

Real-Time Water Quality Deployment Report

Mobile Environmental Monitoring Platform (MEMP)

Kelligrews River at Kelliview Crescent, CBS
July 24, 2024 to September 12, 2024



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

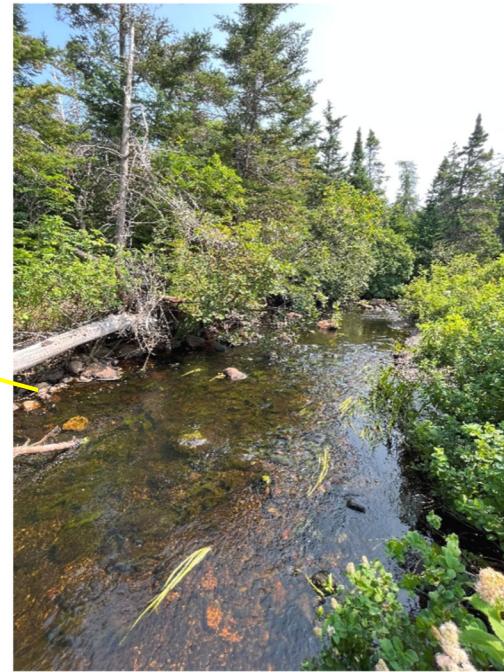
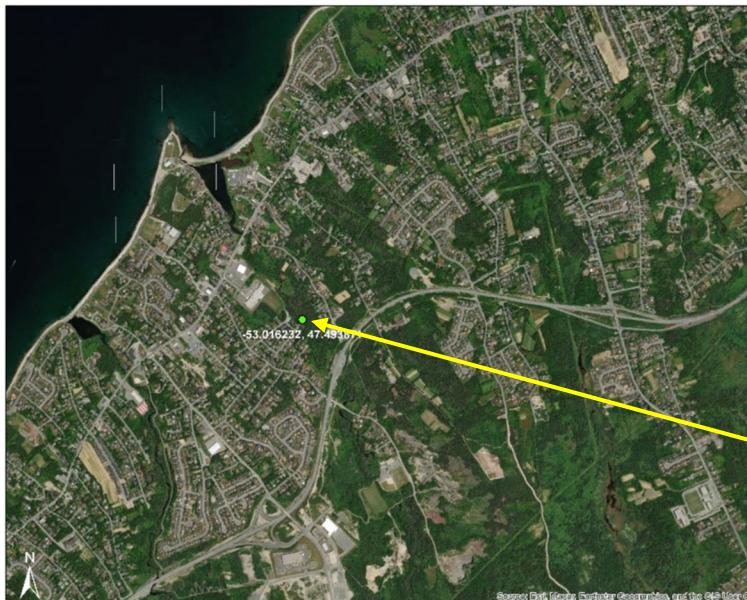
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General

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 51 days from July 24, 2024, to September 12, 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.

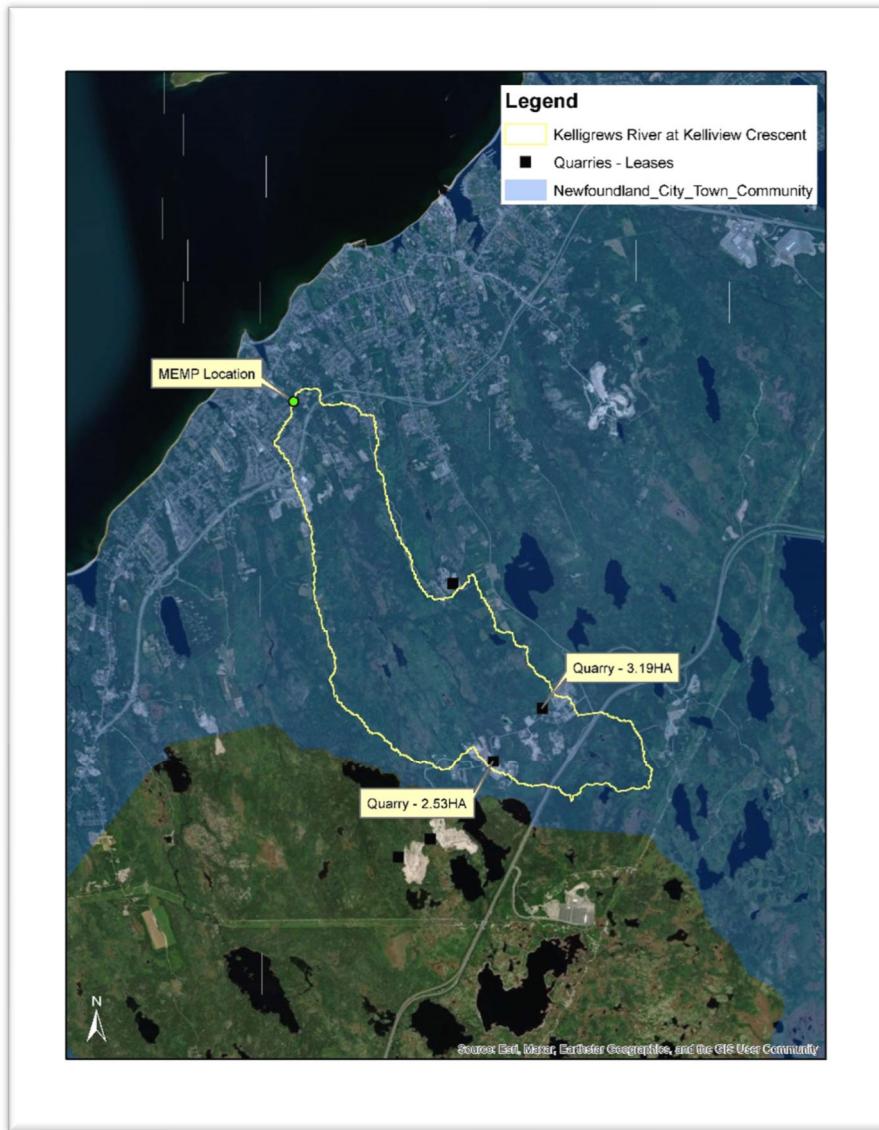
Water quantity monitoring will be equally important, given that increased urbanization and quarrying activities can alter drainage patterns and exacerbate stormwater runoff. The program will track river discharge to assess the risk of flooding and evaluate the effectiveness of stormwater management practices.

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, in CBS 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 via the Government of NL Automated Data Retrieval System (ADRS), was not implemented until July 31, 2024 due to staff and timing constraints.



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 QAQC 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 QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Kelligrews River, CBS, NL	2024-07-24	Deployment	Fair	Excellent	Good	Good	Good
	2024-1715-00-SI-SP	Grab Sample	--	Excellent	Good	--	Good
	2024-09-12	Removal	Excellent	Good	Good	Excellent	Good

