

## Case Study

# BioCube II - Enhanced Ammonia & BOD Removal

## Retrievable & Modular Fixed Bed Bio Reactor (FBBR) Pretreatment System

### Situation

A poultry plant processes about 300,000 chickens per day which equals a total flow of 1.3MGD (4 gallons per bird) which needs to be pretreated prior to discharge to the city wwtp for final processing. Wastewater is primarily treated with the two stage DAF system prior to biological oxidation of organics for then polishing by the city wwtp system. Primary DAF system effluent is pumped to the Flow Equalization system for treatment as shown below

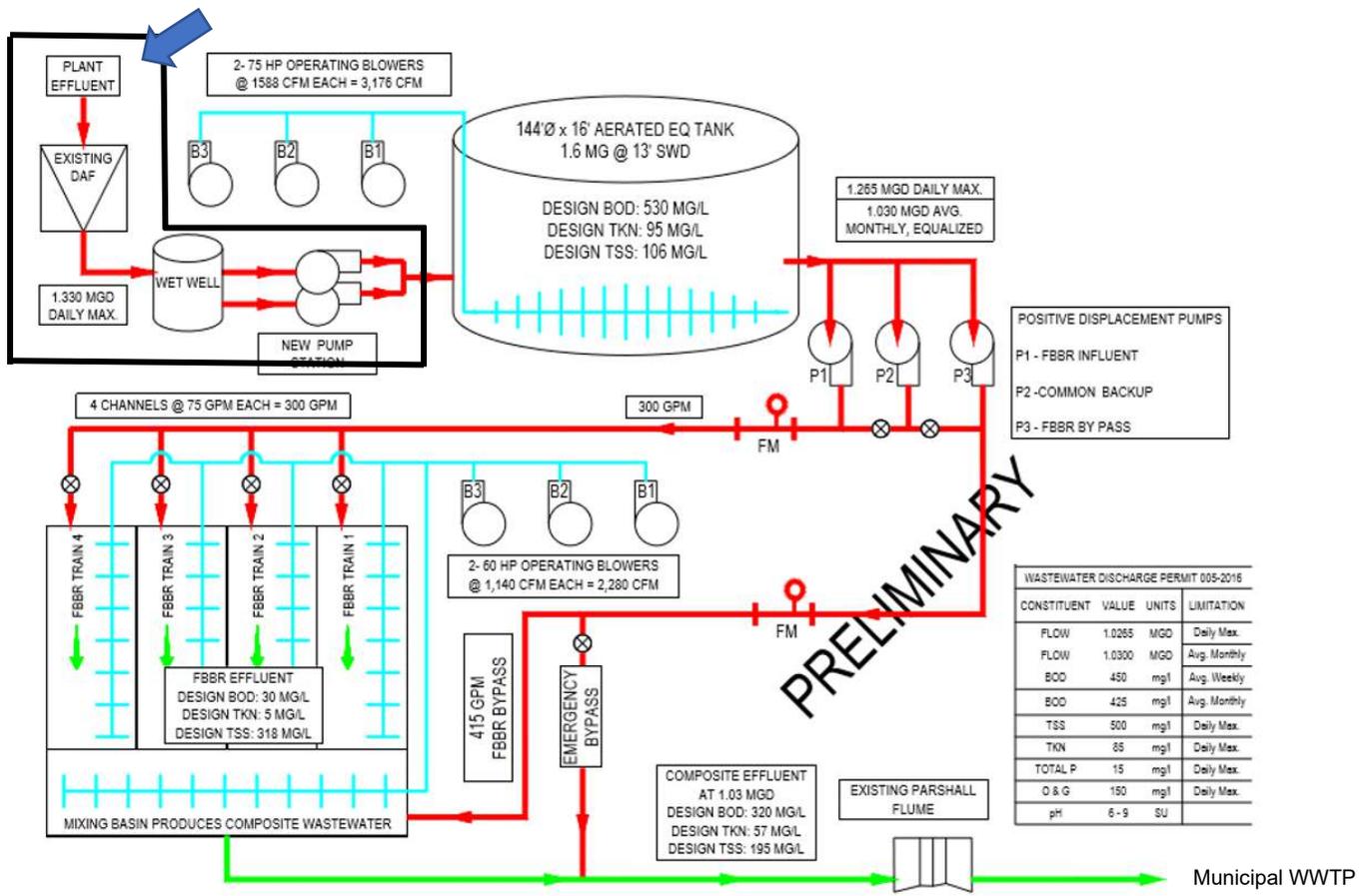


Figure 1: Planned plant extension

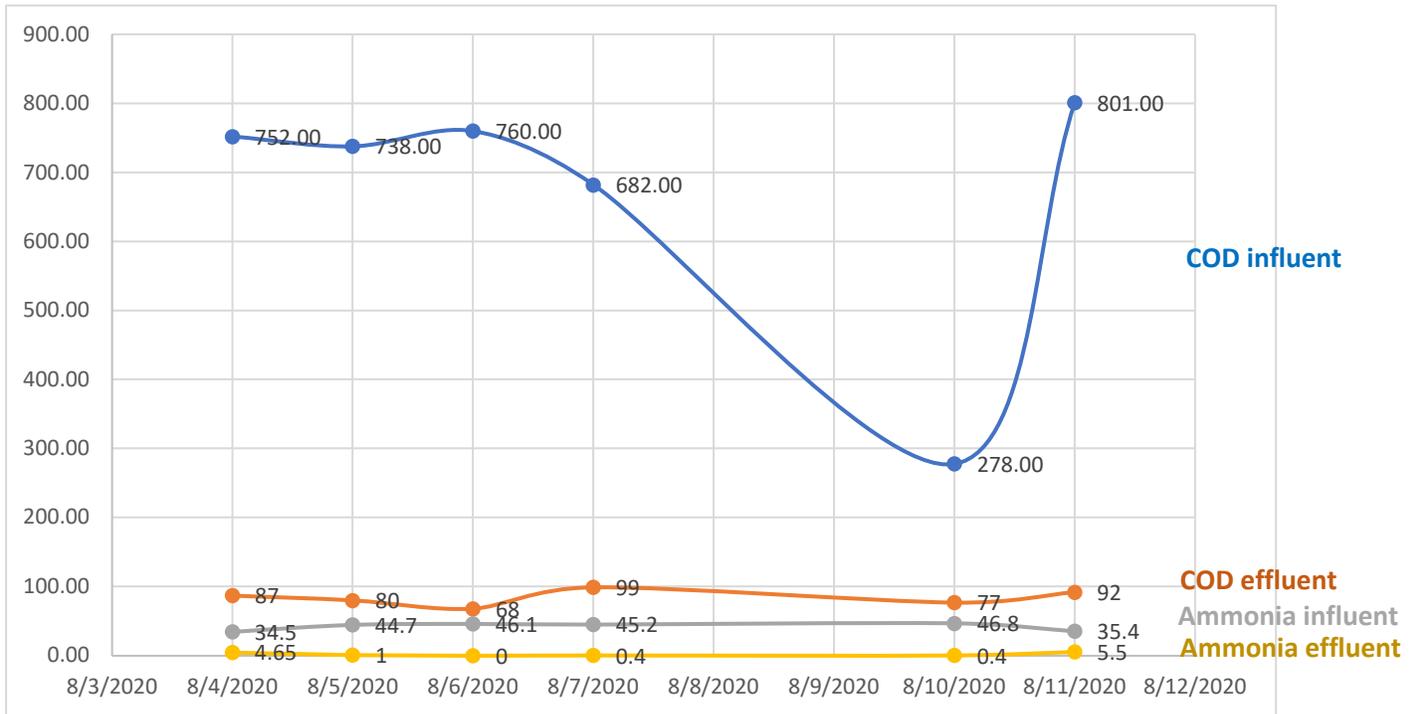
### Solution and process description

The EQ basin manages the 1.3 MGD flow in the 1.6 MG FE tank. Wastewater is pumped to the BioCube system at a consistent flow of 300 gpm to the wastewater 24/7. The FE Basin adsorbs all the instantaneous flow from the processing plant throughout the day; then as the end of the week arrives

the basin is more full to allow for treatment over the non-working weekend days. To improve BOD removal the plant was expanded with an aerated EQ tank as well as fixed bed bio reactor basin. The EQ tank holds up to 1.6MG and releases a continuous design flow of 300GPM (0.43 MGD) to the new FBBR basin 24/7 at the operator managed flow rate of 300 gpm. The operator can adjust that flow based on the number of BioCube trains operational and performance required.

