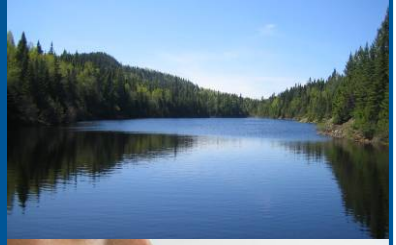







Real-Time Water Quality Annual Report

Northern Harvest Smolt Ltd.

January 1st to December 31st, 2024

Newfoundland Labrador

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

Introduction

- The Real-Time Water Quality (RTWQ) Monitoring Network near Stephenville, NL consists of three groundwater well monitoring stations funded by Northern Harvest Smolt Ltd. The program is a partnership between Northern Harvest and the Newfoundland & Labrador Department of Environment and Climate Change (ECC).

- Each of the three stations consists of groundwater water quality and quantity monitoring equipment (water level) which transmits data in near real-time every 2-3 hours.

- The well stations are known as: MW5/6; FMW10 and FMW12. They were installed in November 2019 by ECC staff and first deployed on November 6th, 2019. The instruments remain in the monitoring wells year-round unless removed temporarily for maintenance and calibration.

- These stations measure the following water parameters: temperature, pH, specific conductivity, total dissolved solids (TDS), oxidation-reduction potential (ORP) and water quantity (depth). Parameters are recorded on an hourly basis during the deployment period and are available in real-time online:

  NLGWMW5/6: https://www.mae.gov.nl.ca/wrmd/ADRS/v6/Template_Station.asp?station=NLGWMW56
  NLGWFMW10: https://www.mae.gov.nl.ca/wrmd/ADRS/v6/Template_Station.asp?station=NLGWFMW10
  NLGWFMW12: https://www.mae.gov.nl.ca/wrmd/ADRS/v6/Template_Station.asp?station=NLGWFMW12

- MW5/6 – This 50mm well is one of the thirteen wells that make up the Northern Harvest near field monitoring well network within 500m of the water supply area. This is a relatively shallow well at 2.92m.

- FMW10 - This 50mm well is one of the five wells that make up the Northern Harvest far-field monitoring network set up outside the 500m radius of the hatchery. This well is relatively deep at 22.54m.

- FMW12 – This 152mm well is one of the thirteen wells that make up the Northern Harvest near-field monitoring network within 500m of the water supply area. This well is relatively deep at 29.25m.

- The purpose of this network is to monitor, process, and distribute water quality/quantity data to Northern Harvest Smolt Ltd. and ECC for assessment and management of water resources, as well as to provide an early warning for any potential or emerging water issues, allowing mitigative measures to be implemented in a timely manner.
- ECC will provide Northern Harvest Smolt Ltd. with deployment and annual reports. Data is also available in near real-time on ECC's website.

Figure 1: Map of Northern Harvest Smolt Ltd. Real Time Water Monitoring Network

- Gaps in the water quality data are the result of transmission loss by the stations or the removal of inaccurate data due to ongoing station maintenance during that time period.
- The first deployment for 2024 began in July 2023. The instruments were next removed for full maintenance in March 2024, followed by July 2024 and December 2024.

(a)MW5/6 **(b) FMW10**

(c) FMW12

Figure 2: Northern Harvest Real Time Monitoring Network: (a) MW5/6, (b) FMW10, (c) FMW12

Maintenance and Calibration

- To ensure accurate data collection of the real time groundwater monitoring network, maintenance and calibration of the water quality instrumentation is performed approximately every four months.
- Maintenance includes a thorough cleaning of each instrument and replacement of any small sensor parts that are damaged or unsuitable for reuse. Once the instrument is cleaned, ECC staff carefully calibrate each sensor attachment for pH, specific conductivity and ORP to ensure accurate data collection.
- Installation and removal dates for 2024 are summarized in Table 1 below.

