality

Temperature

Water temperature is a crucial determinant of water quality due to its profound impact on biological activity, oxygen solubility, chemical reactions, stratification, habitat suitability, and pollution transport. It affects the metabolic rates of aquatic organisms, with warmer water generally increasing oxygen demand and decreasing dissolved oxygen levels. Cold water holds more dissolved oxygen, essential for supporting aquatic life. Temperature influences chemical reactions and nutrient cycling, while stratification can create hypoxic conditions in deeper layers of lakes and reservoirs. Additionally, temperature fluctuations can disrupt habitat suitability and stress sensitive species, ultimately affecting the ecological balance of aquatic ecosystems and the transport and behavior of pollutants. Thus, managing and monitoring water temperature is vital for maintaining healthy aquatic environments.

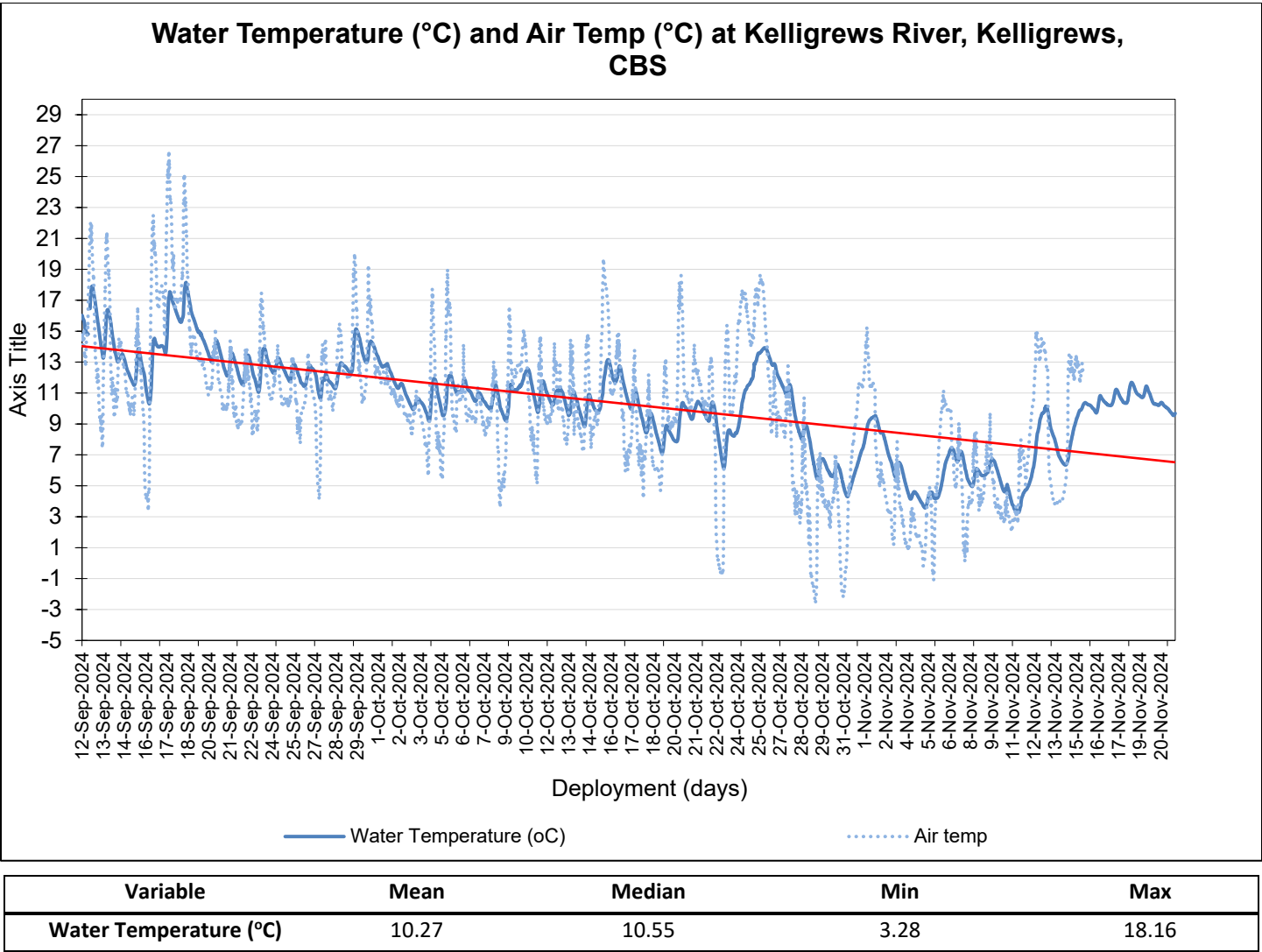


Figure 3: Water Temperature (°C) of Kelligrews River, from September 12 to November 21, 2024, at Kelliview Crescent, CBS.

