CoMag® System

Billerica, Mass., Wastewater treatment facility

Meeting stringent phosphorus limits within extremely tight footprint constraints

Originally constructed in 1966, the Billerica wastewater treatment facility primarily processes residential wastewater. Additionally, alum sludge from Billerica's drinking water treatment facility makes up a significant portion of the solids loading to the wastewater treatment facility. Treated effluent is discharged into the Concord River.

A cost-effective TP removal solution

To meet a new Total Phosphorus (TP) limit of 0.2 mg/L, as well as future TP limits that could be even lower, Billerica considered the CoMag system.

One of the features that made the CoMag system particularly attractive to Billerica was its small footprint. To reduce upgrade costs, Billerica needed to fit tertiary clarifiers within the walls of two existing concrete tanks. Reusing the existing tanks eliminated demolition and excavation costs. The CoMag system was ideal for this configuration because it requires significantly smaller clarifiers than conventional systems to treat equivalent flow rates. Only two 23 ft (7 m) circular clarifiers were needed, which easily fit in the existing concrete tanks.

How it works

The CoMag system settles chemical floc up to 30 times faster than conventional clarification by ballasting floc with magnetite. Because of its high density, magnetite triggers rapid settling when embedded into chemical floc.

At Billerica, the CoMag system provides maximum flexibility to meet seasonally variable TP limits.

A splitter box allows secondary effluent to be diverted to either an intermediate pump station which feeds the CoMag system, or to bypass tertiary treatment. In the summer, all flow is passed through the CoMag system to ensure a lower TP limit is met. In the winter, only 35 percent of the total flow goes through the CoMag system.

Billerica's CoMag system was designed for an average daily flow of 5.5 MGD (20.7 MLD) and a peak hourly flow of 16.5 MGD (62.5 MLD).



Industry
Municipal wastewater

Business challenge
Meet a new permit TP limit of 0.2 mg/L while fitting tertiary clarifiers within the walls of existing concrete tanks

Keys to success
Identify a cost-effective, compact solution for reducing phosphorus

Solution
CoMag system

Results

- Met winter TP limits of 1.0 mg/L and summer limits of 0.2 mg/L
- Demonstrated that future TP limits of 0.05 mg/L could be met without post filtration

The CoMag system requires a smaller footprint than conventional systems to treat equivalent flow rates. Only two 23-ft. (7 m) tertiary clarifiers were needed, which fit within the walls of two existing concrete tanks, shown here. Reusing the existing tanks eliminated demolition and excavation costs.

Initial pilot testing

In the summer of 2007, a pilot of the CoMag system proved its ability to meet the new TP limit with alum, Polyaluminum Chloride (PACL), ferric chloride or sodium aluminate coagulants. Additionally, the pilot proved that the CoMag system could meet future permit limits as low as 0.05 g/L without polishing filters by simply increasing the coagulant dose.

Full-scale installation results

Since it was first installed at Billerica in 2010, the CoMag system has proven to be a reliable and versatile tertiary treatment process with the capability to achieve any effluent TP target down to less than 0.05 mg/L, while also achieving significant reductions in TSS (38 percent), BOD (59 percent) and other contaminants.

"The CoMag system's quick learning curve and reliability make it a great system for tertiary treatment with only a few simple parameters to monitor that make for easy operation," said Jeff Kalmes, Billerica's plant supervisor.

The CoMag system allowed the facility to meet stringent TP limits within challenging footprint limitations, while coping with wide fluctuations in feed flow, TP and TSS concentrations.



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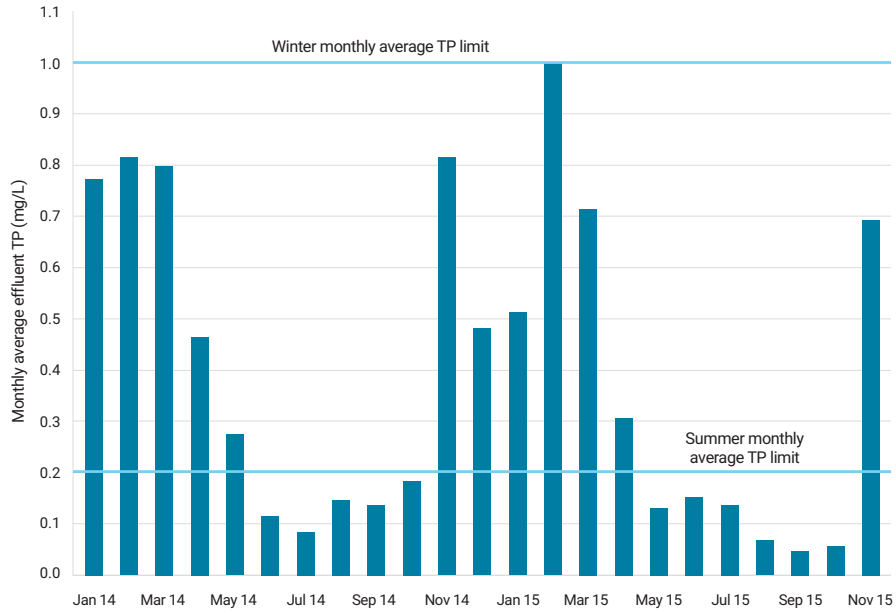
Billerica CoMag System full-scale monthly average TP 2014-2015



The monthly average effluent TP results for 2014-2015 demonstrate the wide range of capability generated by blending flows during the winter. The tertiary CoMag system also produced significant average reductions in secondary effluent BOD (59 percent) and TSS (38 percent) with an average daily flow rate of 3.7 MGD (14 MLD).

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