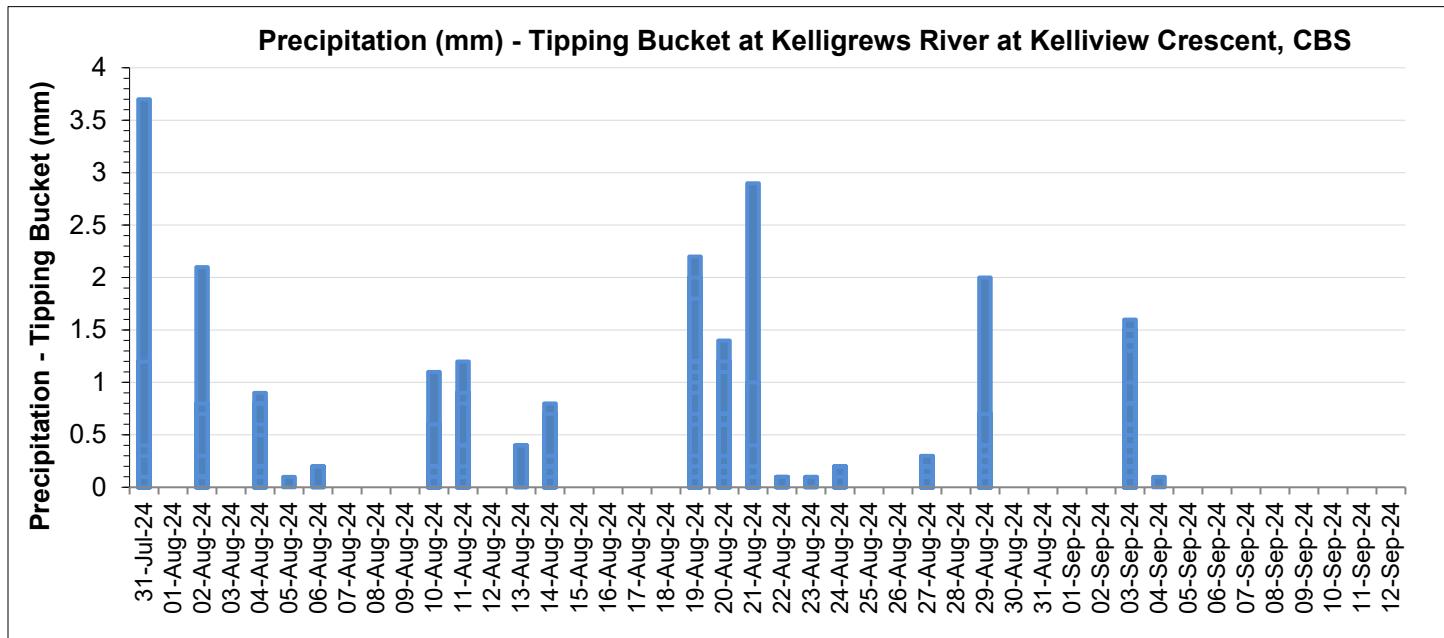
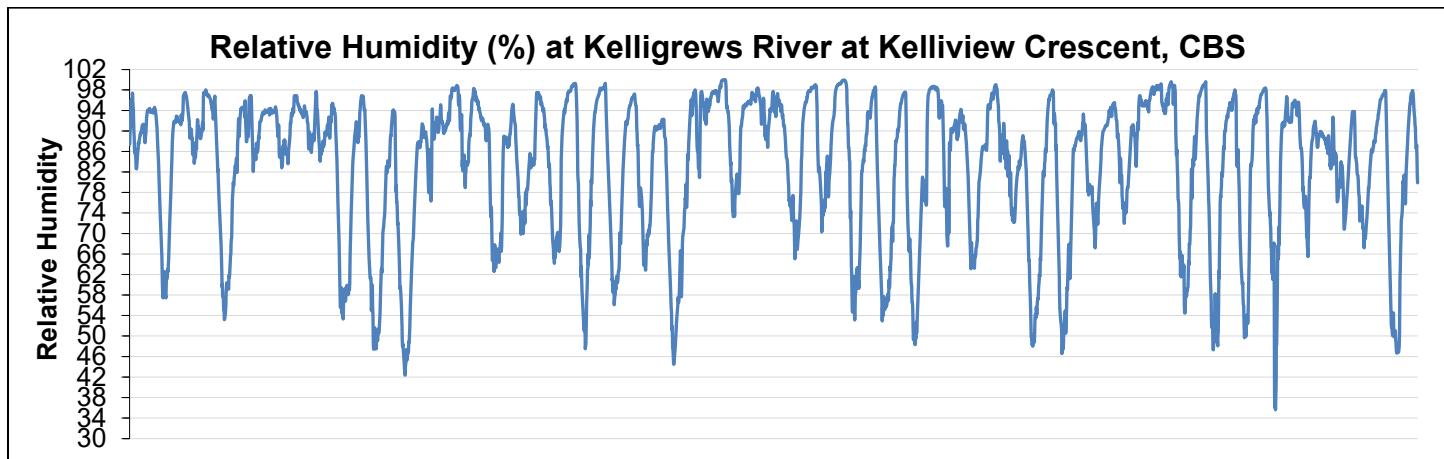
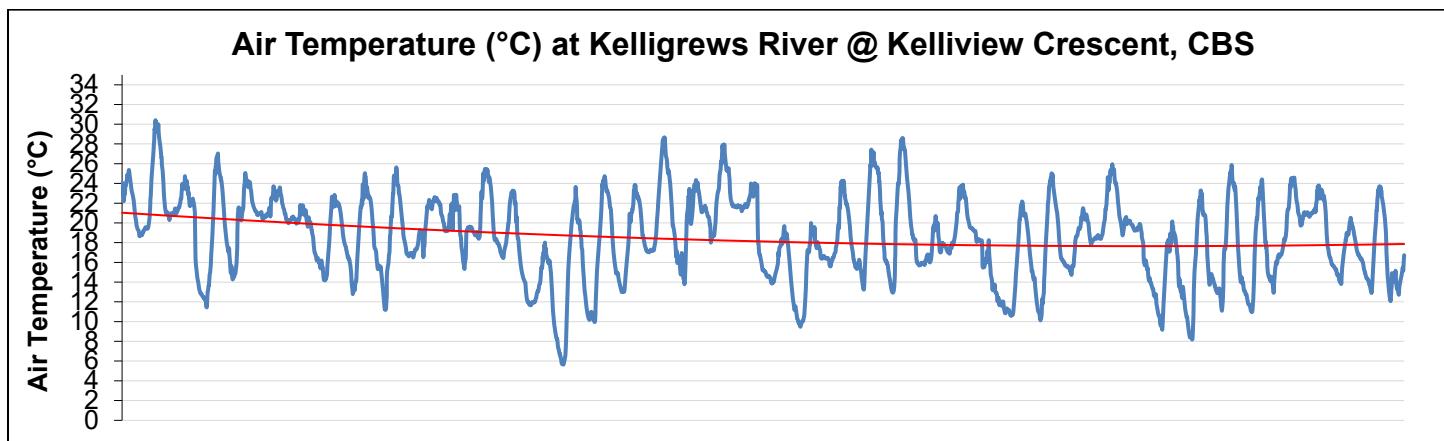
Comparison rankings reflect the accuracy and consistency between the field sonde used in Kelligrews River and a QA/QC sonde and grab sample. On July 24, during deployment, the field sonde's measurements showed a 'Fair' ranking for temperature compared to the QA/QC sonde, which may indicate discrepancies in temperature calibration and most likely the result of inadequate time provided for acclimation to current conditions. However, for other parameters such as pH, conductivity, dissolved oxygen, and turbidity, the rankings ranged from 'Good' to 'Excellent', suggesting strong agreement between the field equipment and the QA/QC checks.

The grab sample on July 15 further reinforced the reliability of the pH and conductivity measurements, both ranked 'Excellent' and 'Good', respectively. This suggests that these parameters were well-calibrated between the field sonde and the laboratory grab sample.

At removal, on September 12, the comparison rankings indicated improvements, with temperature now ranked 'Excellent', indicating that the less than excellent ranking at deployment indicated an issue with adequate acclimation time or QaQc sensor error. Similarly, dissolved oxygen also achieved an 'Excellent' ranking, further confirming accurate calibration. Other parameters remained stable, maintaining 'Good' or 'Excellent' rankings. Overall, this comparison data indicates that the field sonde performed reliably, with most parameters showing strong agreement with QA/QC standards, especially at the end of the monitoring period.