Table 1: Water quality instrument deployment start and end dates for 2024

Station	Installation	Removal	Duration (days)
MW5/6	July 19, 2023	March 13, 2024	234
	March 14, 2024	July 09, 2024	115
	July 10, 2024	December 04, 2024	144
	December 06, 2024	Present	-
FMW10	July 19, 2023	March 13, 2024	234
	March 14, 2024	July 09, 2024	115
	July 10, 2024	December 04, 2024	144
	December 06, 2024	Present	-
FMW12	July 19, 2023	March 13, 2024	234
	March 14, 2024	July 09, 2024	115
	July 10, 2024	December 04, 2024	144
	December 06, 2024	Present	-

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.
- During the maintenance phase, water levels are measured manually and a volume equivalent to three well casings is purged from each well prior to re-installation and the collection of grab samples. This process flushes stagnant water from the wells and ensures that the water being observed is aquifer water.
- After full purging of the well, the sonde is deployed and initial field readings are recorded. A grab sample is taken when possible to compare the values of pH and specific conductance against the deployed sonde's initial values. Due to hold times for these parameters being exceeded, an QA sonde will be used going forward as an additional form of quality assurance.
- Deployment comparison rankings for the stations are summarized in Table 2.

Table 2: QA/QC comparison rankings for Northern Harvest Stations

Station	Date	Action	Instrument #	pH	Specific Conductivity
MW56	July 19, 2023	Deployment	19D105282	Marginal	Fair
	March 14, 2024	Deployment	19D105281	Fair	Fair
	July 10, 2024	Deployment	19E100387	Poor	Marginal
	December 05, 2024	Deployment	19D105282	Poor	Excellent
FMW10	July 19, 2023	Deployment	19D105281	Fair	Excellent
	March 14, 2024	Deployment	19E100387	Marginal	Excellent
	July 10, 2024	Deployment	19D105282	Good	Excellent
	December 05, 2024	Deployment	19D105281	Fair	Excellent
FMW12	July 19, 2023	Deployment	19E100387	Good	Fair
	March 14, 2024	Deployment	19D105282	Good	Good
	July 10, 2024	Deployment	19D105281	Fair	Good
	December 06, 2024	Deployment	19E100387	Fair	Good

Data Interpretation

- The following graphs and discussion illustrate water quality and level related events from January 1st to December 31st, 2024 at Northern Harvest Smolt facility.
- All data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Corrected data can be obtained upon request.

Water Temperature

- In 2024, water temperature ranged from 3.68°C to 14.37°C within the real-time well network (Table 3).
- MW5/6 had the largest range of water temperatures, reaching a low in March and peaking in September, with a range of 10.69°C over the course of 2024.
- At FMW10, water temperature gradually decreased throughout the year (Figure 3).
- FMW12 was very stable throughout the year, varying within a small range with a median of 6.94 (Figure 3).