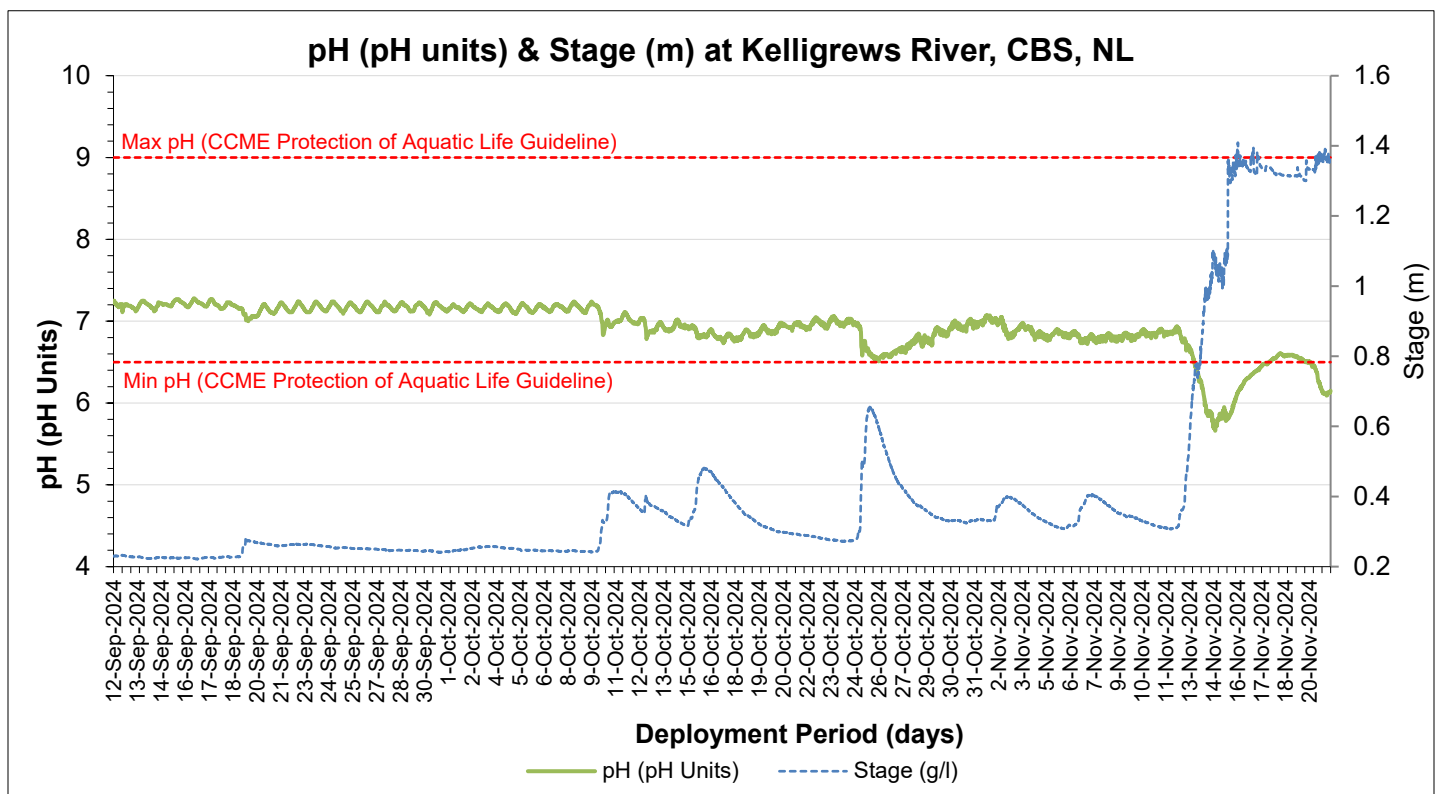
The water temperature data for Kelligrews River at Kelliview Crescent, CBS, shows a steady decline over the deployment period. The trendline (red) highlights a clear downward trend, consistent with cooling due to seasonal fluctuations in river temperature as fall turns to winter. The mean water temperature was 10.27°C, closely matching the median of 10.55°C, suggesting a fairly consistent temperature range throughout the monitoring period. The lowest recorded temperature was 3.28°C, and the highest was 18.16°C.

These temperature variations are typical of a natural water body, influenced by air temperature, solar radiation, and possibly streamflow dynamics. The warmest temperatures occurred during periods of higher air temperatures and lower precipitation, which would reduce cooling from rainfall and increase heat absorption.

The overall pattern suggests a strong seasonal correlation, with cooling air temperatures driving the gradual decline in water temperature.

pH

pH is used to give an indication of the acidity or basicity of a solution. A pH of 7 denotes a neutral solution while lower values are acidic and higher values are basic. Technically, the pH of a solution indicates the availability of protons to react with molecules dissolved in water. Such reactions can affect how molecules function chemically and metabolically.



Variable	Mean	Median	Min	Max
pH (Units)	6.92	6.97	5.66	7.28

Figure 4: Water pH (pH units) of Kelligrews River, from September 12 to November 21, 2024, at Kelliview Crescent, CBS.