Data Interpretation

Weather



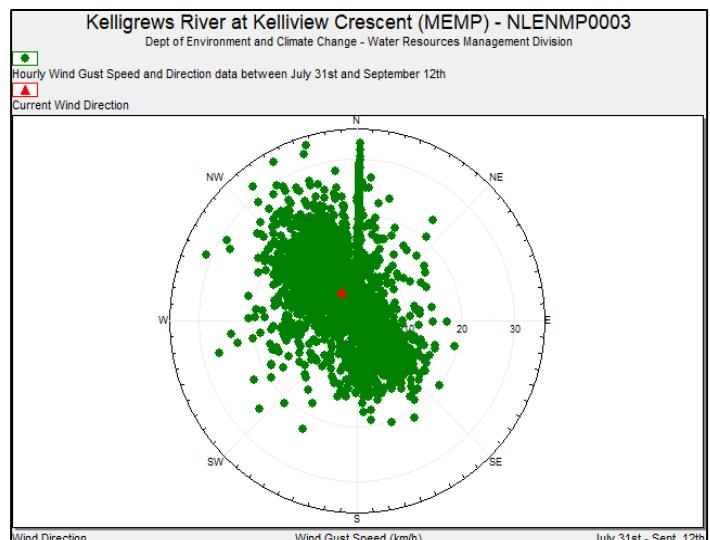
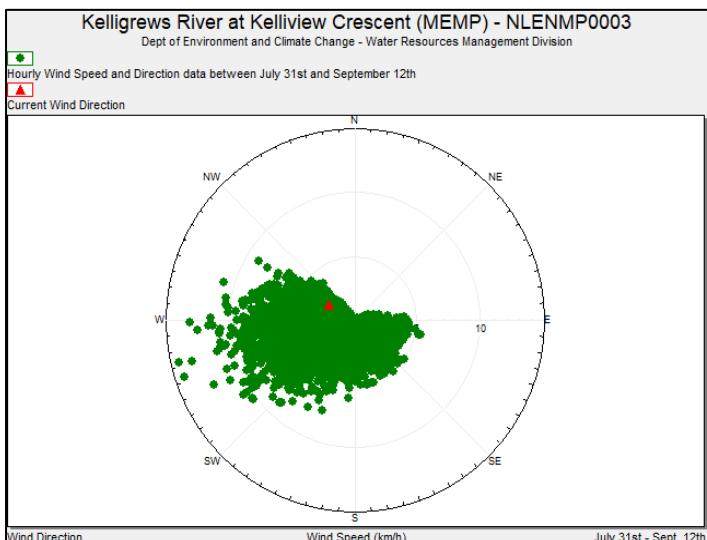
Variable	Mean	Median	Min	Max
Air Temperature (C)	18.56	18.78	5.63	30.42
Relative Humidity (%-Sat)	83.19	88	35.65	100
Precipitation - Rain (mm - water equivalent)	0.0200	0	0	3.7
Snow (mm)	N/A			

Figure 1: Meteorological variable trends and statistical analysis from July 24, 2024, to September 12, 2024, at Kelligrews River at Kelliview Crescent, CBS.

From July 31 to September 12, 2024, climate data from Kelligrews River indicates a relatively warm and humid period. The mean air temperature was 18.56°C, with temperatures ranging from a low of 5.63°C to a high of 30.42°C, reflecting typical summer conditions in the region. The observed decreasing air temperature is expected due to seasonal changes from summer to fall.

Relative humidity, expressed as a percentage of saturation, observed from July to September exhibits a mean of 83.19%, 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 35.65% (September 7, 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 0.0200 mm. The maximum recorded daily rainfall during this time was 3.7 mm, indicating that the area experienced light to moderate rainfall events. Snow was not recorded, which is expected during these summer months. 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.



Variable	Mean	Median	Min	Max
Wind Speed (km/h)	3.15	2.813	0	14.25
Wind Direction (Deg)	229.21	248.1	47.73	332.5
Wind Gust Speed (km/h)	10.35	9.88	0	33.94
Wind Gust Direction (Deg)	197.24	273.4	1	353.8

Figure 2: Wind rose representing wind speed and direction and wind gust speed and direction from July 24, 2024, to September 12, 2024, at Kelligrews River at Killiview Crescent, CBS.

Mild to moderate, predominantly west to southwest winds from 0 to 14.25 km/h were observed, with strongest winds on November 19, 2023. Wind speed may have been influenced by the geographical features of the area, as the MEMP was deployed in an area with naturally forested area on the northern side. Due to an error in filtering out impossibly high wind speed values at one of WRMDs other sites, the wind direction values at this site between 300° and 360° have been clamped to zero erroneously. This issue was resolved on August 13, 2024.

As per Table 2 below and the wind rose above, the average wind speed in July was 5.65 m/s, with winds predominantly coming from a westerly direction (251.47°). This relatively higher wind speed aligns with typical summer conditions, where coastal areas experience stronger breezes due to differences in land and sea temperatures.

August saw a notable decrease in average wind speed to 3.02 m/s, accompanied by a shift in the wind direction to 219.46°, indicating more southwesterly winds. This reduction in wind speed may reflect more stable atmospheric conditions, possibly influenced by settled summer weather patterns.

In September, the wind speed slightly increased to 3.40 m/s, with the wind direction returning to a more westerly orientation (254.62°). The slight rise in wind speed could indicate the transition from late summer to early autumn, with more variable weather patterns beginning to emerge.

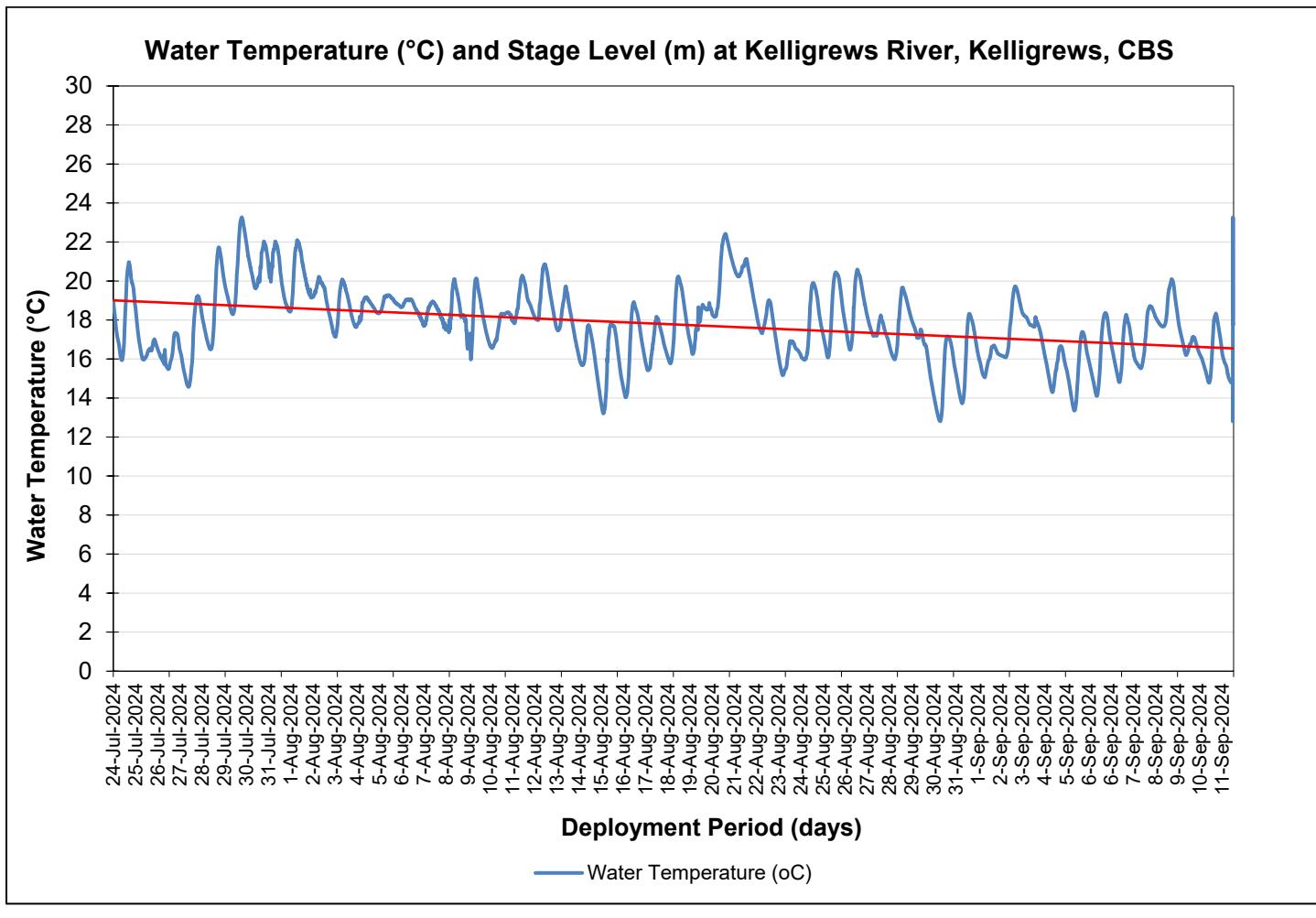
Table 2: Monthly average wind speed (km/h) and wind direction (degrees).

