Floating Treatment Wetlands Remove Contaminants From Stormwater

Project Location: Durham, North Carolina USA

This case study demonstrates the capabilities of Floating Island International's (FII) patented floating treatment wetlands (FTW) technology and its ability to purify water by significantly reducing concentrations of several contaminants. Constructed of post-consumer polymer fibers and vegetated with native plants, FTWs mimic the ability of natural wetlands to clean water by bringing a "concentrated wetland effect" to any water body – in this case, two urban stormwater ponds. An independent research report was written for the North Carolina Department of Environment and Natural Resources (NCDENR) in March 2012 and is excerpted below. In summary, FTWs made good ponds work even better.

Summary

The purpose of the project was to evaluate a retrofit of wet ponds with FTWs, a hydroponic system that when fully vegetated, floats on the surface of open water. FTWs are a particularly attractive retrofit because they:

(1) Do not require earth-moving;
(2) Eliminate the need for additional land to be dedicated to treatment; and
(3) Will not detract from the required storage volume required for wet ponds, because they float.

To test whether FTWs provide a benefit for nutrient and total suspended solids (TSS) removal, two ponds in Durham, NC were monitored, pre- and post-FTW installation. The first (DOT pond) had 9% of its surface area covered, while the second (Museum pond) had 18% coverage. At least 16 events were collected from each pond in each period.

FTWs improved performance of both ponds, with the Museum pond having statistically significant improvement for both total phosphorus (TP) and TSS. Fraction of coverage appears to be an important variable. Root length was approximately two feet below the ponds, which has the benefit of stilling water flow, thereby increasing sedimentation. A very small fraction of N and P was also taken up by the plants. The mean effluent concentrations of total nitrogen (TN) were reduced at one pond from 1.05 mg/L to 0.61 mg/L, a dramatic improvement. Mean TP effluent concentrations were reduced at both ponds (0.17 mg/L to 0.12 mg/L at the DOT pond; 0.11 mg/L to 0.05 mg/L at the Museum pond). The post-retrofit concentrations are similar to those observed for bioretention cells.

Very importantly, both the pre- and post-FTW retrofit ponds performed well from a pollutant removal perspective. One pond had extremely low TN effluent concentrations (0.41 mg/L and 0.43 mg/L) during both pre- and post-FTW retrofit periods, respectively. These ponds regularly exceeded the assigned NCDENR pollutant removal credits for TN, TP and TSS. The report recommended offering additional credits when FTWs are incorporated at various levels.

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Installation Data

Location	Durham, NC USA
Parameters Studied	Nitrate, total nitrogen, total phosphorus, total suspended solids
System Type	Stormwater ponds
Total FTW Size	Area of 2,971 ft^2 (DOT pond); area of 990 ft^2 (Museum pond); thickness of 10 in. for both
Water Source	Stormwater runoff from paved parking surfaces
Installation Date	Spring 2010
Flow Rate	Variable, depending upon precipitation
Water Body Depth	Approximately 4 ft (DOT pond) and 3 ft (Museum pond)
Water Body Area	0.89 acre (DOT pond) and 0.12 acre (Museum pond)
% Coverage	9% (DOT pond) and 18% (Museum pond)

DOT pond with mature FTWs

Results

Removal results for the DOT pond (9% coverage) for nitrate, total N, total P and TSS are shown in Figure 1, for pre-FTW and post-FTW conditions. Removal improved with FTWs for all parameters except TSS. Removal results for the Museum pond (18% coverage) are shown in Figure 2. With higher coverage, removal with FTWs was much higher for all parameters except nitrate. FTWs improved removal of total P and TSS to a statistically significant degree.