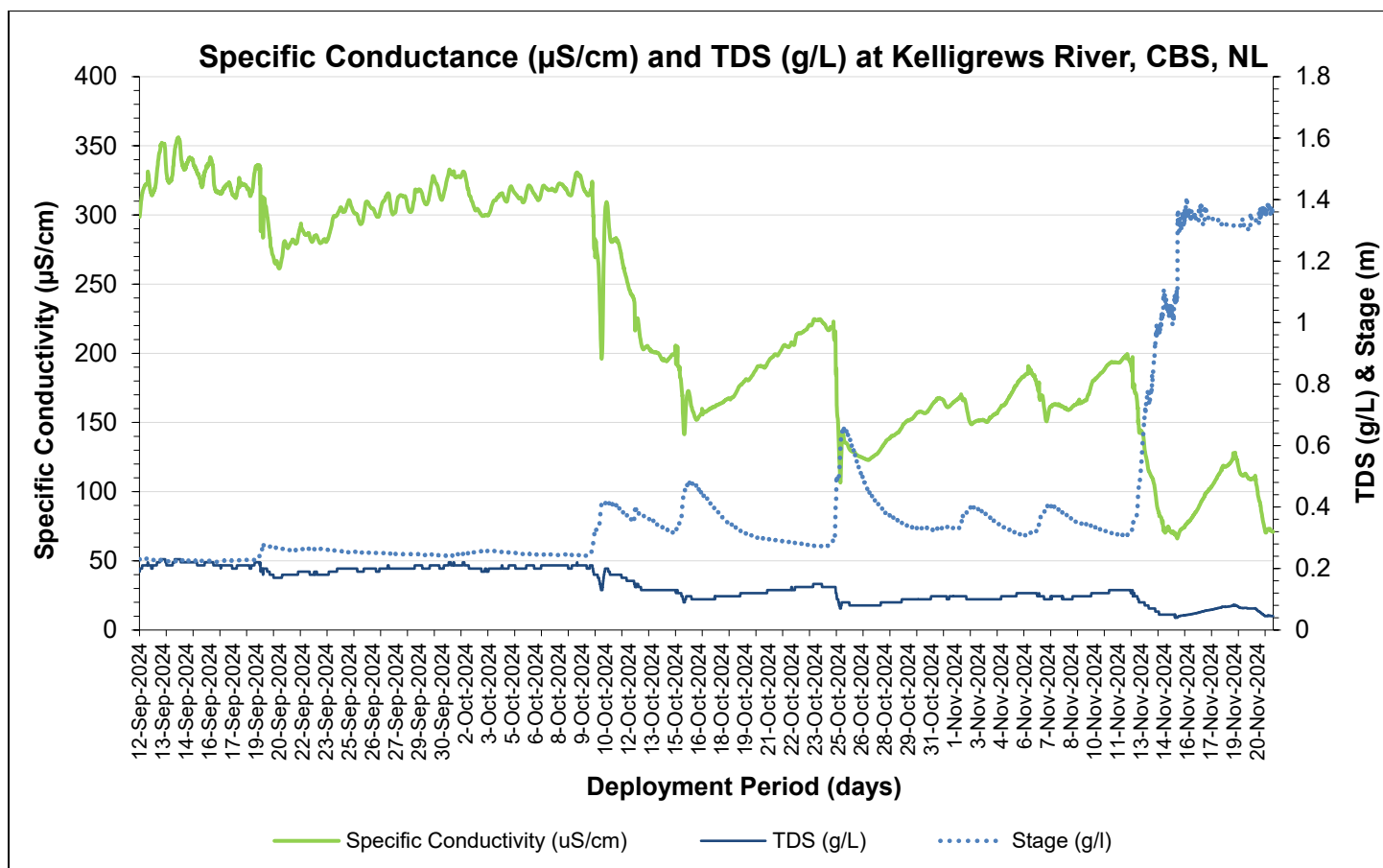
The statistical analysis of pH levels in Kelligrews River indicates relatively stable water chemistry throughout most of the deployment period. The mean pH was 6.92, with a median of 6.97, suggesting that the water remained within a neutral to slightly acidic range. The pH values ranged from a minimum of 5.66 to a maximum of 7.28, demonstrating some fluctuations in acidity and alkalinity.

All recorded pH values remained within the Canadian Council of Ministers of the Environment (CCME) Protection of Aquatic Life guidelines (6.5–9.0) until November 12, 2024. This indicates that the river generally maintains a pH suitable for aquatic life. However, following a significant precipitation event on November 13–14, when 76.3 mm of rain was received, the pH dropped below the guideline threshold.

Variations in pH may be influenced by natural factors such as precipitation, runoff, and interactions with surrounding soils and vegetation. Seasonal changes, particularly during rainfall events or periods of low flow, can contribute to shifts in pH levels and disrupt the typical diurnal variations. The increase in water level (stage) observed on October 10, 16, and 26, as well as during the prolonged rainfall event from November 13–14, suggests that precipitation events play a key role in influencing pH. These effects may result from increased surface runoff carrying addition of acidic precipitation, dilution of buffering ions, or other geochemical processes.

Specific Conductivity

Conductivity relates to the ease of passing an electric charge – or resistance – through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance) while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25°C to allow comparison across variable temperatures. Monitoring specific conductivity is crucial for assessing water quality, identifying potential sources of contamination, and ensuring the health of aquatic ecosystems. Deviations from expected conductivity levels may signal the need for further investigation and management actions to maintain water quality and ecosystem integrity.



Variable	Mean	Median	Min	Max
Conductivity (µS/cm)	223.10	201.7	66.1	356.2
TDS (g/L)	0.1450	0.1300	0.040	0.230

Figure 5: Specific Conductivity (µS/cm), Total Dissolved Solids (g/L) and Stage of Kelligrews River, from September 12 to November 21, 2024, at CBS, NL.

