

Nutrient Removal with Active BioHaven® Floating Treatment Wetlands

Project Location: Lodi, California, USA

This case study demonstrates the ability of BioHaven® floating treatment wetland (FTW) technology to clean water by substantially reducing nutrient levels, which also removes algae from the subject wastewater retention pond. Removal of ammonia, Biochemical Oxygen Demand (BOD) and total suspended solids (TSS) now exceeds 95 percent.

Overview

Floating Islands West of Lockeford, California, an FII licensee, installed a BioHaven Streambed FTW in the North Valley School wastewater retention pond in August 2012. The primary objective was to determine whether the island could improve the pond's visual appearance and odor by creating conditions less susceptible to algae growth. It is known that algae will be prevalent during warm, sunny weather when nutrient levels (nitrogen and phosphorus) are elevated.

Location	Lodi, California USA
Parameters Studied	Algae, dissolved oxygen, ammonia, BOD, TSS, phosphorus
Environment	Privately-owned wastewater retention pond
FTW Size	Area of 630 ft ² (59 m ²), thickness of 8 inches (20 cm)
Water Source	North Valley School holding tank
Installation Date	August 2012
Flow Rate	Estimated at 2.0 gpm (0.45 m ³ /hr)
Water Body Depth	6 ft (1.8 m)
Water Body Area	1800 ft ² (167 m ²)
% Coverage	35% of retention pond covered by BioHaven

This privately-owned wastewater system was designed to handle effluent from 200 people and currently has about 100 users. Water overflows a holding tank to the wastewater retention pond, which historically had high nutrient levels and a thick layer of algae and floating aquatic plants, and then discharges to a leach field.

Aeration (about 4 scfm) and mixing is provided with a linear compressor and three small round air diffusers. Dissolved oxygen (DO) levels are increased from about 0.2 mg/L in the holding tank to 6-8 mg/L in the pond.

Table 1 shows contaminant concentrations entering and exiting the wastewater pond, along with percent removal. Removal rates were generally higher during the warm

water season of August compared to April. Ammonia is almost completely removed. Nitrate is created during biological reduction of ammonia but a portion of this nitrate is also removed. The percentage of total nitrogen removed was high in August 2013. The increased efficiency in August is probably due to either warmer water temperatures or an increase in biofilm and plant life since the system was installed a year earlier.

Table 1. Removal Efficiencies

Parameter	April 2013 Sampling			August 2013 Sampling		
	In	Out	Removal	In	Out	Removal
Ammonia	88	7.3	92%	83	1.2	99%
Total N	88	66	25%	83	18.6	78%
BOD	230	12	95%	78	3.4	96%
Total P	13	10	23%	9.8	15	-53%
TSS	250	40	84%	120	5.5	95%

Total phosphorus was removed in April 2013 but not in August. Possible explanations for the lack of phosphorus removal are:

1. The retention pond has experienced severe algae blooms in the past and these blooms likely produced a buildup of organic debris on the bottom. The current aeration/circulation system may be promoting the stirring and digestion of bottom sludge, which may be supplying phosphorus to the water.
2. The measurement of total phosphorus rather than phosphate may include phosphorus in suspended algae along with dissolved phosphate.
3. The BioHaven is removing almost all of the BOD, which may be the limiting factor for microbial growth. At these low BOD values, plants (algae and macrophytes) are likely to be the predominant mechanisms for removal of the remaining phosphorus.

Conclusions

Active floating treatment wetlands (the BioHaven Streambed FTW) installed in a wastewater retention pond reduced levels of ammonia, total nitrogen, BOD and TSS by up to 99%, 78%, 96% and 95%, respectively. Total phosphorus was not reduced, probably because aeration re-solubilized phosphorus from organic debris on the bottom of the pond. The visual appearance and odor of the pond were noticeably improved after BioHaven installation.



The BioHaven Streambed FTW shortly after installation in August 2012



The pond relatively free of algae and aquatic plants in April 2013