



InnoCyclone — Wastewater Lagoon Clarification and Phosphorus Removal

Case Study | Municipal Wastewater Lagoons, Manitoba

>90% Phosphorus Removal	97.8% TP — Sand Filter Backwash	1 mg/L Provincial Discharge Limit Met	300 m³/d Design Flow
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Project Background and Challenge

In Manitoba, excess phosphorus and nitrogen from agricultural runoff and municipal wastewater pose a significant environmental threat, contributing to algal blooms and the eutrophication of water bodies such as Lake Winnipeg. Phosphorus is the limiting nutrient for algal growth, making its reduction critical.

Approximately 350 small municipalities and First Nation communities operate wastewater lagoons that must comply with provincial and federal regulations, including a 1 mg/L phosphorus discharge limit for facilities exceeding 820 kg TP per year. Most lagoons cannot naturally meet this limit, and current removal methods — ranging from in-situ chemical dosing to mechanical treatment — often fail to fully capture phosphorus. As a result, valuable phosphorus accumulates as sludge, reducing lagoon lifespan, increasing maintenance costs, and wasting a scarce resource.

The Innovantage Solution

Innovantage deployed the InnoCyclone wastewater clarification system to enhance treatment performance in municipal wastewater lagoons. The system utilizes Charged Bubble Flotation (CBF) technology to effectively separate suspended solids, organic matter, and phosphorus from lagoon effluent.

Lagoon wastewater is pumped into a mixing skid, where a coagulant, polymer, and proprietary InnoFloc are precisely dosed to promote coagulation, flocculation, and flotation. The conditioned wastewater then enters the InnoCyclone unit, where its optimized internal configuration enables efficient phase separation. Solids — containing captured phosphorus, organics, and TSS — are concentrated and removed via the overflow, while clarified water is discharged from the bottom of the tank.

The treated effluent consistently met provincial discharge requirements and was safely released to the environment. Captured solids were thickened and dewatered prior to disposal or beneficial reuse, including composting with organic waste to produce a nutrient-rich soil amendment.

The system is designed for reliable, year-round operation and features full automation, enabling continuous treatment with minimal operator intervention and reduced labour requirements.

Project Information	
Location	Manitoba, Canada
Project Type	Wastewater Lagoon Treatment and Phosphorus Removal
Completion Date	December 2024
Design Flow	300 m ³ /day

Results



The InnoCyclone system installed by Innovantage effectively reduced contaminant levels in treated effluent to meet provincial discharge targets. The results below cover two treatment streams: primary/secondary lagoon cell effluent and sand filter backwash.

Wastewater Lagoon — Primary & Secondary Cells

Primary lagoon cells are rich in organic matter, while secondary cells typically achieve low concentrations of TSS, BOD, and COD (generally below 25 mg/L), meeting discharge limits. However, phosphorus levels remain elevated, typically in the range of 3–5 mg/L.

Treatment with the InnoCyclone system achieved over 90% phosphorus removal, reducing effluent concentrations to between 0.32 and 0.76 mg/L — consistently meeting regulatory requirements.

Wastewater Lagoon — Sand Filter Backwash Treatment

Sand filtration systems generate a backwash stream that is highly diluted yet contains elevated concentrations of contaminants. This stream typically requires additional treatment or recirculation to lagoon cells. The InnoCyclone system effectively treated this backwash, achieving significant contaminant removal and enabling compliance with provincial discharge standards.

Contaminant	Sand Filter Backwash (mg/L)	InnoCyclone Effluent (mg/L)	Removal Rate (%)
Total Phosphorus (TP)	16.1	0.357	97.8%
Total Suspended Solids (TSS)	343	16.2	95.3%
BOD	22	10.9	50.5%

Sludge Recovery for Beneficial Use

Captured sludge is dewatered using a customized liner within a containment system, reducing volume and moisture content to below 80%. The dewatered material is then composted by blending it with organic waste at optimized ratios to produce a nutrient-rich soil amendment for agricultural use.

This approach enables the recovery of phosphorus from wastewater lagoons, returning it to the soil for plant uptake and preventing its permanent loss. By converting residuals into a valuable resource, this circular economy strategy supports municipal fertilizer needs while contributing to the broader goal of reducing environmental impacts associated with nutrient discharge.

Key Takeaways

- High phosphorus removal: Over 90% removal from lagoon effluent; 97.8% from sand filter backwash — consistently meeting the provincial 1 mg/L discharge limit.
- Protects Lake Winnipeg: Significant reduction in nutrient loads mitigates eutrophication risk in sensitive receiving water bodies.
- Comprehensive lagoon management: Effective treatment of both primary/secondary cell effluent and challenging backwash streams.
- Year-round automated operation: Minimal operator involvement and reduced labour requirements.
- Circular economy: Sludge composted and returned to the soil as a nutrient-rich soil amendment, recovering phosphorus as a valuable resource.