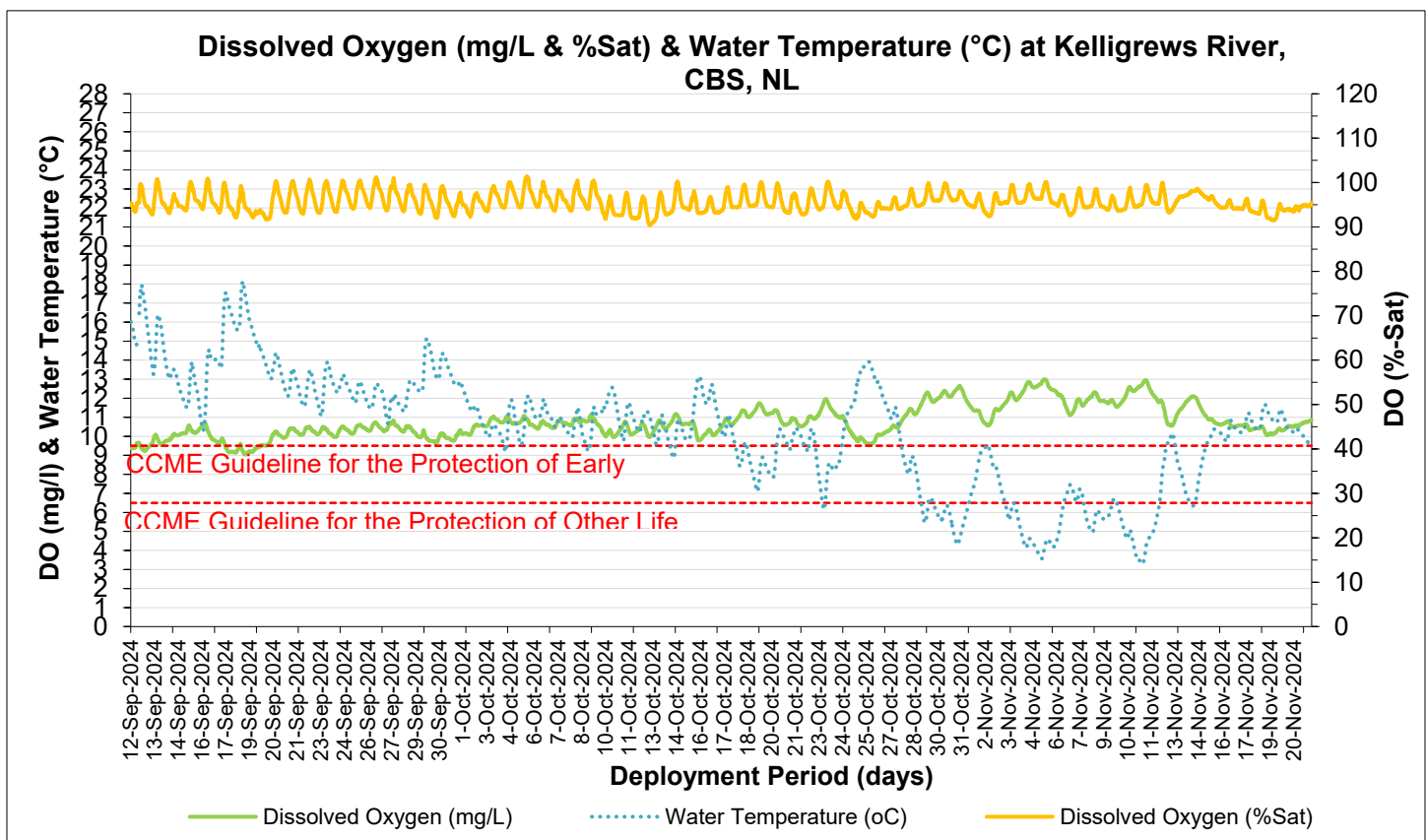
The specific conductivity of Kelligrews River showed a relatively stable pattern early in the monitoring period, indicating little disruption to water chemistry. However, starting in mid-October, sharp declines in conductivity were observed, corresponding with significant increases in water stage, which points to the dilution effects of rainfall and surface runoff. These declines were most noticeable following rainfall events, particularly on October 10, 16, and 26, as well as during the heavy rainfall on November 13–14, which brought 76.3 mm of precipitation. The decreases in conductivity during these periods suggest that rainfall introduced lower-conductivity water into the river, reducing the concentration of dissolved ions.

Statistically, the river's specific conductivity had an average value of 223.10 µS/cm and a median of 201.7 µS/cm, with values ranging from 66.1 µS/cm to 356.2 µS/cm. The higher conductivity peaks, such as 356.2 µS/cm on September 14, likely reflect periods of low flow, when dissolved ions become more concentrated due to reduced water volume. In contrast, lower conductivity values were typically observed during higher-flow conditions, when water from rainfall and runoff diluted ion concentrations.

Historically, Kelligrews River at Kelliview Crescent (NF02ZM0183) has been monitored since 1998, through the Canada -NL Water Quality Monitoring Agreement between Gov NL and Environment and Climate Change Canada. Statistical analysis of conductivity indicates an average of 232 $\mu\text{S}/\text{cm}$ over the past 25 years, which is higher than that of many other local water bodies. This elevated conductivity can be attributed to several factors, including urban development, which increases runoff carrying pollutants like salts and fertilizers, as well as quarry activity that exposes minerals such as calcium, magnesium, and sulfates to the water. Additionally, the region's natural geology, with minerals that easily dissolve into water, likely contributes to the higher conductivity levels observed in the river.

Dissolved Oxygen

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The concentration of oxygen in water depends on many factors, principally temperature – the saturation of oxygen in water is inversely proportional to water temperature. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.



Variable	Mean	Median	Min	Max
DO (mg/l)	10.77	10.61	9.03	13.0
DO (%Sat)	95.65	95.3	90.4	101.4

Figure 6: Dissolved Oxygen (mg/l), Dissolved Oxygen (%Sat) and Water Temperature (°C) of Kelligrews River, from September 12 to November 21, 2024 in Kelligrews River, CBS.

The dissolved oxygen (DO) levels in Kelligrews River exhibit fluctuations influenced by environmental conditions such as temperature, precipitation, and flow variations. Throughout the monitoring period, the DO concentrations generally follow an inverse relationship with water temperature, as expected with seasonal transitions (late summer to fall) in natural aquatic systems.

The dissolved oxygen (DO) data for Kelligrews River reflects a well-oxygenated freshwater environment. The mean dissolved oxygen concentration was 10.77 mg/l, with a median of 10.61 mg/l, indicating a stable distribution around the mean. The minimum dissolved oxygen concentration recorded was 9.03 mg/l, while the maximum was 13.0 mg/l, reflecting variability in oxygen levels during the deployment period. The percent saturation of dissolved oxygen averaged 95.65%, with a median of 95.3%. The minimum percent saturation observed was 90.4%, while the maximum was 101.4%, suggesting occasional supersaturation.

DO levels show variability around the CCME guidelines for the protection of aquatic life, particularly during precipitation events and associated stage increases. Levels remained above the guidelines for the majority of the deployment period. These fluctuations suggest that increased flow and turbulence enhance oxygenation, while runoff introducing organic matter and other pollutants could contribute to oxygen depletion.

A diurnal variation pattern was evident. The extent of this variation is linked to the daily range of water temperature, duration of daylight, and fluctuations in rates of photosynthesis and respiration. Consequently, the observed attenuation winter of the diurnal pattern is expected, given the decrease in aquatic biotic activity, and narrowing daily temperature ranges during the late summer- fall season.

