Real Time Water Quality Deployment Report

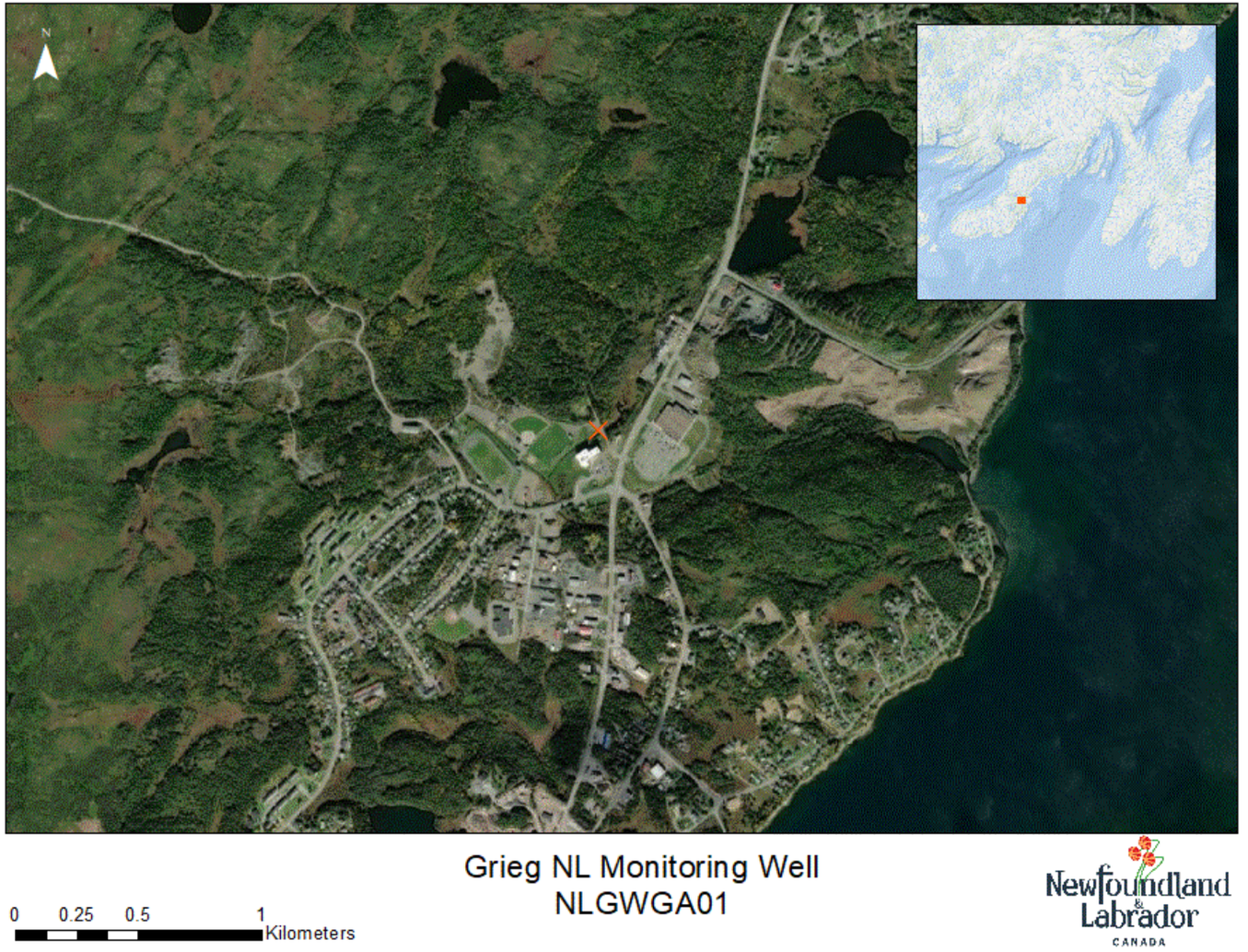
Grieg NL Monitoring Well

NLGWGA01

2024-08-06 to 2024-12-03

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

Grieg NL Monitoring Well



The Water Resources Management Division (WRMD) in partnership with Grieg NL Nurseries Ltd, maintain a real-time water quality groundwater monitoring station in Marystown, NL. The station is located near the YMCA and the Track and Field Complex.

Grieg Seafood has two wells: a primary production well responsible for supplying fresh water to the facility on demand, and a secondary well used for monitoring and backup purposes, housing the WRMD monitoring equipment. To ensure the effective operation of the pump installed in the backup well, the pump is initiated approximately once per week. This can result in variations and abrupt changes in the data collected by the water monitoring instrument.