Table 3: Water Temperature (°C) Summary Statistics from the Well Network

	MW5/6	FMW10	FMW12
MIN.	3.68	6.06	6.87
MAX.	14.37	9.19	7.06
MEDIAN	8.94	7.41	6.94

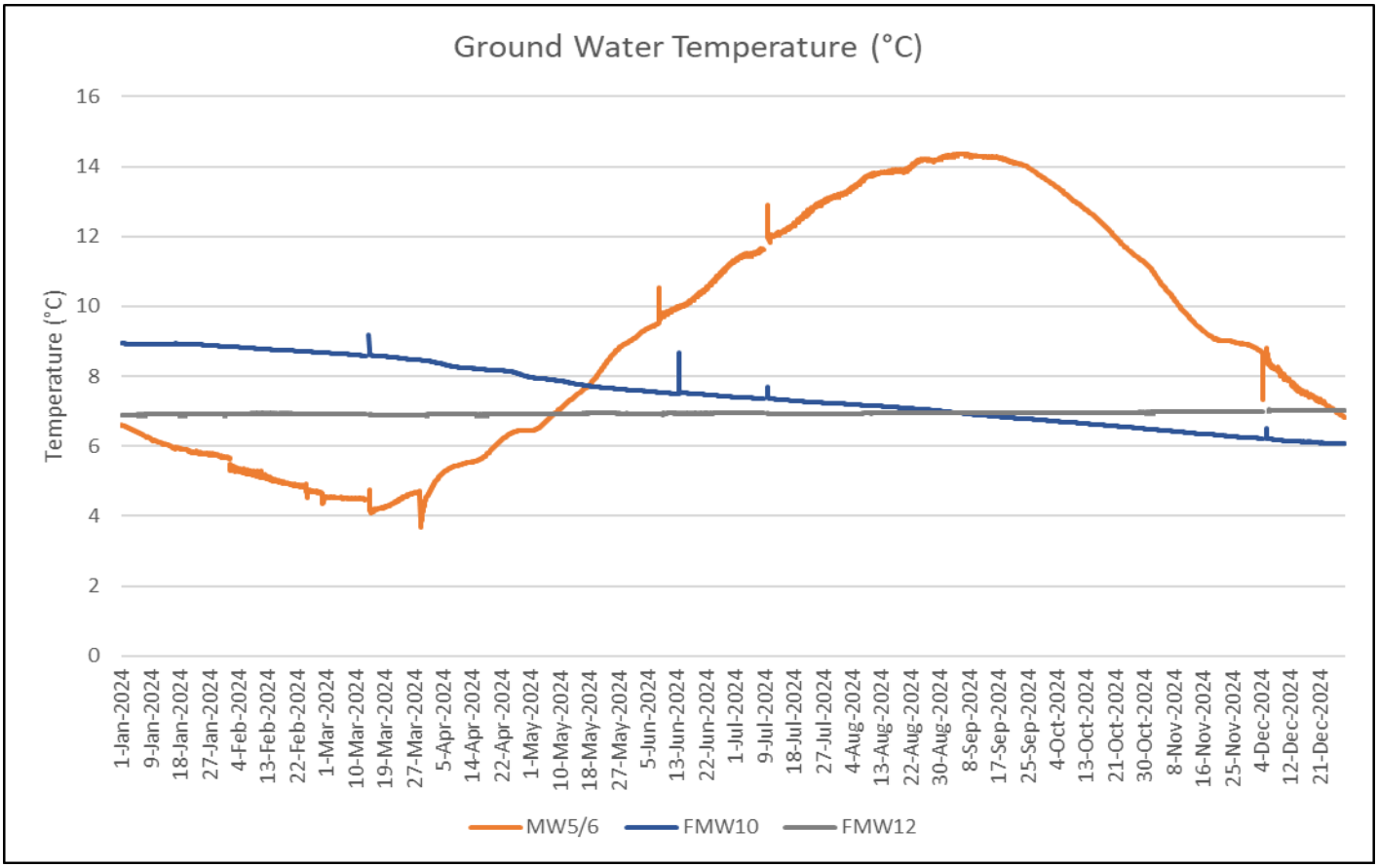

Figure 3: Water Temperature (°C) – Northern Harvest Smolt Ltd. Network

Water Depth

- During the deployment, MW5/6 and FMW12 were relatively stable with daily fluctuations within a small range while FMW10 showed a greater range of fluctuations and slight decreasing trend throughout 2024 (Table 4).
- FMW10 showed the most variability within the network.