Turbidity

Water turbidity is characterized by the cloudiness or haziness caused by suspended particles and can significantly impact water quality. High turbidity reduces light penetration, hindering photosynthesis and affecting aquatic vegetation growth and habitat suitability. It can lead to temperature fluctuations, oxygen depletion from microbial decomposition of organic matter, and sedimentation, smothering benthic habitats and compromising biodiversity. Turbidity can also transport nutrients and pollutants, contributing to eutrophication, algal blooms, and contamination of drinking water sources. Additionally, it diminishes aesthetic appeal and recreational value, highlighting the importance of monitoring and managing turbidity levels for maintaining the health and usability of aquatic ecosystems.

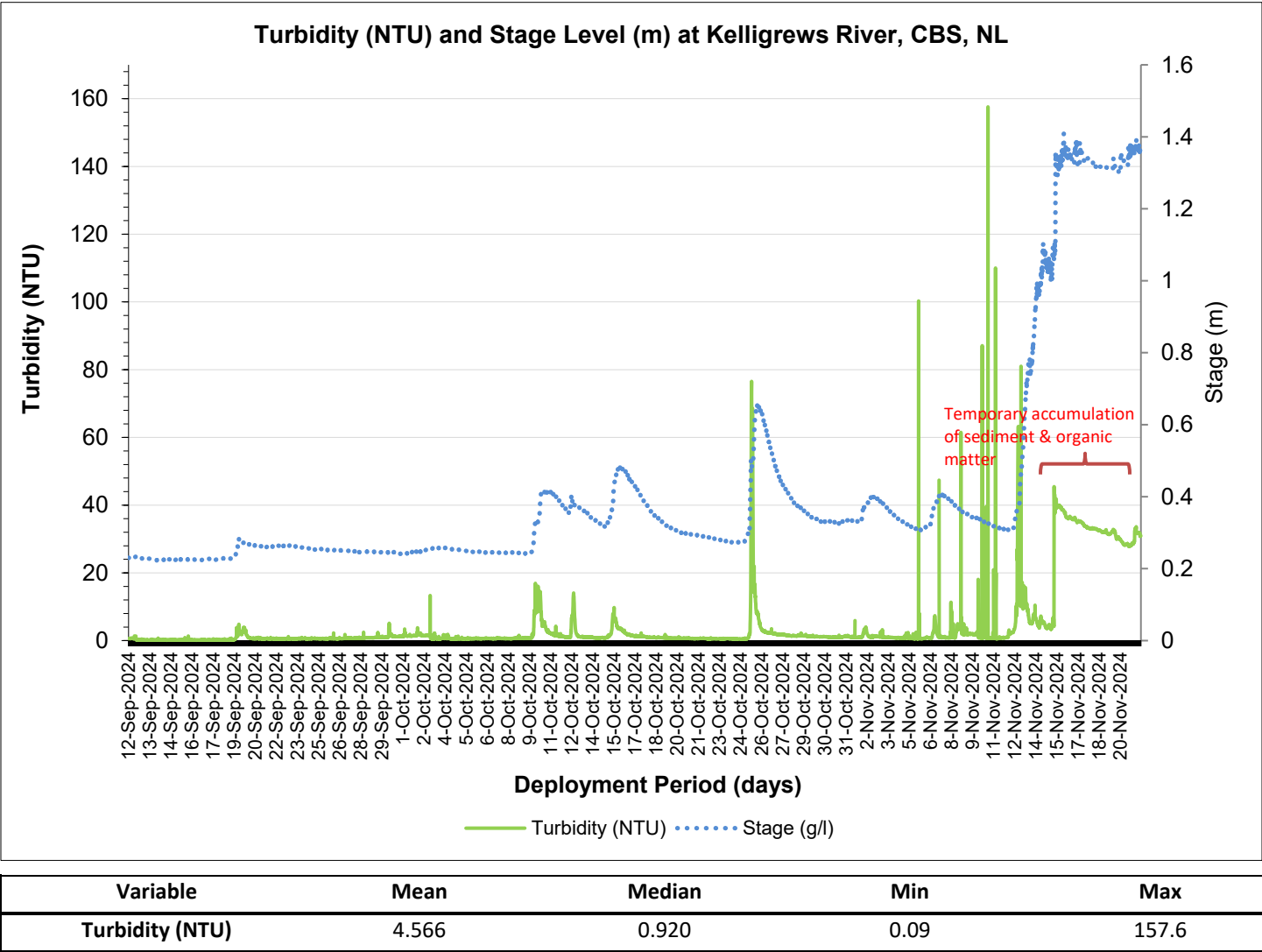


Figure 7: Water Turbidity (NTU) of Kelligrews River, from September 12 to November 21, 2024, at Kelliview Crescent, CBS.

The turbidity levels in Kelligrews River were generally low throughout the deployment period, suggesting good water clarity and favorable environmental conditions for aquatic life. The average turbidity observed was 4.56 NTU, with a lower median value of 0.93 NTU, indicating that the water remained clear most of the time. The minimum turbidity recorded was 0.09 NTU, highlighting occasional periods of exceptionally clear water. However, higher turbidity events were noted, particularly during precipitation events, with correlating increases in stage or when sediment and organic matter temporarily accumulated within the instrument casing. Notable spikes in turbidity occurred on November 10, when levels reached an exceptionally high 157.6 NTU, as well as on October 25, November 6, 7, 11, and 13, 2024. On November 15, sediments and organic material became lodged within the instrument casing, affecting turbidity values for the remainder of the deployment period. Despite these fluctuations, the overall low turbidity levels suggest a healthy water system with minimal disturbance, which is generally beneficial for aquatic life.

Stage and Precipitation

Stage values are determined by a vertical reference and serves as an approximation of the water level at the monitoring station. In addition, stage plays a vital role in understanding various water quality parameters like specific conductivity, dissolved oxygen (DO), and turbidity. It typically rises in response to rainfall events, reflecting the influx of water into the river system. However, during snowfall, the increase in stage may not be as pronounced due to factors such as snow accumulation, which takes time to melt and contribute significantly to the water level. By tracking stage variations, we gain valuable insights into the impact of precipitation on river dynamics, helping us assess water quantity, quality, and potential environmental implications.