Quality Assurance and Quality Control

As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey. With the exception of water quantity data (elevation), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Corrected data can be obtained upon request.

Parameter	Excellent	Good	Fair	Marginal	Poor
pH	≤ ± 0.2 units	≤ ± 0.21 - 0.5 units	≤ ± 0.51 - 0.8 units	≤ ± 0.81 - 1 units	> ± 1 units
Specific conductance	≤ ± 3 µS/cm or ≤ ± 3%, whichever is greater	≤ ± 3.1-10 µS/cm or ≤ ± 3.1-10%, whichever is greater	≤ ± 10 - 15 µS/cm or ≤ ± 10.1-15 %, whichever is greater	≤ ± 15.1 - 20 µS/cm or ≤ ± 15.1-20 %, whichever is greater	> ± 20 µS/cm or > ± 20 %, whichever is greater

At the beginning of the deployment period, grab samples are collected to compare against initial in-situ logged data. Values for pH and specific conductivity are compared between the instrument and the grab sample**.** Based on the degree of difference between parameters recorded by the Field Sonde and grab sample results at deployment, a qualitative statement is made on the data quality.

There are a few circumstances which may cause QA/QC rankings below excellent. Typically when the well is pumped to provide water for the grab sample, the pumping can disturb the water column including any diluted salts and inorganic materials that are present in the groundwater. Additionally, in-situ instrument measurements are recorded shortly after the freshly calibrated instrument is deployed. The limited time for the sonde to reach equilibrium with its surroundings can occasionally lead to variations in values between grab sample results and instrument measurements.

The temperature sensor on any sonde is the most important. All other parameters can be divided into subgroups of: temperature dependent, temperature compensated, and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature 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.

Fair

pH Grab Sample Ranking

Excellent

Spec. Conductivity Grab Sample Ranking

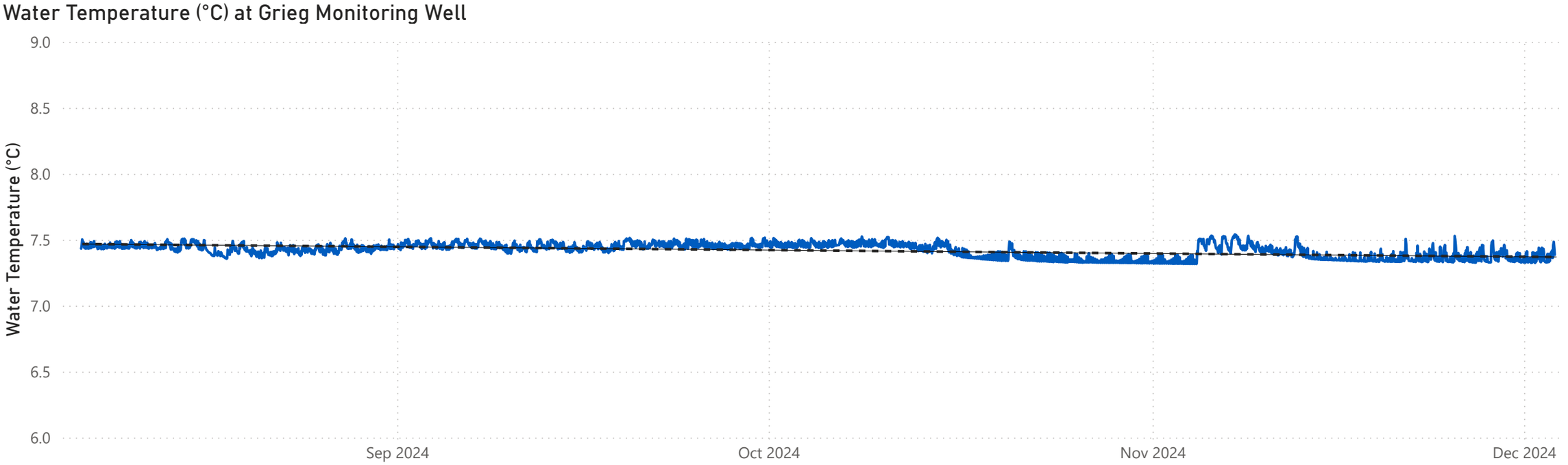
PARAMETER	Field Value	Grab Sample	Difference
pH	7.57	8.02	0.64
Specific Conductivity (µS/cm)	298.06	300.00	1.94

When comparing the field sonde data to grab sample data, pH ranked fair while specific conductivity ranked excellent.

