

Wave Mitigation Using Floating Island Technology

Project Location: Holden, Massachusetts, USA

BioHaven® floating islands (floating treatment wetlands or FTWs) have been proven to dampen wave energy in both deep water and shoreline settings. Thus, they represent a powerful new tool to protect levees, valuable shorelines or other erosion-sensitive areas. FTWs from Floating Island International Inc. (FII) are constructed of post-consumer plastic fibers and typically vegetated with native plants, and are available in a variety of sizes and shapes.

Laboratory Study

In a controlled test overseen by hydraulic engineers at Alden Laboratories, wave attenuation properties of BioHaven® islands were studied in anticipation of their use for both bank stabilization and beach erosion protection. Several module arrangements were simulated, including attenuation in both deep water and adjacent to a simulated beach slope. Results demonstrated that for deep water waves, 7-to-10-inch waves were attenuated by approximately 80%. For the shoreline studies, wave run-up reduction ranged from about 58% for a single module (simulating one FTW) to 93% with three modules (three FTWs) in series.



BioHaven® modules for freshwater wave mitigation

Tests were conducted in a wave basin measuring 54 feet long by 6 feet wide by 7 feet deep. All wave tests were conducted with a 5.2-ft water depth. Two island modules were evaluated—one 9 inches thick and the other 14 inches thick. Both modules measured 5 feet wide by 6 feet long, and were tested with one inch of freeboard. Two 9-inch-thick modules were also evaluated in series.

To better approximate an actual floating island with plant growth, roots were simulated on the modules by adding quarter-inch nylon netting beneath the water surface. The simulated roots had little or no effect on wave attenuation (Table 1). Higher waves, thicker modules and two modules in series all led to slightly better attenuation.

TABLE 1. WAVE ATTENUATION RESULTS

Module Thickness (in.)	Wave Height (in.)	Wave Attenuation	
		No Roots	With Roots
9	7.2	77%	79%
9	10	80%	80%
14	10	NA	83%
9—two in series	7.2	77%	NA
9—two in series	10	84%	NA

Exact attenuation properties will be site-dependent, and will depend on wave height and shape, as well as water depth and shoreline angle. These results should serve as a preliminary guide to help potential FTW users in the planning process; more detailed analysis is available through Floating Island International.

Applications

A BioHaven® placed close to a sensitive shoreline, or attached to the shore as an overhanging bank, can be used in applications ranging from freshwater lakes and ponds to fragile coastal habitats impacted by waves. FII personnel have determined the wave forces imparted to FTWs under various conditions, and can design the appropriate anchoring systems.