Memorandum to the Council of

Corporation of the Municipality of Temagami

Subject: BIOFIXE Modules Performance – Temagami North Aerated Lagoon (2022 – 2024)

Memo No: 2025-M-107

Date: May 8, 2025

Attachment: Appendix A – Technologies Ecofixe -Performance Report for Temagami North Lagoon BIOFIXE Modules (July 2022 – December 2024)

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Recommendation

BE IT RESOLVED THAT Council receives Memo 2025-M-107, including Appendix A, as presented.

Contents

1. Executive Summary

The BIOFIXE system, installed at the Temagami North aerated lagoon in 2022, exceeded performance expectations in 2024:

- Achieved 95.0% BOD removal and 94.5% TAN removal efficiency
- Maintained compliance with effluent limits, even during seasonal high flow periods (March–April and November 2024)

Key challenges identified:

- Missing Dissolved Oxygen (DO), pH, and temperature data after January 2024
- Lack of Cross Chamber (Cell 1 effluent) sampling, limiting evaluation of primary lagoon cell

2. Background and Purpose

In July 2022, three BIOFIXE modules developed by Technologies Ecofixe were installed at the Temagami North aerated lagoon system as part of a federally funded innovation project. The pilot was funded by Innovation Solutions Canada and administered through the Ontario Clean Water Agency (OCWA) to enhance cold-climate lagoon performance using biofilm-based modular technology.

System configuration:

- Two upstream modules for Biochemical Oxygen Demand (BOD) reduction
- One downstream module for Total Ammoniacal Nitrogen (TAN) removal

Sampling and laboratory work were completed by OCWA, with analysis and reporting by Technologies Ecofixe. The 2024 Performance Report, submitted in April 2025, summarizes system performance between July 2022 and December 2024, with a focus on 2024 results.

While treatment results were strong, the report notes key monitoring limitations:

- No data for Dissolved Oxygen (DO), pH, or temperature beyond January 2024
- No samples collected from the Cross Chamber (Cell 1 effluent)

3. Performance Overview – 2024

3.1. Hydraulic Loading

- Average daily flow: 298.5 m^3/day (±134.7)
- Peak daily flow: 626.7 m^3/day in November 2024 (65% above design capacity)
- Flow exceedance periods:
  - April–May 2023
  - March–April and November 2024

3.2. BOD (Biochemical Oxygen Demand) Removal

- Influent concentration (average): 52.3 mg/L
- Effluent concentration (average): 3.6 mg/L
- Maximum effluent concentration: 17.2 mg/L (April 2024)
- Removal efficiency: 95.0%
- Compliance: Effluent remained well below the provincial discharge limit of 25 mg/L

3.3. TAN (Total Ammoniacal Nitrogen) Removal

- Influent concentration (average): 15.5 mg/L
- Effluent concentration (average): 0.7 mg/L
- Maximum effluent concentration: 2.95 mg/L (April 2024)
- Removal efficiency: 94.5%
- Compliance: Generally below MECP threshold of 3.0 mg/L, though April 2024 approached the limit

4. Operational Data Gaps

- Dissolved Oxygen (DO):
  - No measurements reported in 2024
  - Required minimum for TAN removal is ≥4 mg/L
- pH and Temperature:
  - No data available after January 2024
  - Important for microbial process control
- Cross Chamber Sampling:
  - No effluent data collected from Cell 1
  - Limits evaluation of first-stage lagoon performance

5. Operational and Planning Recommendations

- Enhance Monitoring
  - Resume regular tracking of Dissolved Oxygen, pH, and temperature
  - Reinstate Cross Chamber (Cell 1) sampling to assess early-stage lagoon performance
- Mitigate Hydraulic Overload
  - Conduct an Inflow/Infiltration (I&I) study to identify and reduce seasonal surges
  - Assess feasibility of infrastructure upgrades such as equalization basins or additional storage
- Expand Innovation
  - Consider piloting BIOFIXE modules at the Temagami South Lagoon
  - Pursue external funding from FCM's Green Municipal Fund, Innovation Canada, or similar programs

6. Conclusion

The Temagami North Lagoon BIOFIXE system demonstrated outstanding treatment performance in 2024, consistently achieving high BOD and TAN removal rates while meeting compliance targets, even under peak hydraulic loads. Addressing identified monitoring and flow-related issues will support ongoing reliability and transparency.