Table 4: Water Elevation (m) Summary Statistics from the Well Network

	MW5/6	FMW10	FMW12
MIN.	1.54	6.29	5.88
MAX.	2.46	8.44	7.18
RANGE	0.92	2.15	1.30
MEDIAN	1.90	7.18	6.57

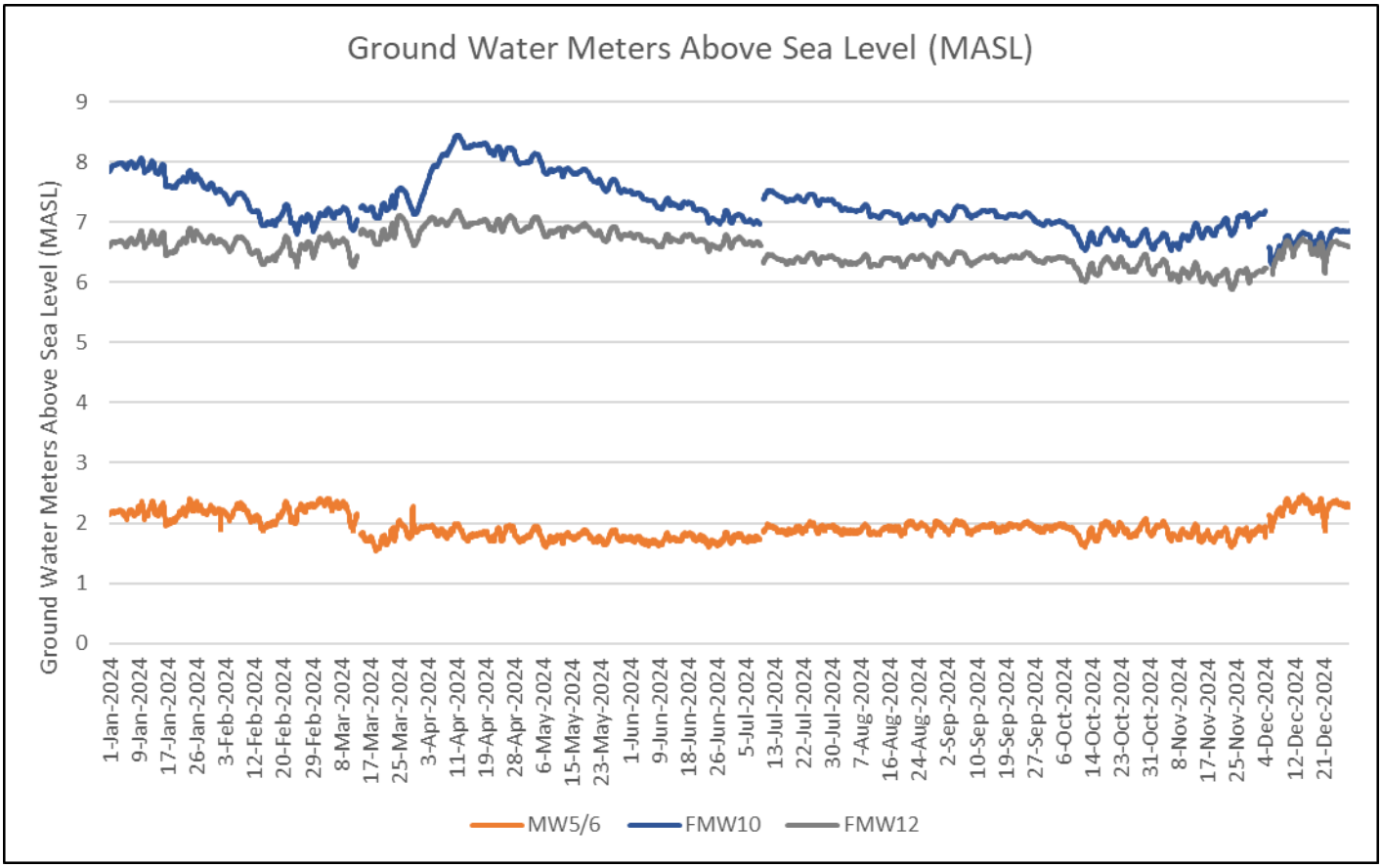

Figure 4: Water Elevation (masl) – Northern Harvest Smolt Ltd. Network

pH

- In 2024, pH ranged from 5.8 (at MW5/6) to 8.15 (at FMW12) pH units within the real-time well network (Table 5).
- All wells in the network displayed similar variability throughout the 2024 deployments (Figure 5).

