Moira Lake Water Quality Report:

May – October 2025

Summary Findings

Moira Lake Property Owners Association (MLPOA)

October 2025

Moira Lake Water Quality Summary Report

Executive Overview

The 2025 monitoring season offered the clearest picture yet of how Moira Lake reacts to both natural cycles and human influence. Sampling at six permanent sites from May through October captured the lake's full seasonal rhythm — from clear, balanced spring conditions to a nutrient-driven midsummer bloom and a welcome autumn recovery.

Findings confirm that Moira Lake remains nutrient-enriched and mineral-rich, conditions that continue to fuel algae and weed growth. Yet the data also show a lake that still has the ability to recover each year when conditions cool and mix. Moira Lake is not in crisis, but it is under growing pressure. Its long-term health now depends on curbing phosphorus inputs, protecting natural shorelines, and maintaining the resilience that allows the lake to rebound.

1. Overview

Moira Lake's water quality reflects both its natural limestone foundation and its location within an actively used watershed. High calcium and magnesium levels give the lake strong buffering capacity, yet they also help trap phosphorus and organic material, allowing nutrients to linger longer in the system.

Throughout 2025, phosphorus and organic carbon consistently exceeded benchmark thresholds, fueling algae growth and reducing oxygen during the warmest months. By autumn, cooler temperatures and full lake turnover restored clarity and reintroduced oxygen to deeper waters — a clear sign of the lake's resilience and capacity to recover when given relief.

These seasonal shifts mirror the classic pattern of a nutrient-rich (eutrophic) lake: gradual nutrient buildup through spring and early summer, visible algal blooms under hot, calm conditions, and reoxygenation and settling as fall brings mixing and cooling.

2. The 2025 Seasonal Story

Across all six monitoring sites, Moira Lake followed a clear seasonal rhythm. Cool, transparent spring waters gave way to a dense green bloom by late July, then recovered to clearer, more oxygen-rich conditions as autumn mixing set in. This pattern shows how temperature, sunlight, and nutrient availability work together to drive visible change in the lake's ecology.

Season	Conditions	Key Observations
Spring (May–June)	Cool, clear, well mixed	Secchi ≈ 3 m; low phosphorus and TOC; oxygen 7–9 mg/L.
Mid-Summer (July–August)	Warm, calm, eutrophic stress	Bloom developed; PO_4-P 0.11–0.35 mg/L; pH > 8.5; clarity < 2 m; east basin worst affected.
Autumn (October)	Mixing and recovery	Clarity 2.6–2.9 m; oxygen 6–8 mg/L; phosphorus 0.03–0.06 mg/L; bloom collapse visible.

This seasonal cycle highlights Moira Lake's dual nature — a system capable of self-correction when conditions cool, yet prone to recurring nutrient stress each summer. Sustained reductions in phosphorus inputs remain key to breaking this yearly pattern.

3. Key Findings

The 2025 results confirmed long-standing trends and helped clarify how multiple stressors interact to shape conditions in Moira Lake.

- Phosphorus remains the primary driver of algal blooms, exceeding the Provincial Water Quality Objective (0.02 mg/L) at every site.
- Hardwater chemistry, with calcium levels of 270–400 mg/L and magnesium 250–380 mg/L, helps trap phosphorus and slows natural recovery.
- Organic buildup was evident, with Total Organic Carbon (TOC 9–12 mg/L) and Chemical Oxygen Demand (COD 10–15 mg/L) indicating heavy decomposition of algae and vegetation.
- Warm temperatures above 25 °C in July and August intensified algal growth and reduced oxygen solubility, amplifying mid-summer stress.

Together, these factors create a self-reinforcing cycle: phosphorus feeds algae, decomposition depletes oxygen, and low oxygen releases even more phosphorus from the sediments. This feedback loop explains why even modest nutrient inputs can trigger large, visible blooms each summer — and why controlling phosphorus is so critical to long-term recovery.