Project:

Ammonia removal within Temagami North aerated lagoons

2024 Performance Report

Presented to:

Ontario Clean Water Agency (OCWA)

Project funded by:

Innovation Solutions Canada

Written by:

Technologies Ecofixe

April 2025

Summary

The Temagami WWTP consists of two aerated lagoons. Three BIOFIXE modules were submerged in the first aerated lagoon. The first two BIOFIXE modules were positioned to remove BOD load and the third BIOFIXE module was positioned further in the process chain used for TAN removal (see Figure below).

Figure 1 - Temagami WWTP

All three modules were installed in July 2022. The overall performance of the station was completed as per OCWA requirements and samples were collected for both influent and effluent verification of Temagami WWTP.

Their report includes multiple treatment parameters for performance measures of the WWTP. The installed BIOFIXE modules are for BOD and TAN removal only.

The results included in this report cover between July 2022, and December 2024.

All samples were taken by OCWA staff and all data and analyzed results were provided by and forwarded from OCWA to Technologies Ecofixe.

The average daily flow during 2024 was below design parameters except for the period from Mars to April 2024 and for November 2024.

Note that there is no more information collected from the cross chamber, effluent of cell 1.

Average Daily Flow

The average daily wastewater flow treated by Temagami WWTP in 2024 was 298.5 ±134.7 m^3/d. The red dots represent where the flow was over the design parameters. The records from April 2023 to May 2023, March 2024 to April 2024, and November 2024 show that these periods exceeded the flow design parameters.