Table 5: pH (pH units) Summary Statistics from the Well Network

	MW5/6	FMW10	FMW12
MIN.	5.8	7.15	7.53
MAX.	6.45	7.62	8.15
MEDIAN	6.02	7.52	7.89

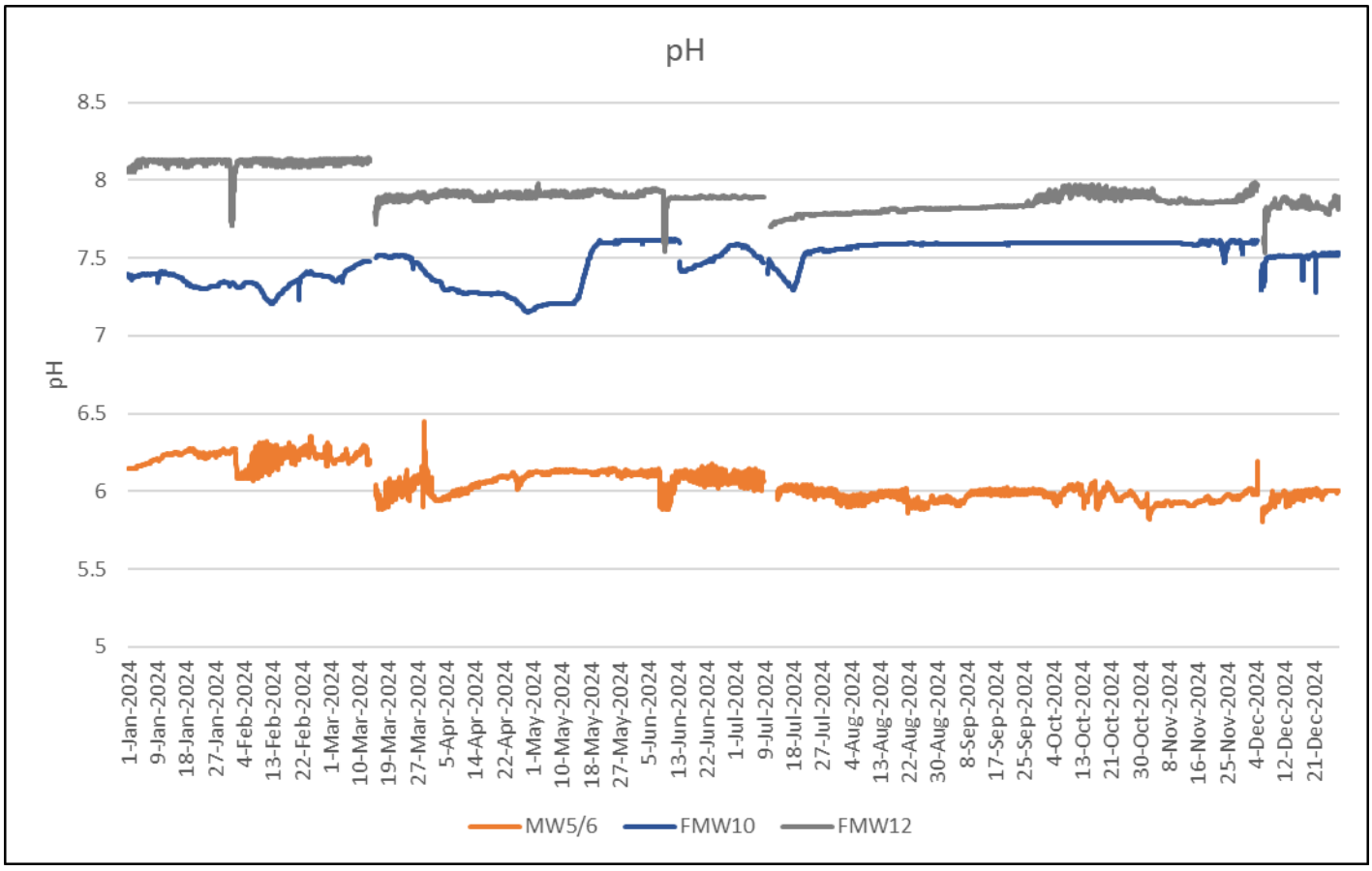

Figure 5: pH – Northern Harvest Smolt Ltd. Network

Specific Conductance and TDS

- In 2024, specific conductance ranged from 68.78 µS/cm to 869.84 µS/cm within the real-time well network (Table 6).
- Specific conductance at FMW12 shows little variation while MW5/6 and FMW10 fluctuate frequently during the 2024 deployments (Figure 6).

Table 6: Specific Conductance (µS/cm) & TDS (g/L) Summary Statistics from the Well Network

	MW5/6	FMW10	FMW12		MW5/6	FMW10	FMW12
SPECIFIC CONDUCTANCE				**TOTAL DISSOLVED SOLIDS**			
MIN.	68.78	378.19	327.63	**MIN.**	0.04	0.25	0.21
MAX.	373.26	869.84	349.53	**MAX.**	0.24	0.78	0.23
MEDIAN	113.06	447.12	339.37	**MEDIAN**	0.07	0.29	0.22