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Figure 1. DOT Pond Results

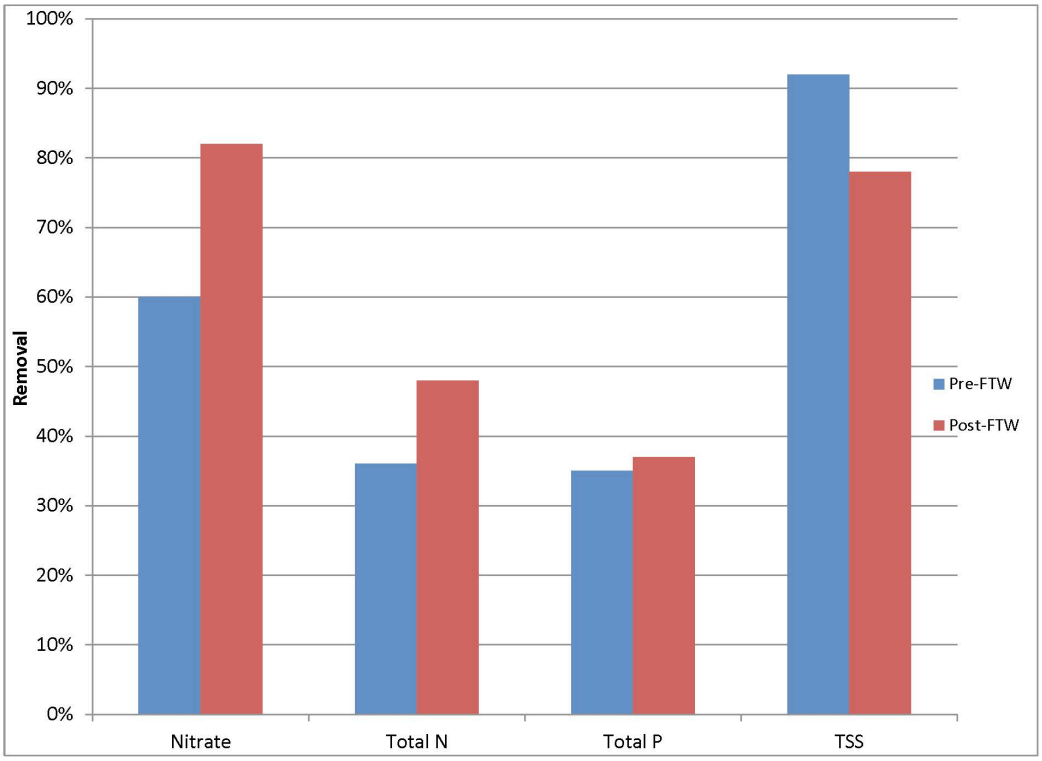
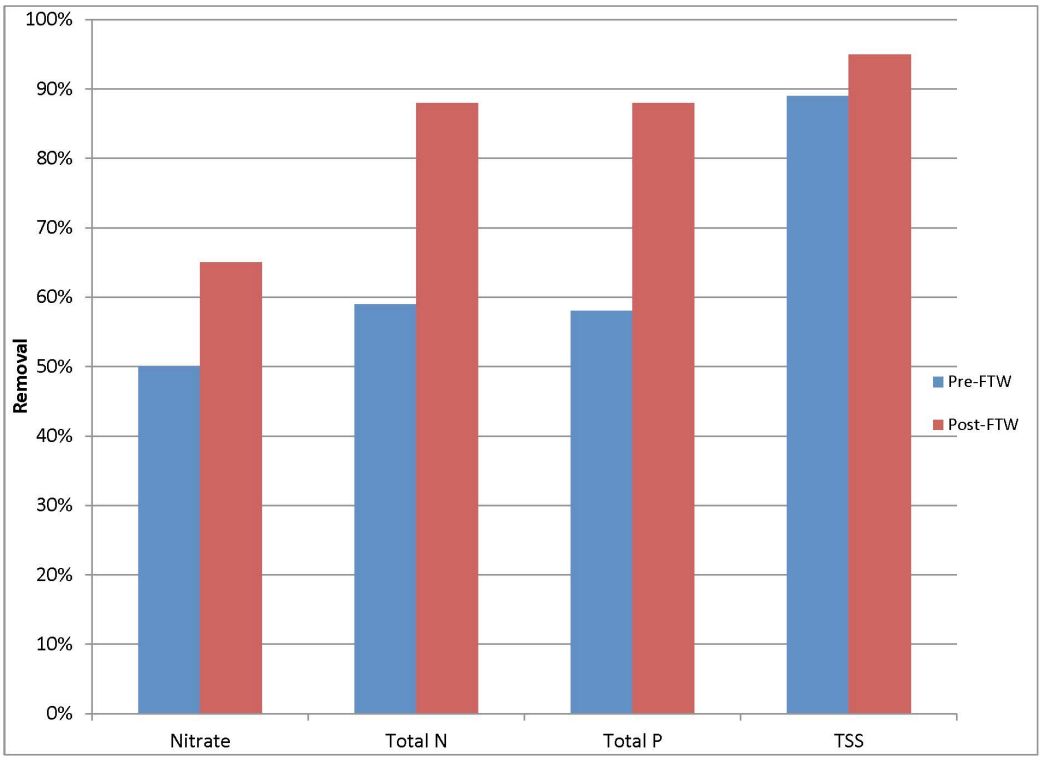


Figure 2. Museum Pond Results



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