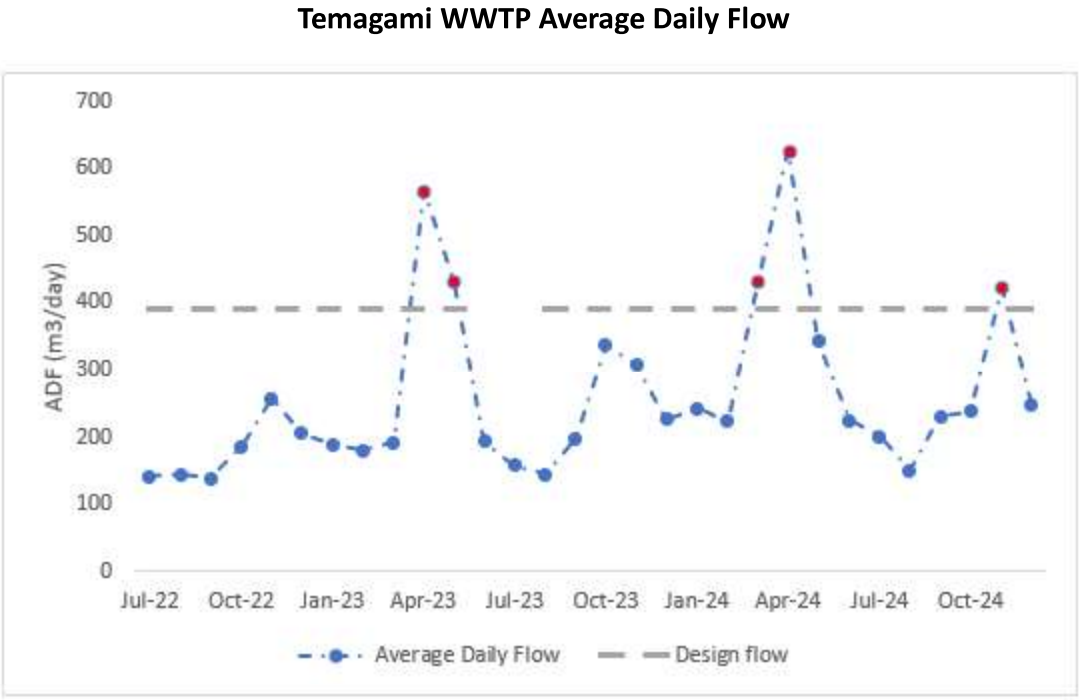

Figure 2 - ADF for Temagami WWTP

Table 1 - Statistics for Temagami WWTP flow

	2022	2023	2024
n (count)	6	12	12
Average flow (m^3/d)	178.6	260.4	298.5
Standard deviation (m^3/d)	47.6	128.5	134.7
Minimum (m^3/d)	137.6	144.5	150.8
Percentile 25% (m^3/d)	142.0	186.7	224.5
Percentile 50% (m^3/d)	164.9	195.8	240.6
Percentile 75% (m^3/d)	200.4	315.4	362.5
Maximum (m^3/d)	257.9	567.5	626.7

Organic Load (cBOD5)

The Temagami WWTP registered an average BOD removal efficiency of 95.0% for months within the design flow rates in 2024. The removal efficiency varied depending on the season. BOD concentrations remained below the discharge limits in 2024, even when the design flow rate was exceeded. The maximum concentration of 17 mg/L was measured in April 2024, when the flow rate was 65% above the design flow rate.