Water Temperature

7.42	7.43	7.32	7.54
Average (°C)	Median (°C)	Minimum (°C)	Maximum (°C)

Water temperature ranged from 7.32°C to 7.54°C during the deployment period. The median water temperature across the deployment is 7.42°C. Grieg's monitoring station is a groundwater well; generally, the water temperatures will remain consistent. This is evident during this deployment with the small range between minimum and maximum values. The water temperatures did not fluctuate significantly across the deployment.

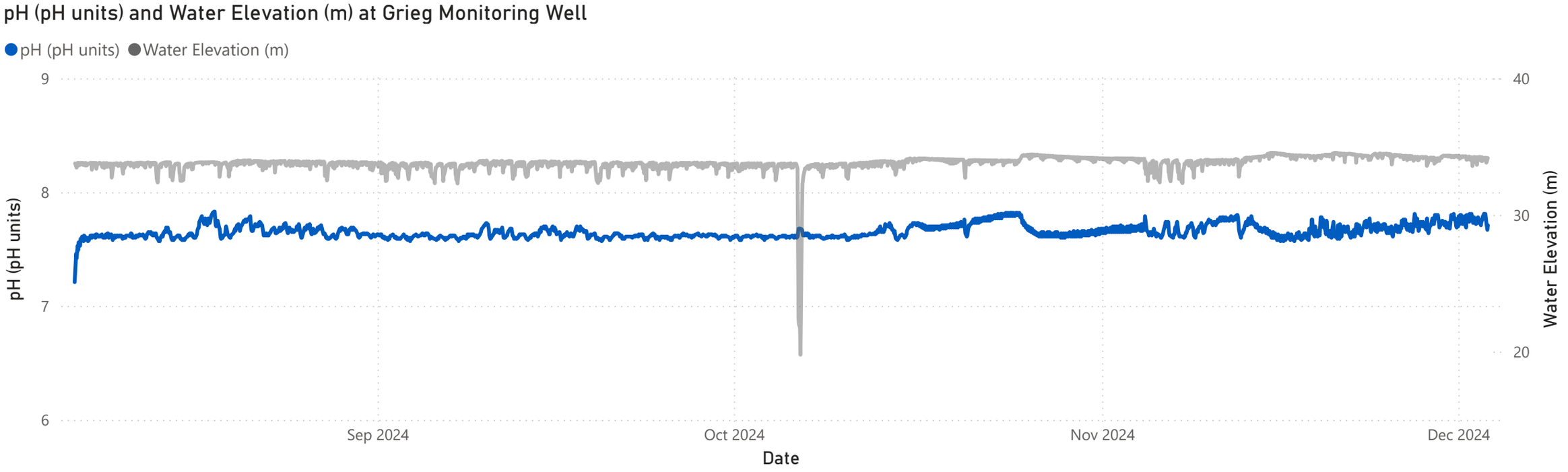


pH

7.65	7.63	7.21	7.83
Average of PH	Median of PH	Min of PH	Max of PH

Throughout the deployment period, pH values ranged between 7.21 pH units and 7.83 pH units. pH remained consistent for the duration of the deployment, with a median of 7.65 pH units. Comparison of the grab sample data for pH indicated the grab sample of 8.02 pH, was slightly higher than what was recorded in-situ at 7.57 pH. It would be expected that these two pH results would vary slightly. The well was pumped throughout the morning before the sample was taken while the in-situ reading was recorded shortly after the pumping of the well had stopped.

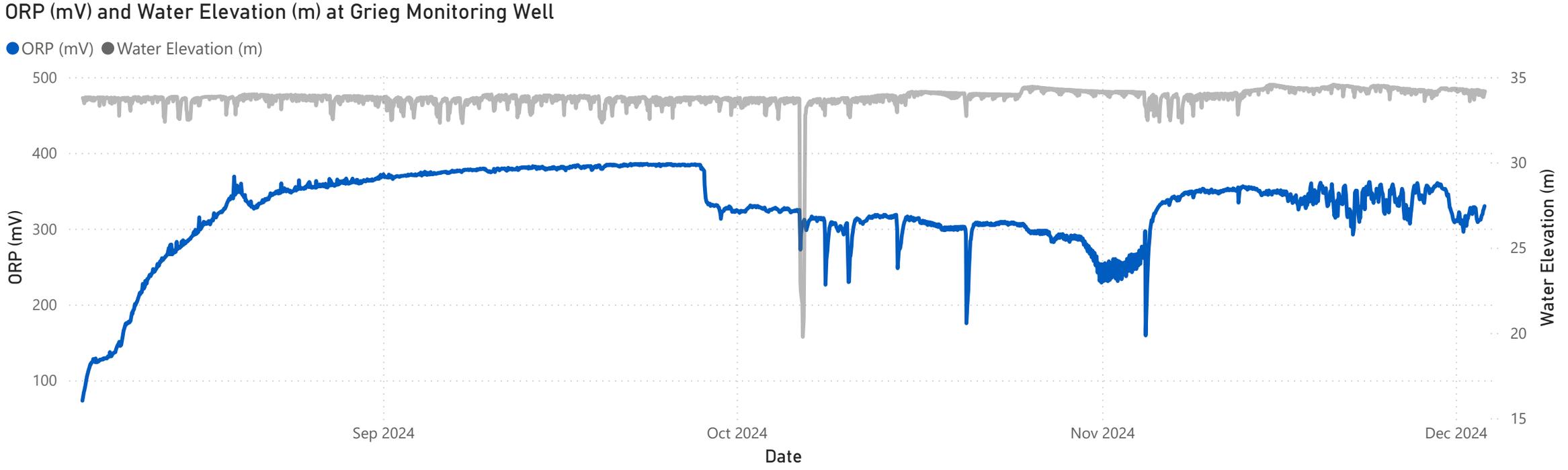
Small variations in pH were likely influenced by the pumping and recharging processes within the aquifer. As the well refills and the water level stabilizes, short-term fluctuations in pH are expected. This is illustrated in the graph below, where pH changes correspond to shifts in water elevation.



