



CASE STUDY: Post-Aeration D.O.

- Kennebunk, Maine -

Plant Effluent Dissolved Oxygen through Super- Oxygenation

COLLECTION SYSTEMS

HEADWORKS

PRIMARY CLARIFIERS

POST-AERATION

INDUSTRIAL

ECO OXYGEN TECHNOLOGIES, LLC

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Kennebunk Sewer District Dissolved Oxygen Discharge Compliance

The Kennebunk Sewer District's 2006 NPDES permit renewal dictated that the discharge from the town's POTW must not lower the quality of the water body it discharges into – the Mousam River Estuary. The estuary is considered impaired with respect to depletion of dissolved oxygen (D.O.). To meet permit requirements in conjunction with a plant upgrade, Kennebunk Sewer District and Woodard & Curran worked with the State to consider all parameters that potentially impact estuary D.O. levels in the estuary. Parameters such as effluent D.O., TSS, BOD, and nutrients were evaluated regarding treatment technologies and expected impact on the D.O. levels in the estuary.

The solution included plant upgrades to minimize solids and BOD in the effluent, and to oxygenate the plant effluent to saturated D.O. levels or greater. To meet this requirement, Kennebunk investigated several aeration and oxygenation technologies, focusing on the ability to meet stated goals and overall capital and operational costs for project life costs. The District selected the ECO2 SuperOxygenation System. This technology uses a conical transfer reactor, also known as the Speece Cone, to dissolve pure oxygen into water at an oxygen transfer efficiency of over 90%



Mousam River Marsh (Photo Credit: Bud in Wells, Maine)



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ECO₂ System Operation

The ECO₂ SuperOxygenation System pulls a sidestream from the gravity flow discharge coming from the chlorine contact tanks. The average D.O. level of the system influent is 5 mg/L. The system then adds pure oxygen into the Speece Cone, to raise the D.O. to above 8 mg/L.

Depending on the plant flow, the effluent D.O. can vary between 8 mg/L and 25 mg/L, which blends with the main flow before being discharged into the Mousam River.

- Plant Flow Max 5.0 MGD
- Plant Flow Ave 1.0 MGD
- Cone Diameter 3 ft
- O₂ Max Feed 230 lbs/day
- Sidestream Flow 700 gpm



Installation of ECO₂ system at the Kennebunk WWTP Effluent

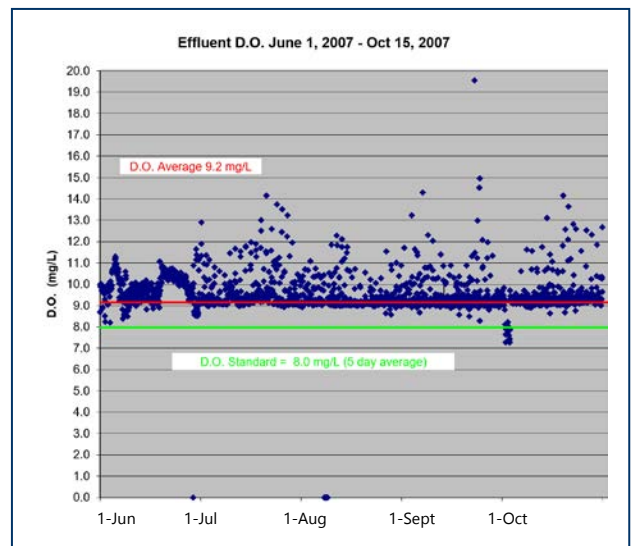
Results

The oxygen transfer efficiency (OTE) of the ECO₂ System has been tested at three different oxygen feed rates 50%, 85%, and 100% of the design flow. The influent D.O. level was 5 mg/L at each scenario. The results demonstrated an oxygen transfer efficiency of 94%, 97%, and 94% respectively, calculated using the following equations.

$$O_2 \text{ Transfer (lbs/day)} = (\text{Cone Discharge mg/L} - \text{Cone Inlet mg/L}) * 8.34 * \text{MGD}$$

$$\text{OTE (\%)} = O_2 \text{ Transfer (lbs/day)} / O_2 \text{ Feedrate (lbs/day)}$$

Historically, the hot summer months were most difficult to meet the effluent D.O. limit. The graph to the right shows an average effluent D.O. level of 9.2 mg/L during those hot summer months after the installation of the ECO₂ system in 2006. The system has been successfully operating for over 10 years.



Plant Effluent D.O. data collected June-Oct, 2007