CASE STUDY:

Warren, Michigan Wastewater Treatment Plant

Application:	BNR Mixing
Design Flow (ADF):	36 MGD
Mixing Efficiency:	0.1 HP/1000 FT^3
Compressors:	Two (2) 15 HP Rotary Screw
Mixing Nozzles:	160
Design Engineer:	Johnson Controls / AECOM

BioMix Compressed Gas Mixing evenly distributes mixing energy across the tank floor to enhance mixing and minimize energy input.

Process Upgrade with BioMix™ Compressed Gas Mixing System Facilitates Bio-P Removal and Reduces Chemical Costs

In 2014, Johnson Controls Inc. entered into an energy savings performance contract (ESPC) with the City of Warren, which included an anaerobic/oxic (A/O) process upgrade. Previously, the plant utilized a conventional activated sludge (CAS) process which was not designed for biological phosphorous removal (BPR), requiring phosphorus to be removed through chemical precipitation using ferric chloride.

By implementing the BPR process with BioMix, the plant realized more than $150,000 per year in operational savings through the elimination of hazardous and costly chemicals.

EnviroMix installed its BioMix Compressed Gas Mixing System to mix anaerobic biological treatment cells created within the existing footprint of the four operating process trains. Originally, the plant considered twelve 36 horsepower mechanical mixers. However, capital and installation costs exceeded the budget allocated to provide a valid ESPC business case. EnviroMix's solution reduced capital and installation costs and lowered the operating power to less than 15 BHP. In addition, the low maintenance requirements of the BioMix system coupled with the lower energy use significantly reduced the long-term O&M costs versus traditional mixing.

ENERGY EFFICIENCY

50-60% or greater energy savings compared to mechanical mixing

STRAIGHTFORWARD OPERATION

No mechanical or electrical components in the wastewater

Greatly reduced quantity of rotating equipment

PROCESS OPTIMIZATION

Complete mixing with proven negligible oxygen transfer

Easy integration with aeration equipment

Guaranteed uniform mixing

UNPARALLELED FLEXIBILITY

Install options for anaerobic, anoxic, swing zone, aerobic, and deox tanks

Variable mixing intensity based on process parameters

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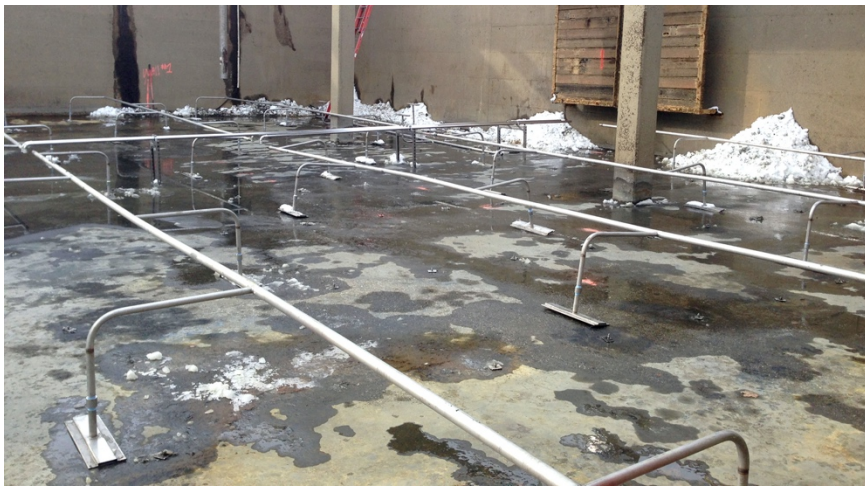
ORP Values in the Anaerobic Selector Zones being mixed with BioMix are typically less than -400 mV.



Numerous modeling simulations were performed to determine the optimum BPR solution, aiming to balance process performance with the cost of modifying the activated sludge process as well as the cost of mixing energy. It was determined that a solution consisting of two anaerobic zones of equal size — representing a total of 20% of the process volume with 75% return activated sludge recycle — would produce the optimal results. Furthermore, it was determined that the introduction of a minimal amount of compressed air would not have a measurable effect on the BPR process, and field performance has proven that assessment to be accurate.

During the plant's conversion from chemical phosphorus removal to BPR, parallel trains of each process regime were operated side-by-side and the results compared. **The BPR process achieved phosphorus removal more efficiently and consistently than the conventional chemical precipitation process.**

The BPR process trains using BioMix Compressed Gas Mixing System removed 50% more total phosphorus than those using chemical precipitation.

Comparative Operating Performance	BPR with BioMix	Phosphorus Removal with $FeCl_3$
Raw Total Phosphorus:	3.6 mg/l	3.6 mg/l
Effluent Total Phosphorus:	0.7 mg/l	1.4 mg/l
Effluent Sol. P:	0.4 mg/l	1.2 mg/l
Effluent NO_3N:	7.1 mg/l	8.4 mg/l
Effluent NH_3N:	0.1 mg/l	0.1 mg/l

The upgrade at the Warren WWTP is just one example of how EnviroMix's BioMix Compressed Gas Mixing System provides a cost effective, energy efficient alternative to mechanical mixing technology that is fully compatible with biological phosphorous removal processes.

Contact sales@enviro-mix.com today to discuss the ways EnviroMix can optimize your mixing solutions.