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**HABITAT RESTORATION
ENVIRONMENTAL MANAGEMENT**

MANAGING STORM WAVE ENERGY USING A SIMPLE SYSTEM

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Storms consist of mass and energy. Most storm management systems try to manage the water mass, which is 40X heavier than air and cannot be compressed. When we discover how to manage the energy, the energy will manage the mass.



Above image by G. Peabody: 40 foot long pilings, originally installed fifteen feet from building, leaning against Restaurant, after years of storm wave impacts. Since water is not compressible, storm waves pushed the pilings against the Restaurant. Subsequent very large storms (on average every 6-10 years) now had access to the Restaurant. When Safe Harbor was asked to replace the pilings, we were not going to recreate the same problem. Instead, we decided to experiment with a simple difference in pile spacing. We created these alternative spaces for the waves to be driven into, where wave energy could be resolved and stop driving the waves.



Safe Harbor was called in because the Restaurant was getting destroyed by waves every 6 yrs.



The innovative piling system Safe Harbor designed, provided pathways for wave access but when Storm waves were forced through those pathways, the energy driving the waves would be expended (managed), sometimes explosively and only inert water mass would remain



This is a great image illustrating the functional (% open/% closed) symmetry of Safe Harbor's successful wave energy management system. If we manage energy, energy will manage mass.

WAVE ENERGY; REDIRECTION; TURBULENCE; PROTECTION

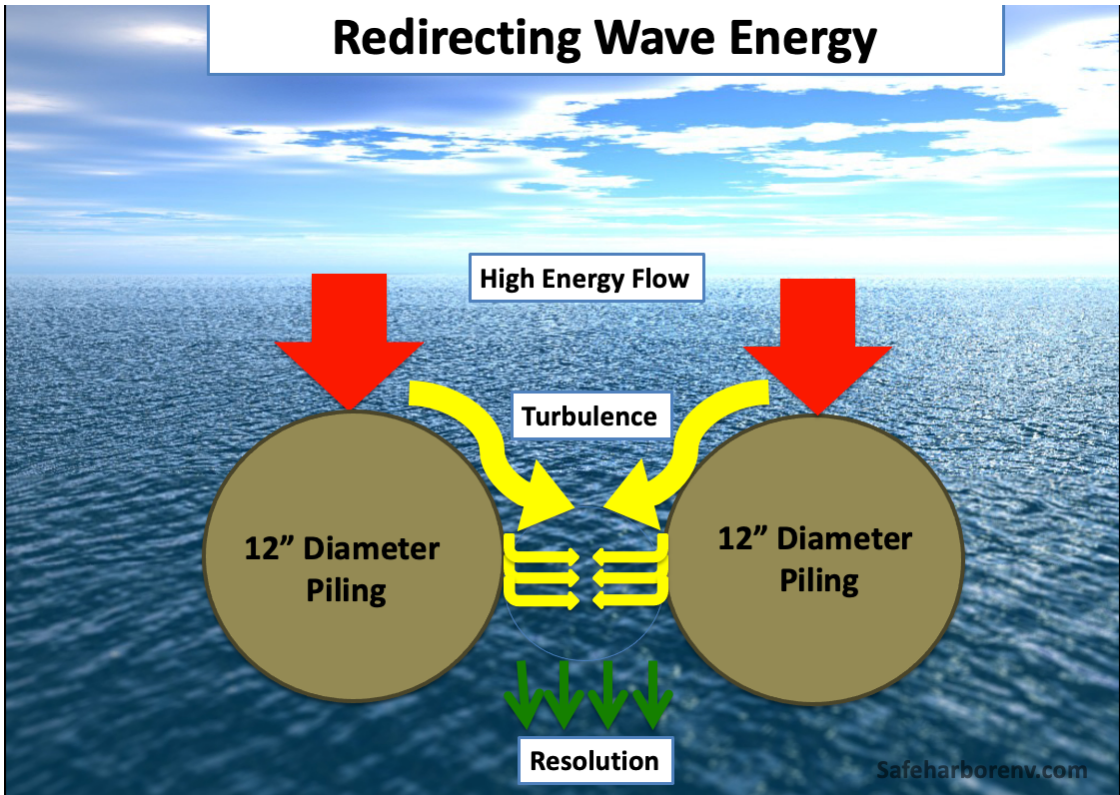


As storm wave energy drives storm wave mass through management openings, the storm wave energy begins to get expended between the pilings, as seen here, from above.



More complete resolution is underway here, as storm wave energy becomes expended. Essentially, the piles and spaces divide the wave mass and the wave energy into two similar parcels, which are then driven into each other and being of similar energy and mass, cancel out.

Redirecting Wave Energy



Safe Harbor image above: Illustrates storm wave energy management strategy.

Image below: Close up of wave energy management system functioning, with wave energy being resolved and no damage to the adjacent Restaurant, a few inches away.





Image above showing conditions at grade after nearly 20 years of use: No erosion; no accretion; no destabilization and no change in vertical piles, following nearly two decades of storms.



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IN THIS 12/24/2022 IMAGE OF SAME LOCATION, THE ELEVATED STORM SURGE (POCKET SURGE FROM SOUTHERLY WAVE LOADING WITHIN PROVINCETOWN HOOK) OVERWASHED PILINGS, WHICH HAD BEEN TRIMMED TO PRESERVE HARBOR VIEW. LACKING THE PROTECTION, THE WAVES GAINED ACCESS TO THE STRUCTURE.