The hydrometric data presented in this report is provisional and has not undergone quality control checks.

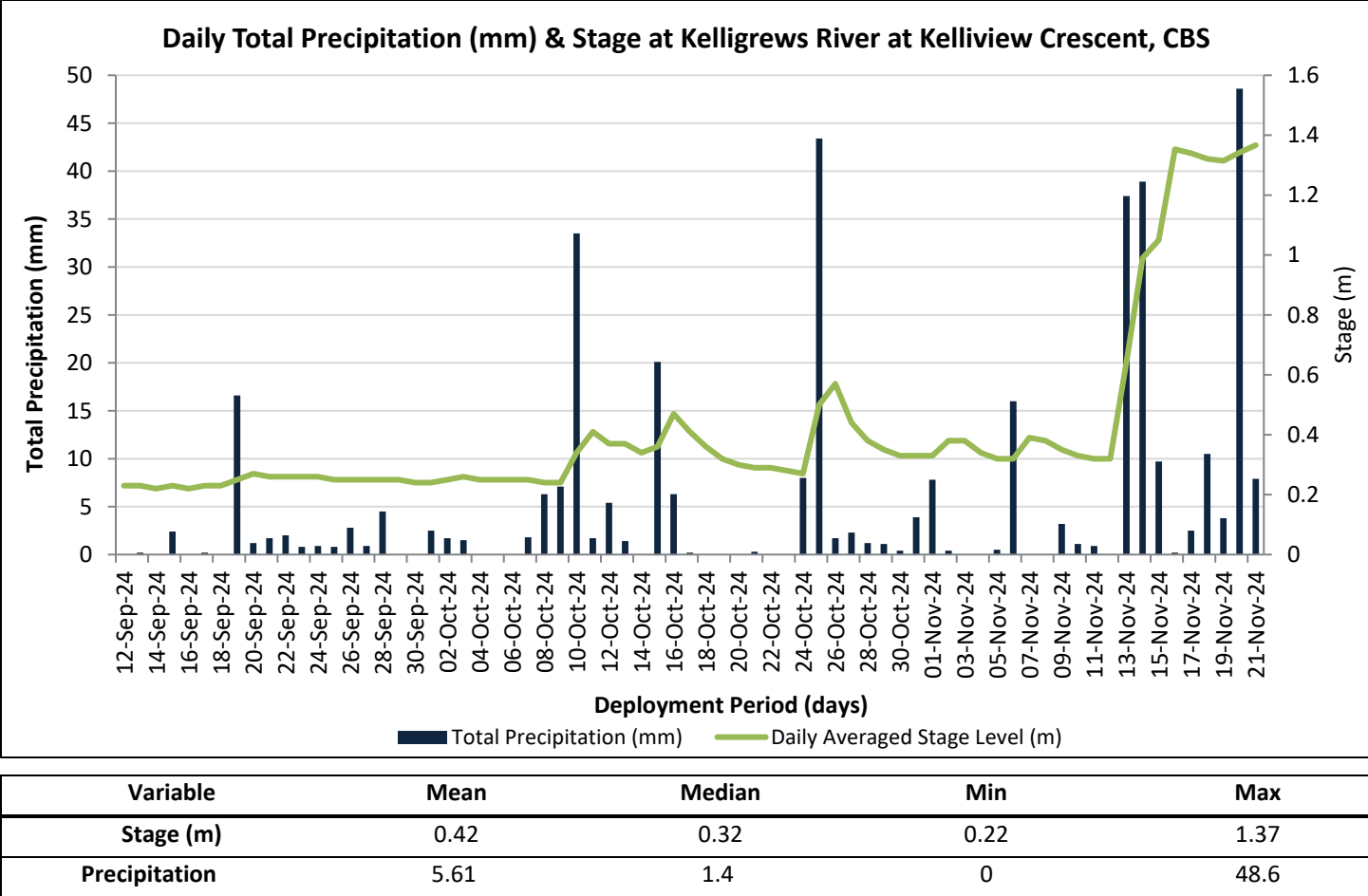


Figure 8: Daily total precipitation (mm) and average stage (m) of Kelligrews River, from September 12 to November 21, 2024, at Kelliview Crescent, CBS.

The statistics for stage measurements and precipitation data for Kelligrews River provide valuable insights into the hydrological conditions during the observation period. The mean stage of the river was approximately 0.42 meters, and the median stage was slightly lower at 0.32 meters, suggesting that the distribution of data is relatively symmetric with few extreme values. The minimum and maximum stage measurements, at 0.22 and 1.37 meters respectively, indicate that the river experienced fluctuations during this time due to rain events.

The mean precipitation was recorded at 5.61 mm, but the median was 0.32 mm. Notably, the maximum recorded precipitation of 48.6 mm on a single day highlights the potential for localized heavy rainfall events, which could lead to significant runoff and temporary increases in river stage.