MONTH	Average WIND_SPEED	Average WIND_DIR
July	5.64762963	251.4685185
August	3.017242272	219.4612097
September	3.404811872	254.6170959

Wind gust speed statistics reveal higher values, with a mean of 10.35 km/h and a median of 9.88 km/h, ranging from 0 km/h to 33.94 km/h. Wind gust direction also varies widely, from north to northwest, south and southwest, with a mean of 197.24 degrees and a median of 273.4 degrees, spanning from 1 to 353.8 degrees.

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.



Variable	Mean	Median	Min	Max
Water Temperature (°C)	17.78	17.82	12.81	23.28

Figure 3: Water Temperature (°C) of Kelligrews River, from July 24, 2024 to September 12, 2024 at Kelliview Crescent, CBS.

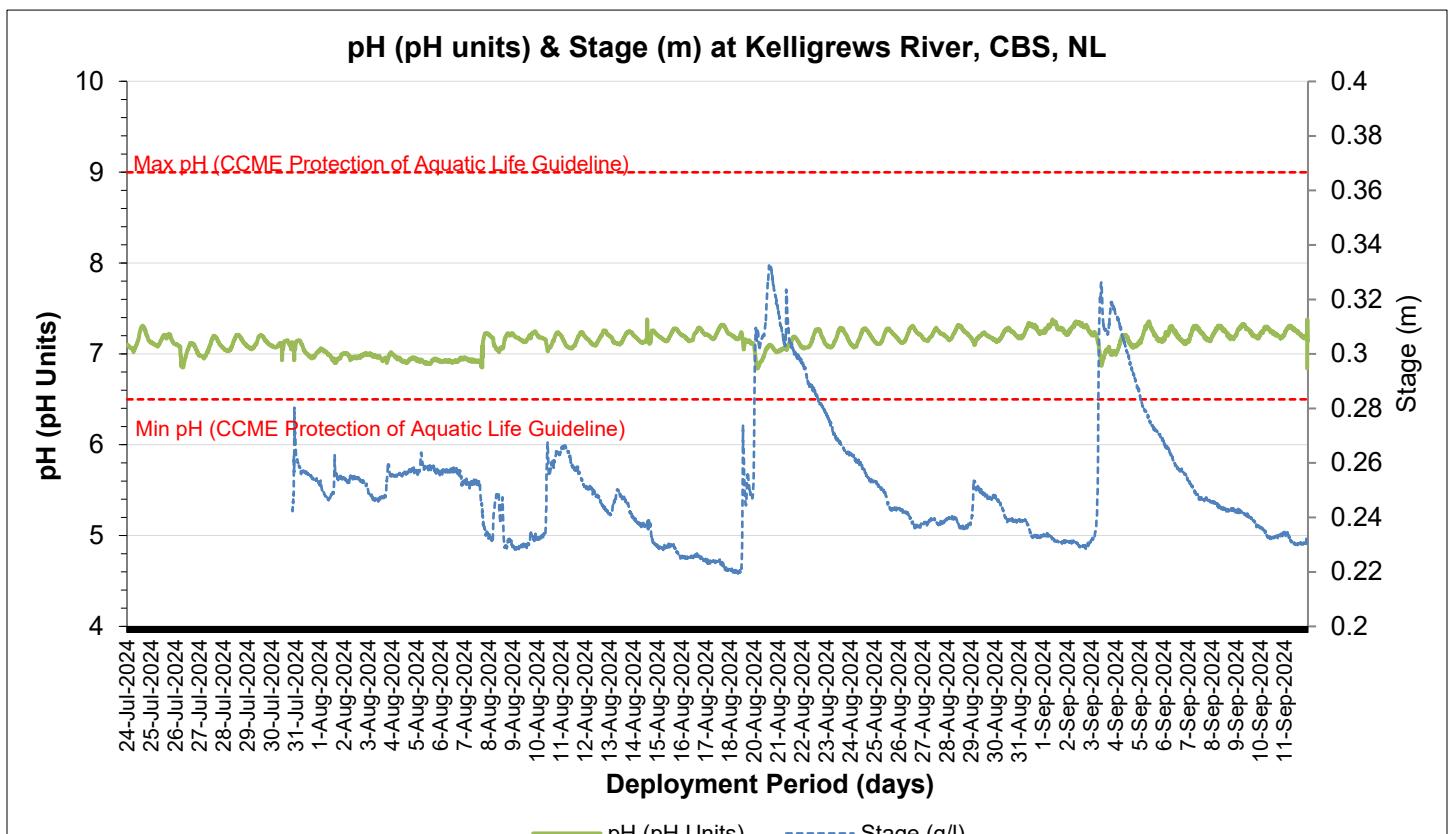
The water temperature data for Kelligrews River at Kelliview Crescent, CBS, from July 24 to September 12, 2024, reveals seasonal fluctuations in river temperature during the summer months. The mean

water temperature was 17.78°C , closely matching the median of 17.82°C , suggesting a fairly consistent temperature range throughout the monitoring period. The lowest recorded temperature was 12.81°C , and the highest was 23.28°C , reflecting both cooler nights and warmer daytime temperatures.

These temperature variations are typical of a natural water body during the summer, 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 decreasing temperature trend is consistent with seasonal variation from summer to fall.

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)	7.14	7.16	6.84	7.38

Figure 4: Water pH (pH units) of Kelligrews River, from July 24, 2024 to September 12, 2024 at Kelliview Crescent, CBS.

The statistical analysis of pH levels in the Kelligrews River shows a stable and neutral water chemistry. The mean pH was 7.14, with a median value of 7.16, indicating that the water remained relatively neutral throughout the monitoring period. The pH ranged from a minimum of 6.84 to a maximum of 7.38, demonstrating only minor fluctuations in acidity and alkalinity.

All pH values were within the CCME Protection of Aquatic Life guidelines of 6.5 and 9.0 units (horizontal dashed lines). These values suggest that the water in Kelligrews River is within a healthy pH range for aquatic life. The minor variations in pH may be influenced by natural factors such as precipitation, runoff, and the river's interactions with surrounding soils and vegetation. Seasonal changes, especially during rainfall events or periods of low flow, could contribute to shifts in pH levels and disruptions in daily diurnal variation.

Precipitation events and subsequent increase in stage as seen on July 31 to August 7, August 19-21 and on September 3, can affect the pH of a water body through multiple pathways. Firstly, the addition of slightly more acidic rain can directly lower pH upon contact with surface water as observed on August 19-21 and on August 29, 2024. Additionally, on August 8, 2024 the Town of CBS was actively involved in construction activities that led to an accidental discharge of heavily silt-laden water into a near-by storm drain. This drainage system channeled the turbid water into the Kelligrews River, specifically upstream of the water quality monitoring instrument. Once this activity was halted pH levels can be seen to return to baseline levels.

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.