Oxidation-Reduction Potential (ORP)

325.72	335.10	73.10	385.70
Average ORP (mV)	Median ORP (mV)	Min ORP (mV)	Max ORP (mV)

Throughout the deployment period, ORP values ranged between 73.10 mV and 385.70 mV with a median of 335.10 mV. ORP may require days to weeks to reach equilibrium with its surroundings, as illustrated in the figure below, where it initially rises at the start of deployment before stabilizing. The sharp declines in ORP are often synchronized with drops in water elevation. Fluctuations in water elevation may cause mixing of oxidized surface water and deeper, reduced groundwater. Additionally, there could be an influx of water with different chemical properties. Both scenarios can cause shifts in ORP. ORP is individual and specific to each water body and gathering background data is essential in understanding what the changes in the data represent.

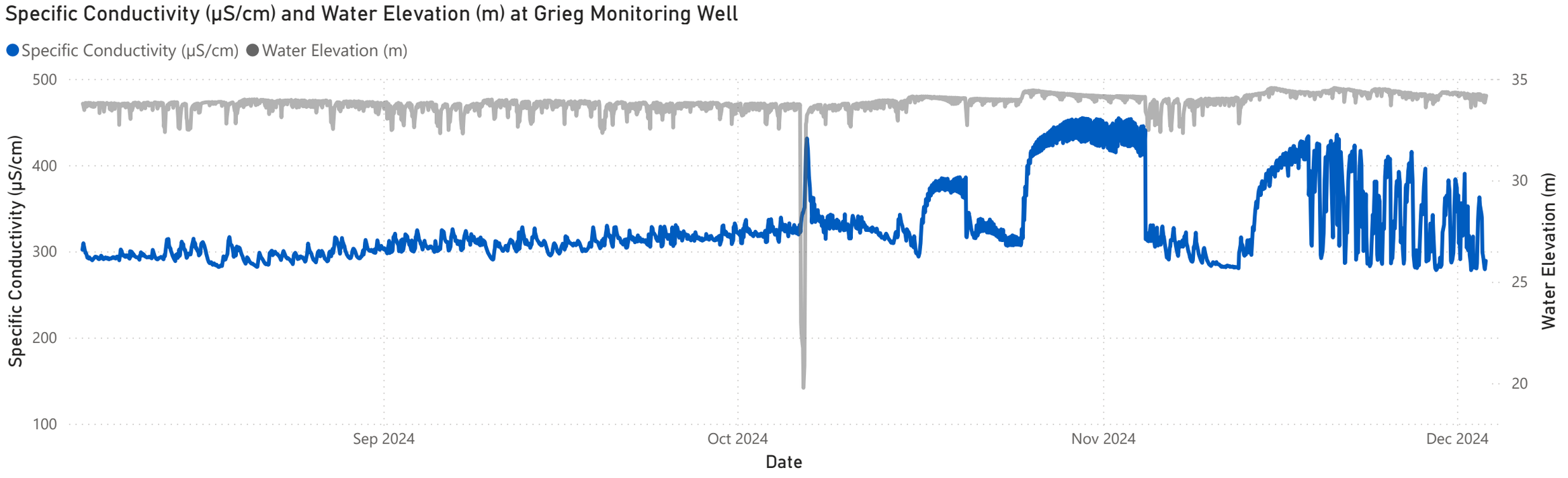


Specific Conductivity

329.13	313.68	278.14	454.66
Average µS/cm	Median µS/cm	Minumum µS/cm	Maximum µS/cm

During the deployment, specific conductivity levels were within 278.14 µS/cm and 454.66 µS/cm ,with a median of 313.68 µS/cm. Comparison of the grab sample data for specific conductivity indicated the grab sample of 300.00 µS/cm, was similar to what was recorded in-situ at 298.06 µS/cm.