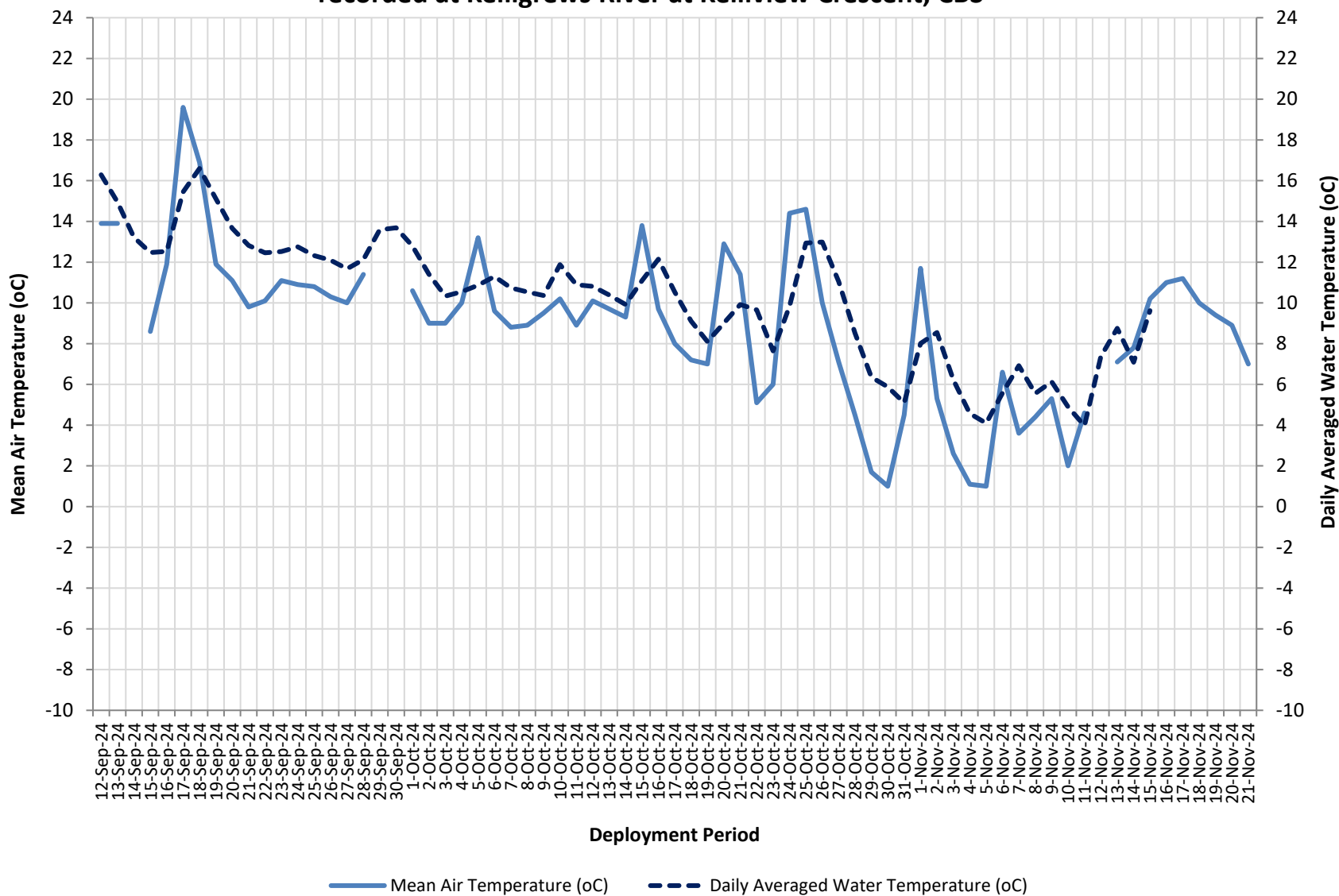
Conclusions and Path Forward

The deployment of the MEMP in Conception Bay South (CBS) offered valuable insights into its functionality and the environmental conditions within the Kelligrews River. The MEMP provided essential water quality, quantity, and weather data for assessing the river's environmental integrity and monitoring the impacts of industrial and residential activities. The collaboration between the Water Resources Management Division and the Town of CBS highlights the importance of interdisciplinary efforts in environmental monitoring and management.

Moving forward, it is necessary to expand monitoring efforts by enhancing instrumentation capabilities to measure calculated flow in water bodies, facilitating a more comprehensive understanding of hydrological dynamics.

APPENDIX A: MEAN DAILY AIR TEMPERATURE AND AVERAGE WATER TEMPERATURE

**Daily Averaged Water Temperatures (°C) recorded and Mean Air Temperatures (°C)
recorded at Kelligrews River at Kelliview Crescent, CBS**



APPENDIX B: QA/QC GRAB SAMPLE FIELD RESULTS



Your P.O. #: 224006869-3
Site#: KELLIGREWS RIVER @ KELLIGREWS
Site Location: FOREST POND @ BUOY
Your C.O.C. #: N/A, 2024-1719-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
Water Resources
PO Box 8700
St. John's, NL
CANADA A1B 4J6

Report Date: 2024/09/23
Report #: R8332183
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4S7373

Received: 2024/09/13, 09:47

Sample Matrix: Drinking Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2024/09/19	ATL SOP 00142	SM 24 2320 B
Anions (1)	1	N/A	2024/09/20	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2024/09/19	ATL SOP 00020	SM 24 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2024/09/20	ATL SOP 00203	SM 24 5310B m
Conductance - water	1	N/A	2024/09/19	ATL SOP 00004	SM 24 2510B m
Fluoride	1	N/A	2024/09/19	ATL SOP 00043	SM 24 4500-F- C m
Hardness (calculated as CaCO3)	1	N/A	2024/09/18	ATL SOP 00048	Auto Calc
Mercury - Total (CVAA,LL)	1	2024/09/19	2024/09/19	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS	1	2024/09/16	2024/09/17	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2024/09/18	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2024/09/19	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2024/09/19	ATL SOP 00017	SM 24 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2024/09/20	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2024/09/19	ATL SOP 00003	SM 24 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2024/09/20	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2024/09/19	2024/09/20	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2024/09/18	ATL SOP 00203	SM 24 5310B m
Total Phosphorus (Colourimetric) (1)	1	2024/09/19	2024/09/20	CAM SOP-00407	SM 24 4500-P I
Total Suspended Solids	1	2024/09/18	2024/09/20	ATL SOP 00007	SM 24 2540D m
Turbidity	1	N/A	2024/09/20	ATL SOP 00011	EPA 180.1 R2 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Mississauga, 6740 Campobello Rd , Mississauga, ON, L5N 2L8

(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

(3) The APHA Standard Method requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.