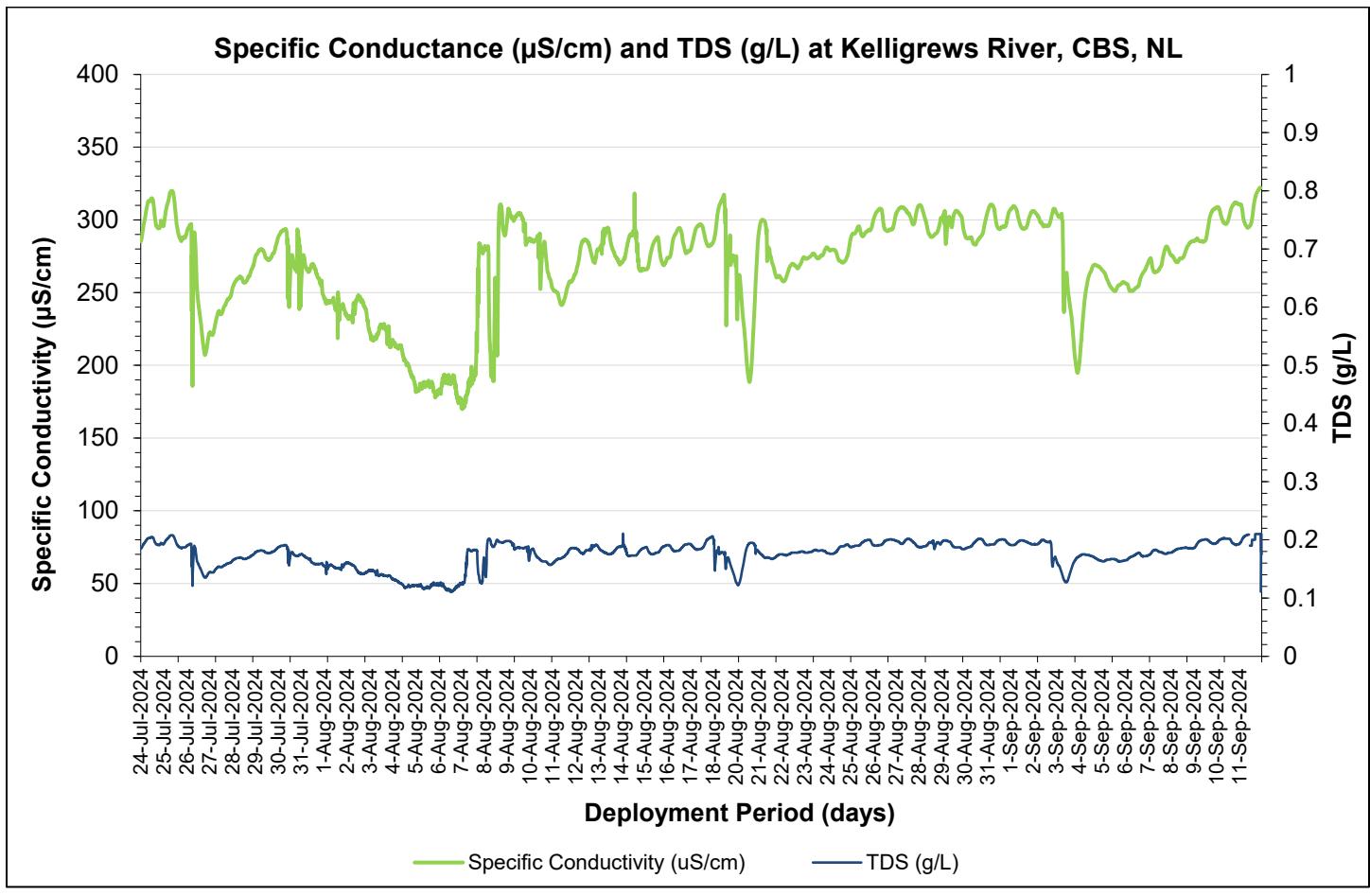


Figure 5: Specific Conductivity ($\mu\text{S}/\text{cm}$) and Total Dissolved Solids (g/L) of Kelligrews River, from July 24, 2024 to September 12, 2024 at CBS, NL.

The analysis of water specific conductivity reveals a mean value of 269.42 μ S/cm, with a median of 277.1 μ S/cm. This indicates relatively consistent conductivity levels across the dataset. The recorded specific conductivity ranges from a minimum of 169.9 μ S/cm to a maximum of 322.8 μ S/cm, suggesting variability within the conductivity range. While the mean and median values are close, variations in conductivity levels within the dataset may be attributed to factors such as changes in dissolved ion concentrations, temperature fluctuations, and seasonal changes.

Higher conductivity values, such as the peak of 322.3 μ S/cm (September 12), could be linked to periods of low water flow, where dissolved ions become more concentrated. Conversely, lower values may correspond to periods of higher flow, which can dilute the ion concentration.

From August 3 to August 8, conductivity levels showed a decline, albeit coinciding with minimal precipitation. On August 8, construction activities by the Town of CBS were noted, which resulted in the accidental discharge of heavily silt-laden water into a nearby storm drain. This drainage system directed the turbid water into the Kelligrews River, upstream of the water quality monitoring instrument. After these construction activities were ceased, conductivity levels spiked and returned to baseline levels.

Twenty-five-year historical specific conductivity of Kelligrews River, averaging 232 μ S/cm is typically higher than that of other natural waterbodies observed in the area. This can be attributed to a combination of urban development, quarry activity, and natural geological influences. Urban areas contribute to increased runoff from roads, which can introduce salts, fertilizers, and other pollutants into the water, raising the level of dissolved solids and, in turn, conductivity. Quarry activities may also be a factor, as they often expose minerals like calcium, magnesium, and sulfates that can be washed into the river, further increasing ion concentration. Additionally, the natural geology of the region may play a role, with bedrock and soil types potentially containing minerals that dissolve easily in water, naturally elevating conductivity.

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.

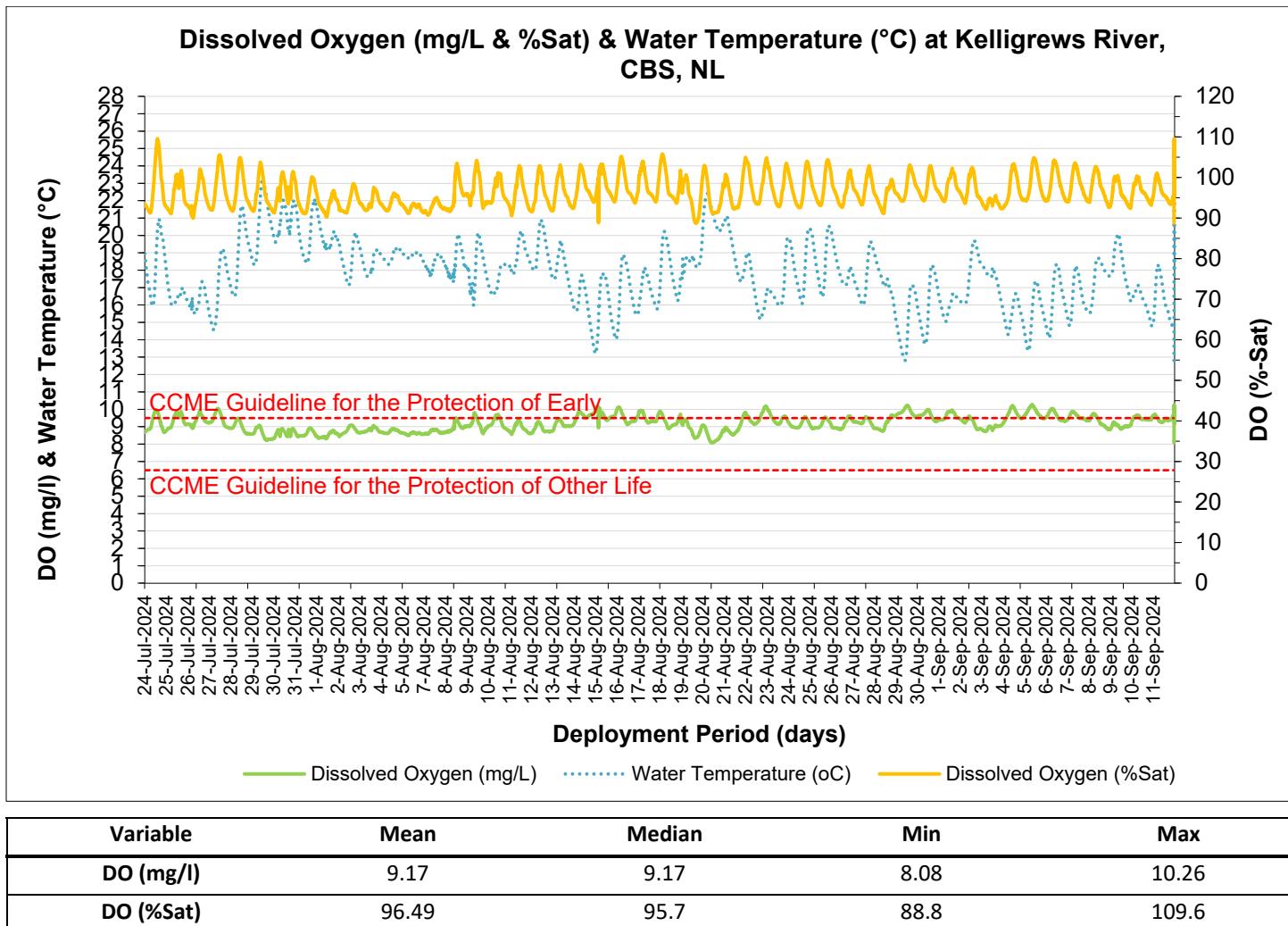


Figure 6: Dissolved Oxygen (mg/l), Dissolved Oxygen (%Sat) and Water Temperature (°C) of Kelligrews River, from July 24, 2024 to September 12, 2024 at CBS, NL.