4. Basin-Level Differences

Moira Lake operates as two connected but distinct systems. The shallow west basin, fed by Madoc Creek and the Moira River, receives most of the lake's external nutrient and sediment load. In contrast, the larger, deeper east basin retains heat and nutrients for longer periods, making it more vulnerable to mid-summer oxygen depletion and nutrient release from sediments.

Retriever Lane (Site 6) consistently stood out as a nutrient hotspot — recording the highest phosphorus levels (≈ 0.35 mg/L in August) and the lowest clarity (~ 1 m). Localized shoreline runoff and the buildup of organic-rich sediments appear to be the main contributors. The west-basin sites recovered more quickly after autumn turnover, likely due to faster flushing rates and stronger wind-driven mixing.

These contrasts highlight how the lake's two basins respond differently to stress. The west basin shows the effects of external loading, while the east basin reveals the impact of internal nutrient cycling. Protecting Moira Lake will therefore require dual strategies — reducing watershed and inflow nutrients in the west and managing shoreline runoff and sediment release in the east.

5. Regional Comparison

When compared with other lakes in Eastern Ontario, Moira Lake ranked among the most nutrient-enriched and mineral-loaded systems in 2025. The July data (Figure 1) show that orthophosphate and organic carbon levels were several times higher than regional medians, while water clarity and oxygen were lower.

By October (Figure 2), the lake had visibly cleared and oxygen improved, yet phosphorus and hardness remained elevated — signs of lasting chemical stress even after physical recovery.

These results show that Moira Lake's condition is not an isolated case but part of a wider trend affecting hardwater lakes across the region. However, the degree of enrichment and the persistence of high phosphorus levels set Moira apart as a regional outlier — a system requiring ongoing attention and active nutrient management to prevent long-term decline.

Figure 1: Moira Lake in Context — Mid-Summer (July 2025) Comparison of Key Parameters

Parameter	Moira July Avg	Status	How it Compares
Orthophosphate (PO_4-P mg/L)	0.24	❌	Very High / Worse – Confirms nutrient enrichment driving algae bloom and weed growth.
Total Organic Carbon (mg/L)	10.5	❌	High / Worse – Lake-wide organic enrichment consistent with bloom activity.
Chemical Oxygen Demand (mg/L)	9	⚠	Elevated – Linked to organic build-up and decomposition.
Ammonia (mg/L)	0.03	⚠	Elevated – Declining from spring spike as algae uptake increases.
pH	8.6	❌	High / Worse – Photosynthesis-driven; may stress aquatic life and amplify nutrient effects.
Dissolved Oxygen (mg/L)	6.5	✓	Moderate / Similar – Slightly above stress threshold; minor oxygen strain during bloom period.
Conductivity (µS/cm)	390	⚠	Moderate / Slightly Worse – Reflects mineral and nutrient loading; typical of hardwater systems.
Secchi Depth (m)	2.1	⚠	Low / Worse – Reduced clarity from algae and organic material.
Alkalinity (mg/L $CaCO_3$)	118	✓	Normal – Strong buffering capacity; typical for limestone watersheds.
Hardness (mg/L $CaCO_3$)	160	⚠	Elevated – Consistent with hardwater lakes; supports zebra-mussel habitat.
Calcium (mg/L)	408	❌	Extremely High / Worse – Far exceeds regional norms; defines Moira as very hard water. Reflects underlying geology.
Magnesium (mg/L)	388	❌	Extremely High / Worse – Confirms strong mineral loading and hardwater status. Reflects underlying geology.
Iron (µg/L)	5.7	✓	Low / Better – Well below provincial thresholds; no metal concern.
UV_{275} Absorbance (RU)	0.19	⚠	Slightly Elevated – Reflects dissolved organic and colour increase.
Nitrate + Nitrite (mg/L)	0.00	✓	Low / Typical – Indicative of nitrogen limitation during phosphorus-driven blooms.