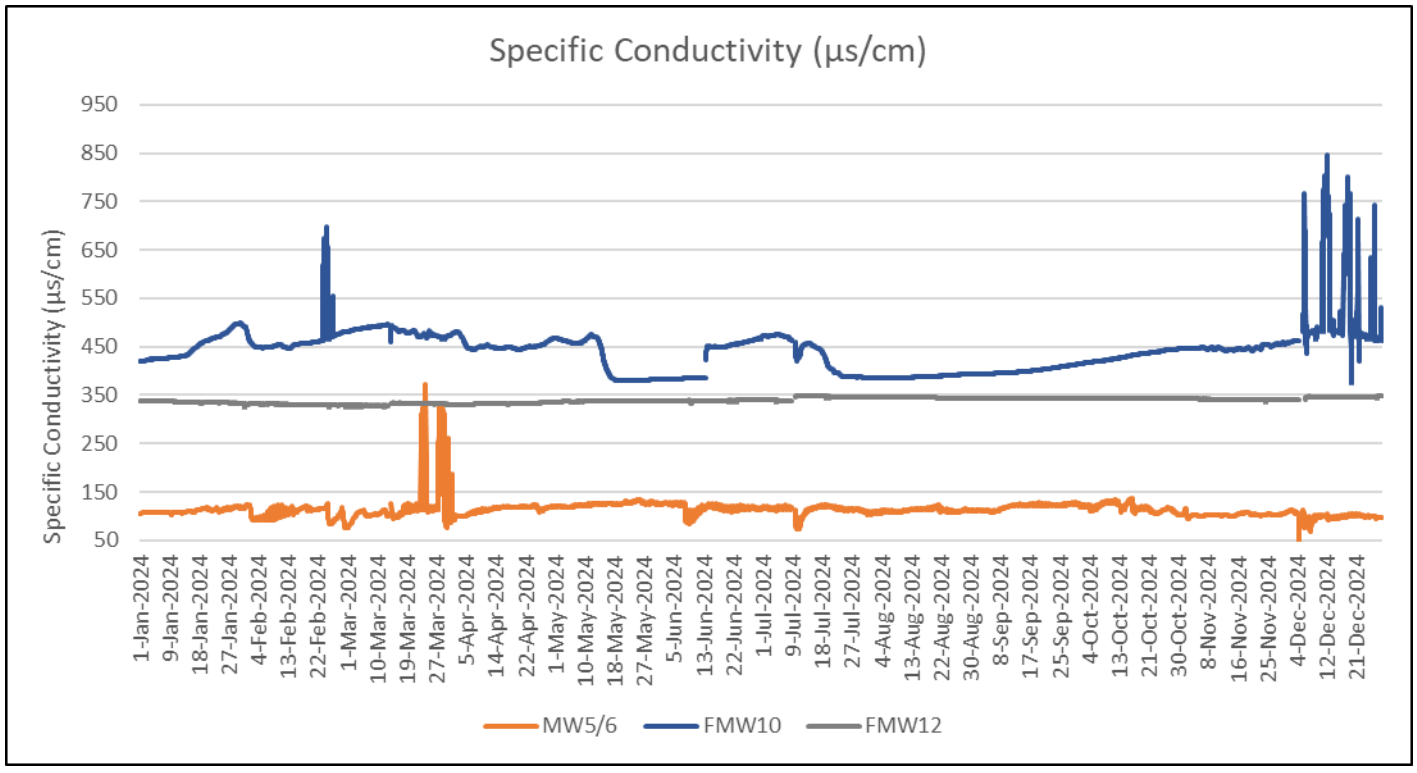

Figure 6: Specific Conductance – Northern Harvest Smolt Ltd. Network

- During 2024, total dissolved solids (TDS) ranged from 0.04 mg/L to 0.78 mg/L within the real time well network (Table 6).
- TDS varied minimally at FMW12 in 2024. At FMW10 and MW5/6, TDS varied more frequently and to a larger degree during the 2024 deployments. (Figure 7).