## Results

The BioCube is a combination treatment of a fixed film and suspended growth biological system for BOD and Ammonia oxidation prior to city sewer wwtp final treatment. The BioCube system has performed very well with a 90% BOD reduction and a 99% Ammonia reduction from the influent levels of 500 ppm BOD and a 40 ppm Ammonia level. A chart below provides a trend chart of the performance for the past month showing the startup biomass growth process to the current effluent performance. The FBBR system took about 3-4 months for biomass stabilization and growth for nitrifiers to become stable for nitrification to achieve performance needed for system design performance expectation.



Date	Influent FBBR COD/ ammonia	Effluent FBBR COD/ammonia
8/4/2020	752/ 34.5	87/ 4.65
8/5/2020	738/ 44.7	80/ 1
8/6/2020	760/ 46.1	68/ 0
8/7/2020	682/ 45.2	99/ 0.4
8/10/2020	278/ 46.8	77/ 0.4
8/11/2020	801/ 35.4	92/ 5.5

## Jaeger Aeration System Design

Jaeger Aeration provided integral system design and support services to the consulting engineering firm who reached out for support on the project. Other technologies were considered, but after an construction cost analysis and performance difference the BioCube was selected for the project. A specific design feature of the BioCube is that each of the modules can be removed for maintenance without dewatering the reactor which other systems evaluated was not available. The retrievable BioCube provides much more redundancy without removing media surface area or backwashing stainless steel screens. Project delivery was also short due to the violations of the processing plant to their effluent limitations; the engineer then wanted Jaeger Aeration to coordinate and supply in addition to the BioCube modules we also included the blowers, air piping layout, controls and startup services. The contractor provide the installation and concrete tank installation. The simultaneous construction/fabrication provided a condensed schedule for an expedited project delivery.

The final product is shown below. There are four parallel trains of BioCube reactors which can operate independently at the same reactor loading. Each of the reactor trains is conservatively designed for the organic BOD and Ammonia loading for improved effluent performance. No clarifier is applied and not required for the project; sloughed solids are discharged to the city wwtp which quickly settle.



*Figure 2: Finished BIOcube tank*

The blower setup allows additionally for variable automatized airflow control reducing energy consumption during phases with low wastewater loads. To prevent that the biofilm thickens too much

and clogs fill media channels the airflow can be increased to scour the surface area of the fill media and to maintain an adequate biofilm thickness.

OxyStrip diffusers are installed below the BioCube for fine bubble diffusers to supply air rising through the media. The OxyStrip diffuser is made of silicone material which increases the life and reduces the maintenance frequencies for inspection. BioCube and OxyStrip maintenance can be managed by retrievable of the complete cube, as shown below, for the

Inspection of the BIOcube units was conducted about 6 months after system start up and a biomass could be seen as a built layered film. As the organic loading is higher in the beginning of the reactor the biofilm is “thicker” than toward the effluent end of the reactor. Therefore, the design has a more “open” media for the first half of the reactor and then a less “open” design media for the nitrification. The nitrification media will achieve a thinner biomass thickness which is expected since for the lower loaded area of the wastewater train design. Consider the media as creating a “hotel room” for the specific biological species for the wastewater treatment plant.



*Figure 3: Retrievable BIOcube unit*

## Summary:

BioCube designs can be an effective solution for BOD and TKN reduction of wastewater for final discharge or industrial pretreatment. The BioCube modules are completely retrievable for servicing or inspection without dewatering the basin. Photographs of the modules are below for reference.



See also:

  
BioCube™



Retrievable FBBR | IFAS | MBBR systems

Increasing existing systems organic removal performance

Ammonia nitrification applications

Retrievable modules – increases system redundancy

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