Source (Figures 1 and 2): Eastern Ontario Reference Lakes Dataset (2021–2024), MECP / FOCA Regional Benchmarks.

Figure 2: Moira Lake in Context — Fall Rebound (October 2025) Comparison of Key Parameters

Parameter	Moira Lake (Oct avg)	Status	How it Compares
Orthophosphate (PO_4-P mg/L)	0.05	❌	High / Worse – Remains above provincial objective; nutrient enrichment persists despite late-season decline.
Total Organic Carbon (mg/L)	6.5	⚠	Moderate / Improved – Organic load dropped from July peak but still slightly elevated.
Chemical Oxygen Demand (mg/L)	7	✓	Low / Better – Decomposition pressure eased as blooms subsided.
Ammonia (mg/L)	0.02	✓	Low / Better – Back to baseline levels following algal uptake.
pH	7.9	✓	Normal / Better – Returned to stable range after mid-summer photosynthetic spikes.
Dissolved Oxygen (mg/L)	7.5	✓	Healthy / Better – Well-mixed and reoxygenated after autumn turnover.
Conductivity (µS/cm)	360	⚠	High / Worse – Stable but above regional average due to hardwater and ion loading.
Secchi Depth (m)	2.8	✓	High / Better – Visibility improved as blooms collapsed and organic matter settled.
Alkalinity (mg/L $CaCO_3$)	107	✓	Normal – Consistent with regional lakes; strong buffering capacity maintained.
Hardness (mg/L $CaCO_3$)	140	⚠	Elevated / Worse – Borderline hard; typical for limestone watersheds.
Calcium (mg/L)	270	❌	Extremely High / Worse – Well above regional range; defines very hardwater conditions.
Magnesium (mg/L)	269	❌	Extremely High / Worse – Persistent mineral loading; unchanged from July.
Iron (µg/L)	1.2	✓	Very Low / Better – No metal concern; well below provincial thresholds.
UV_{275} Absorbance (RU)	0.14	✓	Low / Better – Colour and dissolved organics declined with improved clarity.
Nitrate + Nitrite (mg/L)	0.00	✓	Low / Typical – Reflects nitrogen limitation common in phosphorus-rich systems.

Source (Figures 1 and 2): Eastern Ontario Reference Lakes Dataset (2021–2024), MECP / FOCA Regional Benchmarks.

6. Management and Community Actions

Moira Lake's recovery depends on two things working together: coordinated watershed management and strong local stewardship. The following actions are recommended to reduce phosphorus inputs and maintain a healthy oxygen balance.

- **Reduce external nutrient inputs** — Schedule regular septic inspections, limit or eliminate fertilizer use, manage stormwater and erosion, and ensure leaves and yard waste are collected rather than dumped near the shoreline.
- **Address internal nutrient loading** — Monitor bottom-water oxygen levels, minimize the decay of excess aquatic vegetation, and evaluate potential in-lake options such as aeration or sediment sealing if internal loading proves significant.
- **Maintain full-season monitoring** — Continue monthly sampling from May through October using consistent methods to track trends and measure the success of management actions.

Community involvement remains the cornerstone of lake protection. Simple measures — planting and maintaining natural shoreline vegetation, reducing hard surfaces, and directing runoff away from the lake — collectively make a measurable difference. Moira Lake still has the capacity to heal, but only if nutrient inflows are steadily reduced and the community continues to act together.

7. Outlook for 2026

The 2026 program will build on the progress made this year, with a stronger focus on earlier spring sampling, improved nutrient tracking, and expanded shoreline engagement. By refining field methods and increasing volunteer participation, MLPOA and its partners aim to turn Moira Lake's seasonal recovery into measurable, long-term improvement.

Success will depend on continued collaboration — among residents, local governments, and conservation organizations — to share data, reduce nutrient inputs, and protect the lake's natural resilience for the future.

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