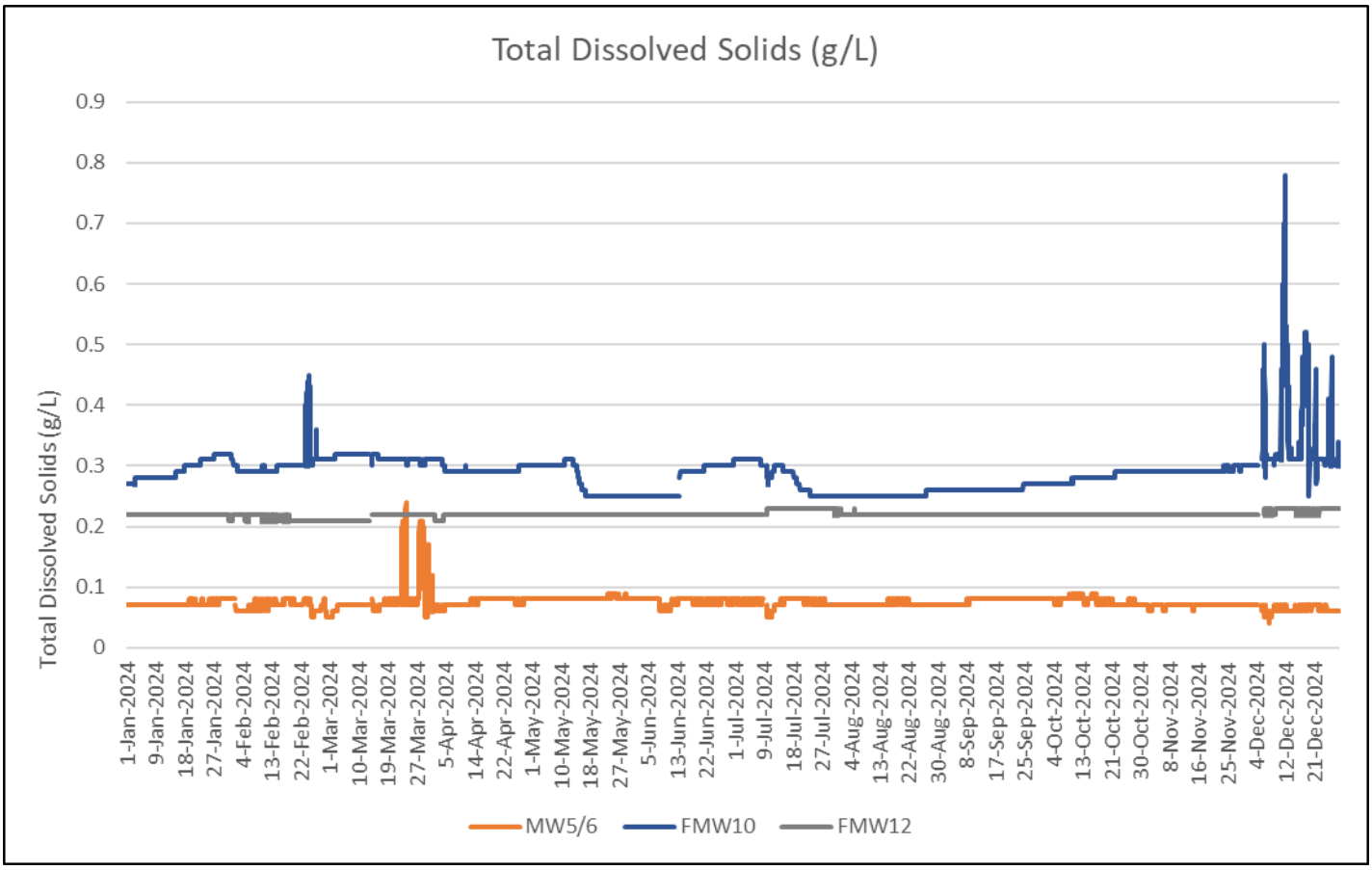

Figure 7: Total Dissolved Solids – Northern Harvest Smolt Ltd. Network

Oxidation – Reduction Potential (ORP)

- During 2024, oxidation-reduction potential (ORP) ranged from -484.4 mV to 526.25 mV within the real time well network (Table 7).
- During the 2024 deployment year, FMW12 appeared to be oxidative in nature while MW5/6 and FMW10 exhibited large fluctuations and were both reductive and oxidative.

Table 7: Oxidation-Reduction Potential (ORP) Summary Statistics from the Well Network