The dissolved oxygen (DO) data for Kelligrews River reflects a well-oxygenated freshwater environment. The mean dissolved oxygen concentration was 9.17 mg/l, with a median of 9.17 mg/l, indicating a stable distribution around the mean. The minimum dissolved oxygen concentration recorded was 8.08 mg/l, while the maximum was 10.26 mg/l, reflecting variability in oxygen levels during the deployment.

period. The percent saturation of dissolved oxygen averaged 96.49%, with a median of 95.7%. The minimum percent saturation observed was 88.8%, while the maximum was 109.6%, suggesting occasional supersaturation.

The observed increase in dissolved oxygen (DO) levels from July to September corresponds to decreasing water temperatures throughout deployment. From the data, water temperature likely peaked in late July when the instrument was deployed. As temperatures dropped due to the natural transition from summer to fall, the solubility of oxygen in water increased due to the colder water's ability to hold more dissolved gases. Dissolved oxygen level remained consistently above the Canadian Council of Ministers of the Environment (CCME) Guideline for the Protection of the Other Life (6.5 mg/L), and near the CCME guideline of 9.5 mg/l for the protection of early life stage cold water biota for most of the deployment period.

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 of the diurnal pattern is expected, given the decrease in aquatic biotic activity, and narrowing daily temperature ranges during the summer-fall season.

It can be observed in Figure 6, that from August 3 to August 8, DO %Sat diurnal variation levels were attenuated, albeit coinciding with minimal precipitation. On August 8, construction activities by the Town of CBS were observed, which resulted in the discharge of heavily silt-laden water into a nearby storm drain. This drainage system directed the turbid water into the Kelligrews River, upstream of the water quality monitoring instrument. After these construction activities were ceased, the DO %Sat diurnal variation range returned to normal anticipated levels.

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.

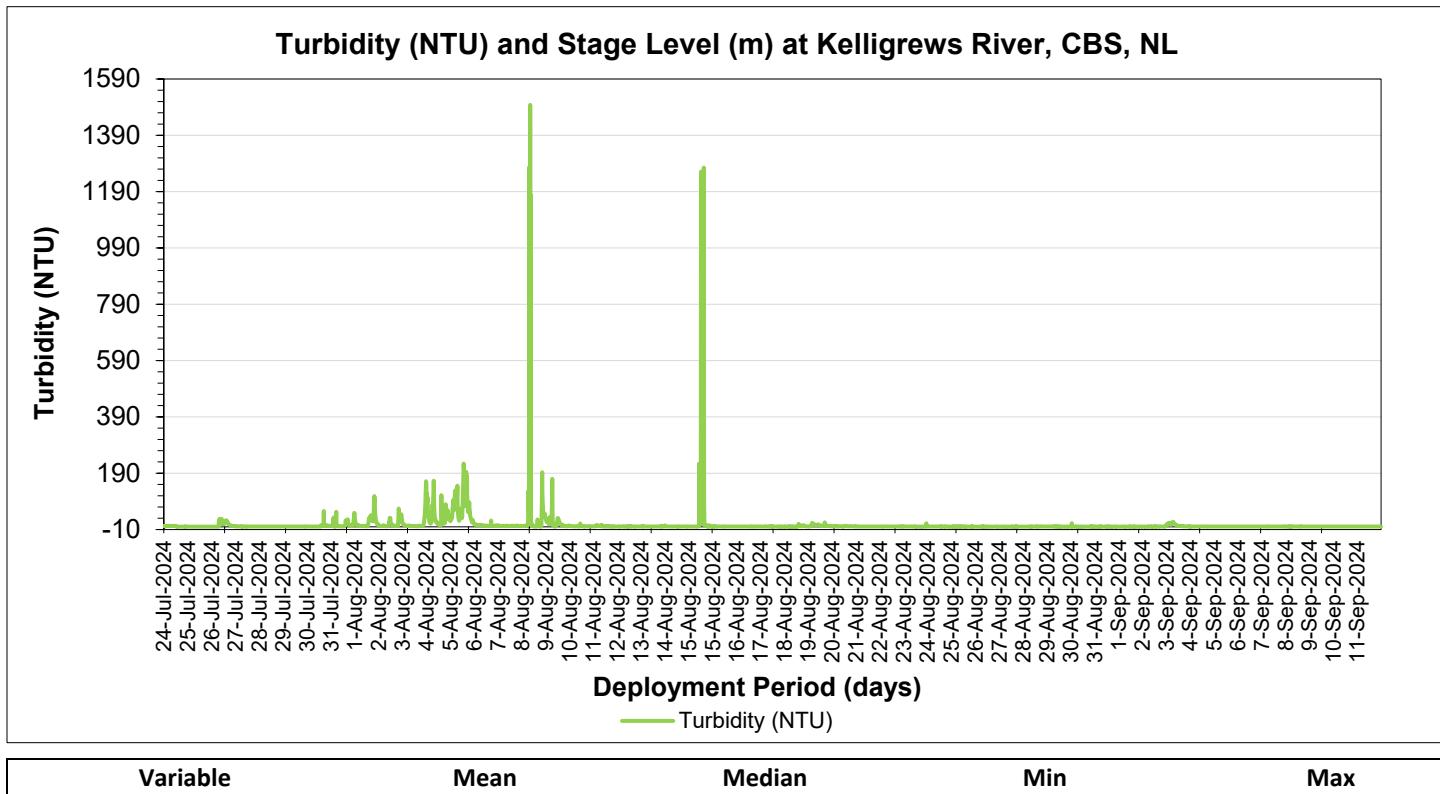


Figure 7: Water Turbidity (NTU) of Kelligrews River, from July 24, 2024 to September 12, 2024 at Kelliview Crescent, CBS.

During the deployment period from July 24 to September 12, 2024, at Kelligrews River, the water turbidity remained consistently low with exception of anthropogenic high turbidity events. An average turbidity of 6.65 NTU (Nephelometric Turbidity Units) and a lower median value also of 0.63 NTU was observed. The minimum turbidity recorded during this period was 0.21 NTU, suggesting occasional periods of exceptionally clear water. The maximum turbidity observed, indicates exceptionally high turbidity events as seen on August 8 (1498 NTU) and August 15, 2024 (1261 NTU). Baseline turbidity was maintained once hay bales were placed to limit the turbid water entering storm drains and construction activity ceased.

These high turbidity events are concerning, as elevated levels can negatively impact aquatic habitats by reducing light penetration, affecting photosynthesis, and potentially harming fish by clogging gills.

Turbidity measurements at times throughout the deployment period indicated very low turbidity including negative values. This situation is most likely to happen when measuring low-level turbidity. Natural variations in all measurements, instrument, and non-instrument related, can lead to a negative result. Some other turbidimeters are designed to round up a negative number to 0.00 NTU, since a result of less than 0.00 NTU is theoretically impossible. However, in practice, these results are actually quite meaningful. The problem could be operator technique or sonde error. It could also indicate a problem with the low turbidity/turbidity-free water used for a blank or a problem with the calibration. If the meter rounds the negative result to 0.00 NTU, the user will not be alerted to a potential problem.