Temagami WWTP Monthly BOD removal Performance

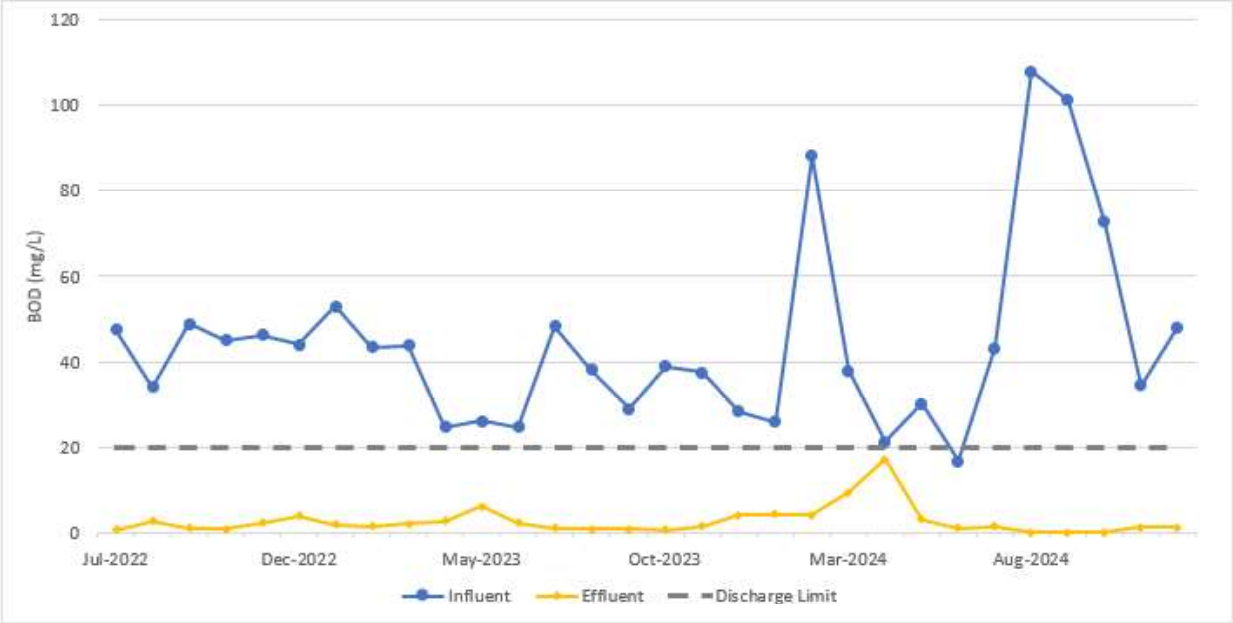

Figure 3- BOD concentration for Temagami WWTP

Temagami WWTP Monthly BOD removal efficiency

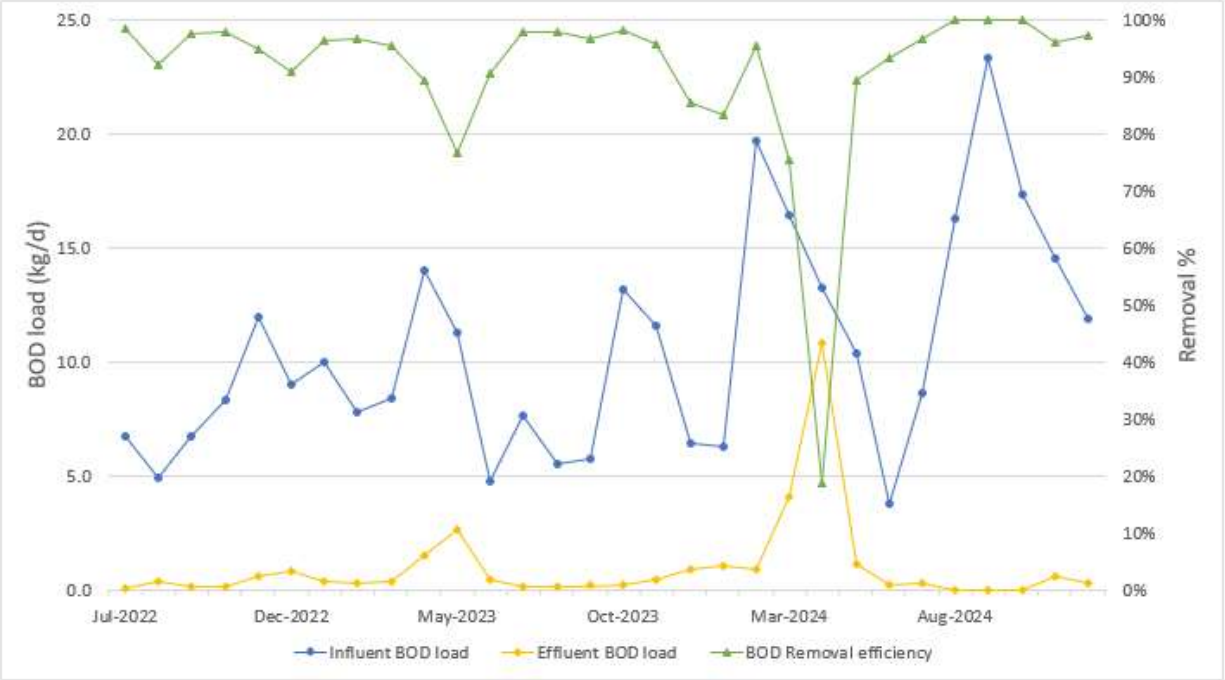

Figure 4 - BOD removal for Temagami WWTP

Table 2 - Temagami WWTP BOD Characterisation

	2022		2023		2024	
	Influent	Effluent	Influent	Effluent	Influent	Effluent
n (count)	6	6	12	12	12	12
Average (mg/L)	44.3	2.0	36.4	2.1	52.3	3.6
Standard deviation (mg/L)	5.3	1.3	9.7	1.6	31.9	5.0
Minimum (mg/L)	34.0	0.7	24.8	0.7	16.8	0.0
Percentile 25% (mg/L)	44.2	1.0	27.8	1.0	29.2	0.8
Percentile 50% (mg/L)	45.6	1.8	37.9	1.8	40.6	1.4
Percentile 75% (mg/L)	47.2	2.6	43.6	2.4	76.6	4.1
Maximum (mg/L)	48.9	4.0	53.0	6.1	107.9	17.2