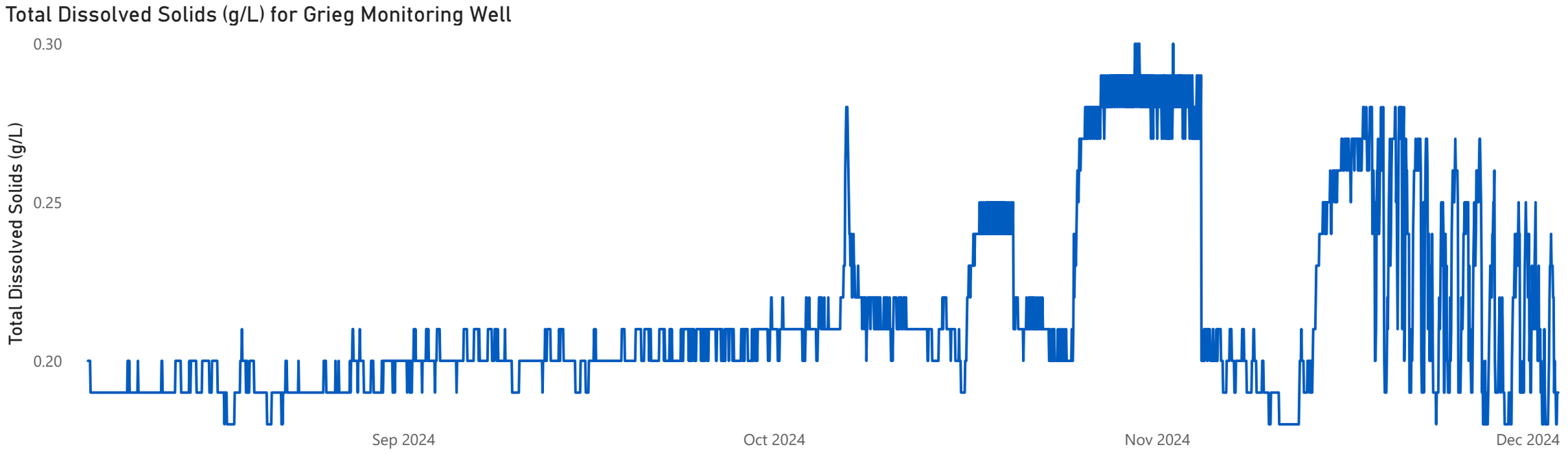
Specific conductivity remained relatively stable for the first half of the deployment period with little variation. Fluctuations are more frequent in the later half of the deployment with sharp drops and subsequent increases that coincide with water elevation changes. The large conductivity spike that coincides with the elevation drop in the beginning of October can likely be explained by pumping of the well and conductivity increasing due to the disturbed water column after pumping. Often, the sharp drops in conductivity coincide with declines in water elevation, suggesting a potential influx of water with lower ion concentrations, likely from recharge events. When water elevation recovers, conductivity tends to increase again, potentially indicating the return of groundwater with higher ion concentrations. The increasing variability toward the end of the monitoring period may be a result of more active recharge or water mixing from different zones within the aquifer (i.e fresh recharge water with lower conductivity vs. deep mineral-rich water with higher conductivity).



Total Dissolved Solids (TDS)

0.21	0.20	0.18	0.30
Average TDS (g/L)	Median TDS (g/L)	Min TDS (g/L)	Max TDS (g/L)

For the deployment period, Total Dissolved Solids ranged within 0.18 g/L to 0.30 g/L, with an average of 0.21 g/L. The water quality instrument is programmed to calculate an estimated TDS value from a conductivity value. TDS data will mirror the movement of the specific conductivity data, however TDS is calculated in g/L.



Water Elevation (m)

33.81	33.84	19.77	34.56
Average (m)	Median (m)	Minimum (m)	Maximum (m)

For the deployment period, water elevation ranged within 19.77 m to 34.56 m, with a median of 33.84 m. Generally, water elevation within a groundwater well is consistent if the water is not drawn for use. This well is intermittently pumped, therefore there will be variations in water level as seen on the graph below. The large drop in elevation towards the beginning of October can be attributed to pumping of the monitoring well. The increased variation towards the end of the monitoring period can likely be a result of pumping activity or groundwater recharge and discharge.