	MW5/6	FMW10	FMW12
MIN.	-293.03	-484.4	113.05
MAX.	482.03	526.25	413.55
MEDIAN	49.85	405.61	380.27

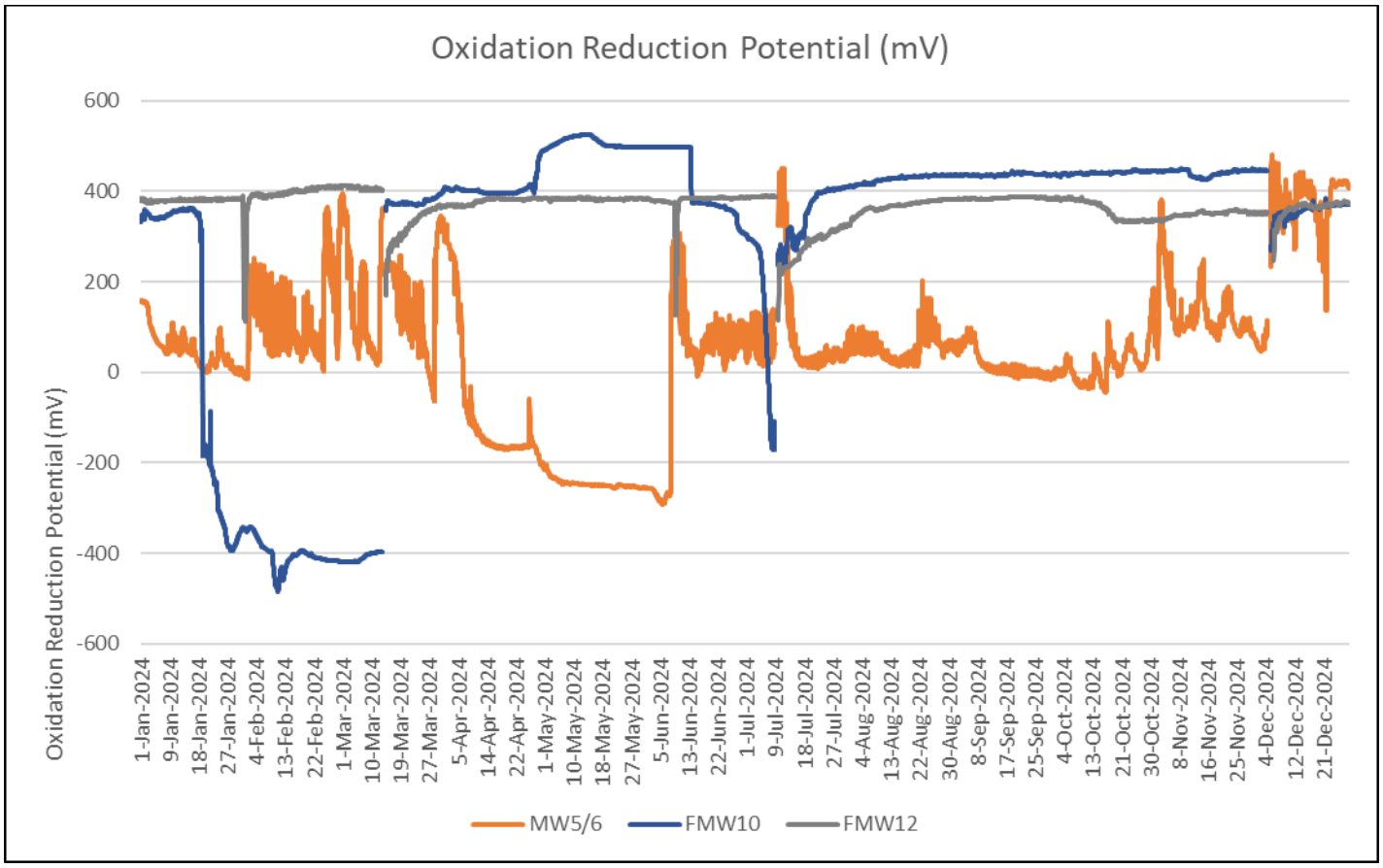

Figure 8: Oxidation-Reduction Potential (ORP) – Northern Harvest Smolt Ltd. Network

Conclusions

- The real-time water quality and quantity monitoring network at Northern Harvest Smolt Ltd was established on November 6, 2019, when instruments were initially deployed at each of the three wells in the network: MW5/6, FMW10, and FMW12.
- Since initial deployment, data has been monitored closely to determine if the instruments are accurately placed in the well casings and if there are other issues such as sensor errors.
- QA/QC rankings were obtained when grab samples could be collected. Going forward a QA sonde will be used as an additional method of quality assurance.
- Water temperature at MW5/6 displayed the most variability in the network due to seasonal temperature changes, while temperatures at FMW10 displayed a decrease and FMW12 was stable throughout 2024.
- Over the course of the year, water depth was relatively stable at both MW5/6 and FMW12, while the data illustrates a slight decrease at FMW10. All wells in the network displayed a similar variability throughout the 2024 deployments.
- pH at MW5/6 was slightly acidic and showed moderate variability. pH values at FMW10 and FMW12 were slightly basic with similar variability.
- Specific conductivity was generally lowest at MW5/6 with some variability. Levels at FMW10 showed moderate variability and peaked in December. FMW12 was relatively stable throughout the year.
- During the 2024 deployment year, FMW12 appeared to be oxidative in nature while MW5/6 and FMW10 exhibited large fluctuations and were both reductive and oxidative.
- During 2024, the instruments performed well with few issues.

Path Forward

- Staff will continue to monitor the data for issues.
- If necessary, deployment techniques will be evaluated and modified, ensuring secure and suitable conditions for RTWQ monitoring.
- ECC will continue to work on its Automatic Data Retrieval System (ADRS), to incorporate new capabilities in data management and data display.
- Open communication lines will continue to be maintained between ECC and Northern Harvest Smolt Ltd in order to respond to emerging issues on a proactive basis. Northern Harvest Smolt Ltd. will receive deployment reports and an annual report summarizing the events of the deployment season.

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Appendix 1: Air Temperature and Precipitation at Stephenville, NL