Ammonia Load (TAN)

The Temagami WWTP registered a TAN removal efficiency of 94.5% for months within the design flow rates. The removal efficiency varied depending on the season. TAN concentrations remained below the discharge limits in 2024, even when the design flow rate was exceeded. The maximum concentration of 2.95 mg/L was measured in April 2024, when the flow rate was 65% above the design flow rate.

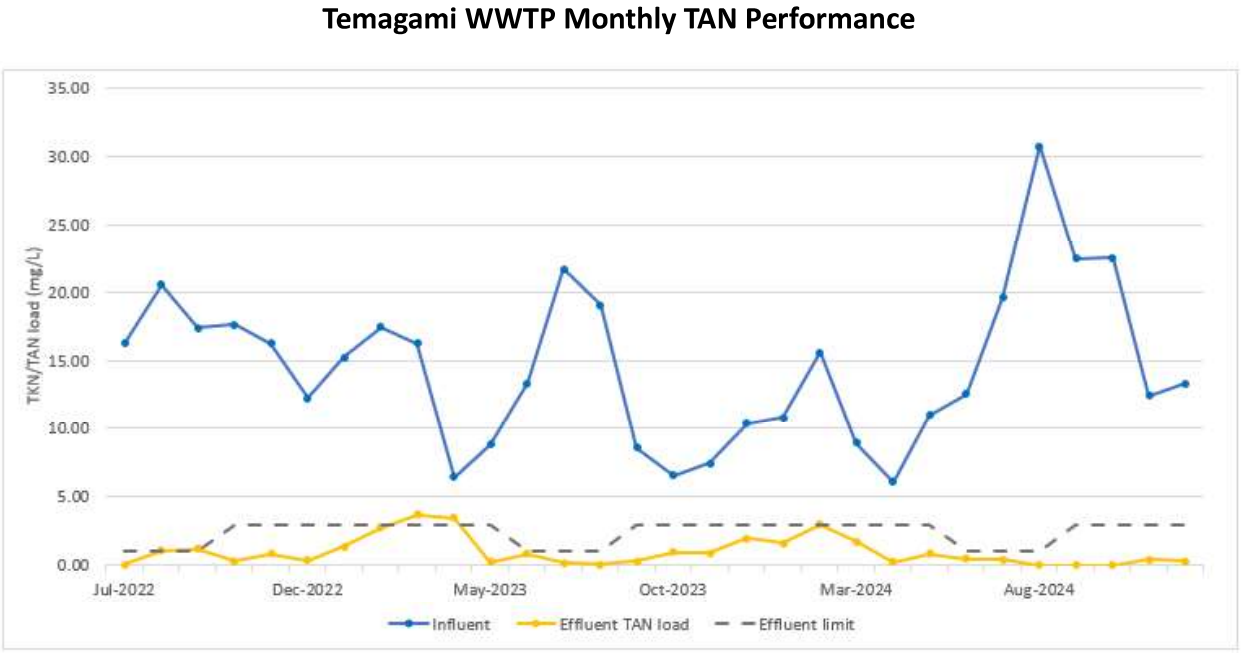

Figure 5 - TAN concentration for Temagami WWTP

Temagami WWTP Monthly TAN removal efficiency

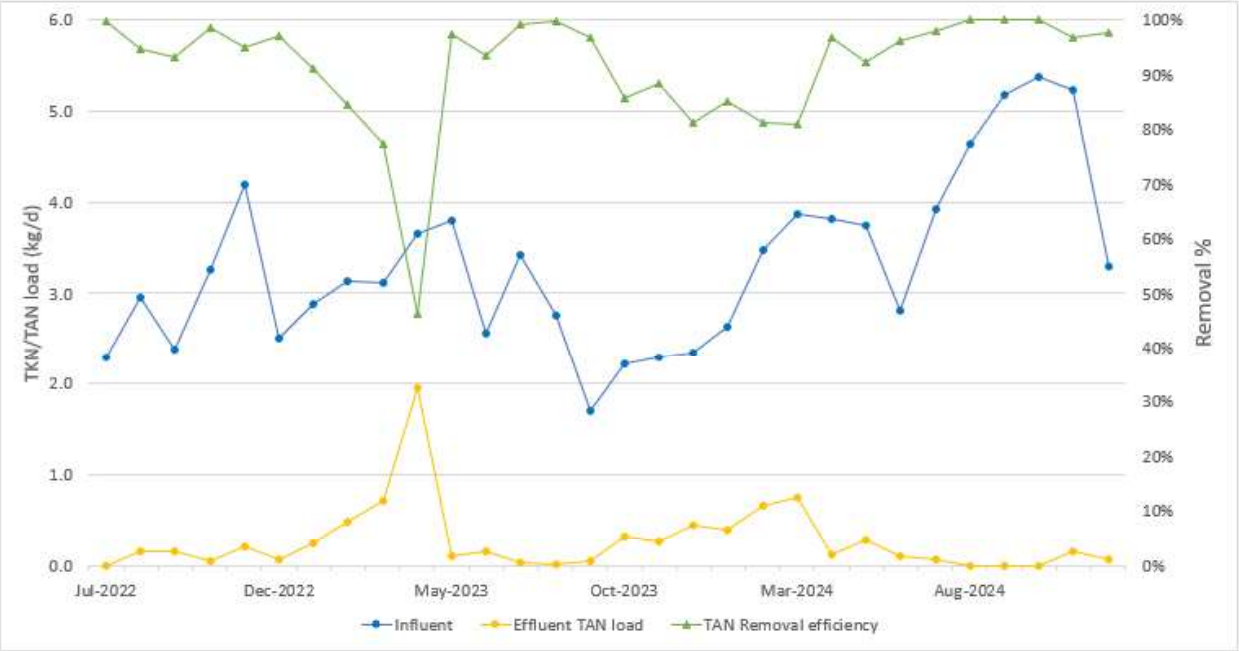

Figure 6 - TAN removal for Temagami WWTP

Table 3 - Temagami WWTP Ammonia Nitrogen Characterisation

	2022		2023		2024	
	Influent	Effluent	Influent	Effluent	Influent	Effluent
n (count)	6	6	12	12	12	12
Average (mg/L)	16.7	0.6	12.6	1.4	15.5	0.7
Standard deviation (mg/L)	2.7	0.5	5.3	1.3	7.0	0.9
Minimum (mg/L)	12.3	0.0	6.4	0.1	6.1	0.0
Percentile 25% (mg/L)	16.2	0.3	8.3	0.3	10.9	0.2
Percentile 50% (mg/L)	16.8	0.6	11.8	0.9	12.9	0.4
Percentile 75% (mg/L)	17.5	1.0	16.5	2.1	20.3	1.0
Maximum (mg/L)	20.5	1.2	21.7	3.7	30.7	2.95

Dissolved Oxygen Level

For design and best performance, residual D.O. for BOD needs to be maintained over 2 mg/L while for TAN removal, it needs to be maintained over 4 mg/L. Additional blowers were calculated based on these criteria to meet this requirement based on summer conditions. Therefore, samples from the Cross Chamber were expected to be maintained with D.O. over 4 mg/L.

No information has been provided on the dissolved oxygen level in 2024. This information could be useful to ensure the proper functioning of the aerated lagoon.

pH and Temperature data

No information has been provided for pH and temperature since January 2024. This information could be useful to ensure the proper functioning of the aerated lagoon.

Contact Information

For all questions or feedback, please do not hesitate to contact our team:

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