Overall, these statistics suggest that Kelligrews River experienced consistently low levels of turbidity throughout the deployment period, which is indicative of good water clarity and potentially favorable environmental conditions 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 environmental 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

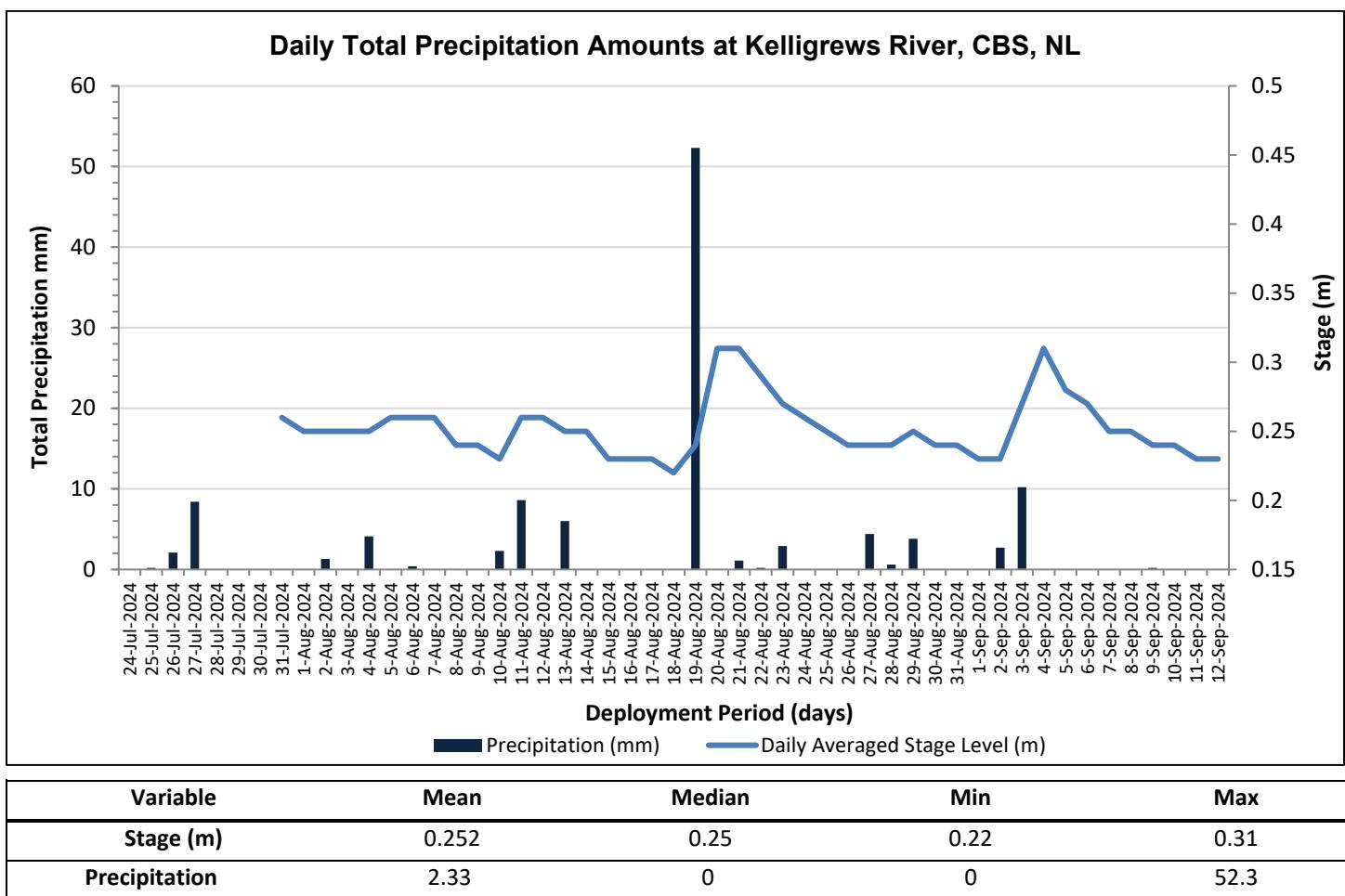


Figure 8: Daily total precipitation (mm) and average stage (m) of Kelligrews River, from July 24, 2024, to September 12, 2024, at CBS, NL.

The statistics for stage measurements and precipitation data for Kelligrews River provide valuable insights into the hydrological conditions during the observation period from July 24 to September 12, 2024. The mean stage of the river was approximately 0.252 meters, indicating a stable water level overall. The median stage was slightly lower at 0.25 meters, suggesting that the distribution of data is relatively symmetric with few extreme values.

The minimum and maximum stage measurements, at 0.22 and 0.31 meters respectively, indicate that the river experienced only minor fluctuations during this time, implying that there were no significant flood events or drought conditions affecting the river.

In contrast, the precipitation data reveals a different story. The mean precipitation was recorded at 2.33 mm, but the median was 0 mm, indicating that more than half of the days did not experience any measurable rainfall. This suggests that the overall conditions were relatively dry, with precipitation events being sporadic. Notably, the maximum recorded precipitation of 52.3 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.