Your P.O. #: 224006869-3
Site#: KELLIGREWS RIVER @ KELLIGREWS
Site Location: FOREST POND @ BUOY
Your C.O.C. #: N/A, 2024-1719-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
Water Resources
PO Box 8700
St. John's, NL
CANADA A1B 4J6

Report Date: 2024/09/23
Report #: R8332183
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4S7373

Received: 2024/09/13, 09:47

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Please direct all questions regarding this Certificate of Analysis to:

Maryann Comeau, Customer Experience Supervisor/PM

Email: Maryann.COMEAU@bureauveritas.com

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Bureau Veritas Job #: C457373
Report Date: 2024/09/23

NL Department of Environment, Climate Change and
Municipalities
Site Location: FOREST POND @ BUOY
Your P.O. #: 224006869-3
Sampler Initials: LB

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ACUT97 KELLIGREWS RIVER @KELLIGREWS CRESCENT Sampling Date 2024/09/12 11:46 Matrix DR Sample # 2024-1719-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF DRINKING WATER								
Calculated Parameters								
Hardness (CaCO ₃)	-	54	1.0	mg/L	N/A	2024/09/18		9638732
Nitrate (N)	-	0.17	0.050	mg/L	N/A	2024/09/20		9638897
Total dissolved solids (calc., EC)	-	190	1.0	mg/L	N/A	2024/09/20		9638899
Inorganics								
Conductivity	-	340	1.0	uS/cm	N/A	2024/09/19	M2C	9648231
Chloride (Cl ⁻)	-	75	1.0	mg/L	N/A	2024/09/20	LKH	9650591
Bromide (Br ⁻)	-	ND	1.0	mg/L	N/A	2024/09/20	LKH	9650591
Sulphate (SO ₄)	-	9.1	1.0	mg/L	N/A	2024/09/20	LKH	9650591
Total Alkalinity (Total as CaCO ₃)	-	29	2.0	mg/L	N/A	2024/09/19	M2C	9648233
Colour	-	23	5.0	TCU	N/A	2024/09/19	EMT	9648043
Dissolved Fluoride (F ⁻)	-	ND	0.10	mg/L	N/A	2024/09/19	M2C	9648234
Total Kjeldahl Nitrogen (TKN)	-	0.18	0.10	mg/L	2024/09/19	2024/09/20	RTY	9650483
Nitrate + Nitrite (N)	-	0.17	0.050	mg/L	N/A	2024/09/19	EMT	9648046
Nitrite (N)	-	ND	0.010	mg/L	N/A	2024/09/19	EMT	9648047
Nitrogen (Ammonia Nitrogen)	-	0.15	0.050	mg/L	N/A	2024/09/18	MCN	9645722
Dissolved Organic Carbon (C)	-	4.4	0.50	mg/L	N/A	2024/09/20	ACK	9649417
Total Organic Carbon (C)	-	4.4	0.50	mg/L	N/A	2024/09/18	ACK	9645281
pH	-	7.45		pH	N/A	2024/09/19	M2C	9648208
Total Phosphorus	-	ND	0.004	mg/L	2024/09/19	2024/09/20	VKH	9649894
Total Suspended Solids	-	ND	1.3	mg/L	2024/09/18	2024/09/20	CAC	9645203
Turbidity	-	1.0	0.10	NTU	N/A	2024/09/20	M2C	9649082
MERCURY BY COLD VAPOUR AA (DRINKING WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2024/09/19	2024/09/19	JEP	9648789
ELEMENTS BY ICP/MS (DRINKING WATER)								
Metals								
Total Aluminum (Al)	-	0.023	0.0050	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Antimony (Sb)	-	ND	0.0010	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Arsenic (As)	-	ND	0.0010	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Barium (Ba)	-	0.054	0.0010	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Boron (B)	-	ND	0.050	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Calcium (Ca)	-	16	0.10	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Chromium (Cr)	-	ND	0.0010	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Copper (Cu)	-	ND	0.00050	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Iron (Fe)	-	0.22	0.050	mg/L	2024/09/16	2024/09/17	MTZ	9640842
Total Lead (Pb)	-	ND	0.00050	mg/L	2024/09/16	2024/09/17	MTZ	9640842



BUREAU
VERITAS

Bureau Veritas Job #: C457373
Report Date: 2024/09/23

NL Department of Environment, Climate Change and
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Sampler Initials: LB

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ACUT97 KELLIGREWS RIVER @KELLIGREWS CRESCENT Sampling Date 2024/09/12 11:46 Matrix DR Sample # 2024-1719-00-SI-SP Registration # SA-0000 ELEMENTS BY ICP/MS (DRINKING WATER) Metals Total Magnesium (Mg) Total Manganese (Mn) Total Nickel (Ni) Total Phosphorus (P) Total Potassium (K) Total Selenium (Se) Total Sodium (Na) Total Strontium (Sr) Total Uranium (U) Total Zinc (Zn)	- - - - - - - - - -	3.1 0.19 ND ND 1.4 ND 42 0.066 0.00012 ND	0.10 0.0020 0.0020 0.10 0.10 0.00050 0.10 0.0020 0.00010 0.0050	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16 2024/09/16	2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17 2024/09/17	MTZ MTZ MTZ MTZ MTZ MTZ MTZ MTZ MTZ MTZ	9640842 9640842 9640842 9640842 9640842 9640842 9640842 9640842 9640842 9640842



Bureau Veritas Job #: C4S7373
Report Date: 2024/09/23

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Site Location: FOREST POND @ BUOY
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	10.0°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C4S7373

Report Date: 2024/09/23

NL Department of Environment, Climate Change and
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Sampler Initials: LB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Colleen Acker, B.Sc, Scientific Service Specialist

Cristina Carriere, Senior Scientific Specialist

Ernie Publicover, Scientific Specialist

Janah Rhyno, Scientific Specialist



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