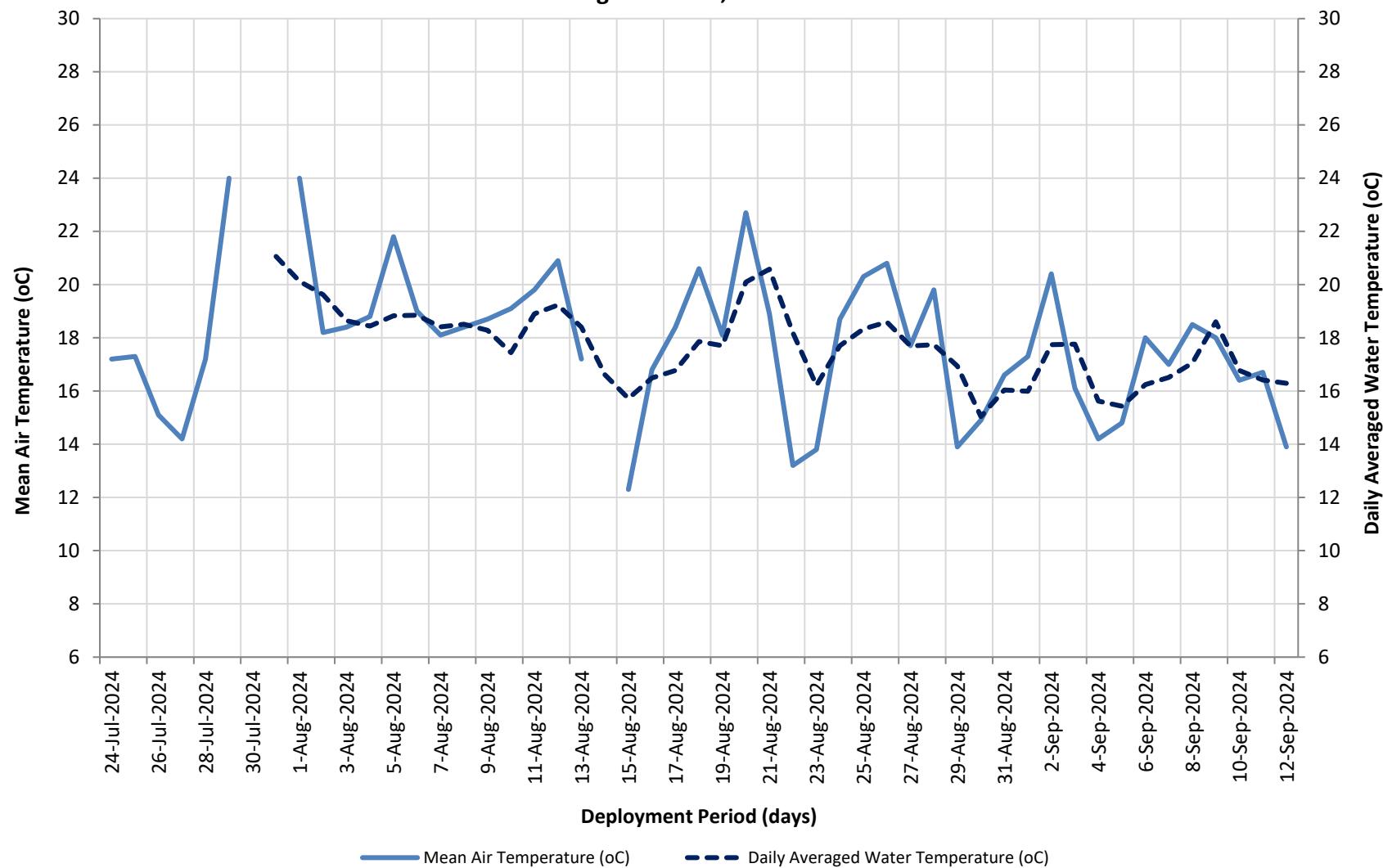
Conclusions and Path Forward

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, CBS**



APPENDIX B: QA/QC GRAB SAMPLE FIELD RESULTS



BUREAU
VERITAS

Your P.O. #: 224006869-3
Your C.O.C. #: NA, 2024-1715-00-SI-SP

Attention: Robert Richard Harvey

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Water Resources
PO Box 8700
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CANADA A1B 4J6

Report Date: 2024/08/02

Report #: R8261616

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4M9833

Received: 2024/07/26, 09:53

Sample Matrix: Drinking Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2024/07/30	ATL SOP 00142	SM 24 2320 B
Anions (1)	1	N/A	2024/07/30	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2024/07/31	ATL SOP 00020	SM 24 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2024/07/31	ATL SOP 00203	SM 24 5310B m
Conductance - water	1	N/A	2024/07/30	ATL SOP 00004	SM 24 2510B m
Fluoride	1	N/A	2024/07/30	ATL SOP 00043	SM 24 4500-F- C m
Hardness (calculated as CaCO ₃)	1	N/A	2024/07/30	ATL SOP 00048	Auto Calc
Mercury - Total (CVAA,LL)	1	2024/07/31	2024/08/01	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS	1	2024/07/29	2024/07/30	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2024/07/31	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2024/07/31	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2024/07/31	ATL SOP 00017	SM 24 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2024/07/31	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2024/07/30	ATL SOP 00003	SM 24 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2024/07/31	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2024/08/01	2024/08/01	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2024/07/29	ATL SOP 00203	SM 24 5310B m
Total Phosphorus (Colourimetric) (1)	1	2024/08/01	2024/08/01	CAM SOP-00407	SM 24 4500-P I
Total Suspended Solids	1	2024/07/29	2024/08/02	ATL SOP 00007	SM 24 2540D m
Turbidity	1	N/A	2024/07/31	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.



BUREAU
VERITAS

Your P.O. #: 224006869-3
Your C.O.C. #: NA, 2024-1715-00-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: 2024/08/02

Report #: R8261616

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4M9833

Received: 2024/07/26, 09:53

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Maryann Comeau, Customer Experience Supervisor/PM

Email: Maryann.COMEAU@bureauveritas.com

Phone# (902)420-0203 Ext:298

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For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Suzanne Rogers, General Manager responsible for Nova Scotia Environmental laboratory operations.

Total Cover Pages : 2
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Bureau Veritas Job #: C4M9833

Report Date: 2024/08/02

NL Department of Environment, Climate Change and
Municipalities

Your P.O. #: 224006869-3

Sampler Initials: LB

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZVM291 KELLIGREWS RIVER @KELLIVIEW								
CRESCENT								
Sampling Date	2024/07/24 10:56							
Matrix	DR							
Sample #	2024-1715-00-SI-SP							
Registration #	SA-0000							
RESULTS OF ANALYSES OF DRINKING WATER								
Calculated Parameters								
Hardness (CaCO ₃)	-	49	1.0	mg/L	N/A	2024/07/30		9540554
Nitrate (N)	-	0.15	0.050	mg/L	N/A	2024/07/31		9540558
Total dissolved solids (calc., EC)	-	170	1.0	mg/L	N/A	2024/07/31		9540475
Inorganics								
Conductivity	-	300	1.0	uS/cm	N/A	2024/07/30	LJV	9545652
Chloride (Cl ⁻)	-	64	1.0	mg/L	N/A	2024/07/30	VP2	9547232
Bromide (Br ⁻)	-	ND	1.0	mg/L	N/A	2024/07/30	VP2	9547232
Sulphate (SO ₄)	-	13	1.0	mg/L	N/A	2024/07/30	VP2	9547232
Total Alkalinity (Total as CaCO ₃)	-	26	2.0	mg/L	N/A	2024/07/30	LJV	9545654
Colour	-	40	5.0	TCU	N/A	2024/07/31	EMT	9545724
Dissolved Fluoride (F ⁻)	-	ND	0.10	mg/L	N/A	2024/07/30	LJV	9545655
Total Kjeldahl Nitrogen (TKN)	-	0.18	0.10	mg/L	2024/08/01	2024/08/01	RTY	9552155
Nitrate + Nitrite (N)	-	0.15	0.050	mg/L	N/A	2024/07/31	EMT	9545726
Nitrite (N)	-	ND	0.010	mg/L	N/A	2024/07/31	EMT	9545728
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2024/07/31	EMT	9546059
Dissolved Organic Carbon (C)	-	5.5	0.50	mg/L	N/A	2024/07/31	SSI	9549152
Total Organic Carbon (C)	-	6.1	0.50	mg/L	N/A	2024/07/29	MKY	9544123
pH	-	7.39		pH	N/A	2024/07/30	LJV	9545650
Total Phosphorus	-	ND	0.004	mg/L	2024/08/01	2024/08/01	VKH	9552090
Total Suspended Solids	-	ND	1.0	mg/L	2024/07/29	2024/08/02	ACK	9543949
Turbidity	-	0.60	0.10	NTU	N/A	2024/07/31	LJV	9548408
MERCURY BY COLD VAPOUR AA (DRINKING WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2024/07/31	2024/08/01	JEP	9548714
ELEMENTS BY ICP/MS (DRINKING WATER)								
Metals								
Total Aluminum (Al)	-	0.067	0.0050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Antimony (Sb)	-	ND	0.0010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Arsenic (As)	-	ND	0.0010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Barium (Ba)	-	0.052	0.0010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Boron (B)	-	ND	0.050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Calcium (Ca)	-	15	0.10	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Chromium (Cr)	-	ND	0.0010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Copper (Cu)	-	ND	0.00050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Iron (Fe)	-	0.45	0.050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Lead (Pb)	-	ND	0.00050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Magnesium (Mg)	-	2.9	0.10	mg/L	2024/07/29	2024/07/30	MTZ	9543748



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Sampler Initials: LB

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZVM291 KELLIGREWS RIVER @KELLIVIEW								
CRESCENT								
Sampling Date	2024/07/24 10:56							
Matrix	DR							
Sample #	2024-1715-00-SI-SP							
Registration #	SA-0000							
ELEMENTS BY ICP/MS (DRINKING WATER)								
Metals								
Total Manganese (Mn)	-	0.24	0.0020	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Nickel (Ni)	-	ND	0.0020	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Phosphorus (P)	-	ND	0.10	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Potassium (K)	-	0.99	0.10	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Selenium (Se)	-	ND	0.00050	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Sodium (Na)	-	36	0.10	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Strontium (Sr)	-	0.063	0.0020	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Uranium (U)	-	0.00022	0.00010	mg/L	2024/07/29	2024/07/30	MTZ	9543748
Total Zinc (Zn)	-	ND	0.0050	mg/L	2024/07/29	2024/07/30	MTZ	9543748



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GENERAL COMMENTS

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

Package 1	8.5°C
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Results relate only to the items tested.



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VALIDATION SIGNATURE PAGE

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

Ernlie Publicover, Scientific Specialist

Janah Rhyno, Scientific Specialist

Louise Harding, Team Lead



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