

## PEM - Eco-friendly and economical beach erosion control

Pressure Equalizing Modules, PEM is a patented Eco-friendly beach erosion control system that has been used world-wide for more than a decade.

PEM restores and enhances the beach's ability to drain. More water will drain through the top layer of the beach causing extra sand grains to be deposited on the beach rather than pulled away by the waves. Sand will be blown by the wind further onto the beach and the dunes.

Gradually the beach will grow.

PEM may be used in combination with beach nourishment to retain sand, or as a stand-alone solution if enough sand is available in the beach eco system. The PEM System

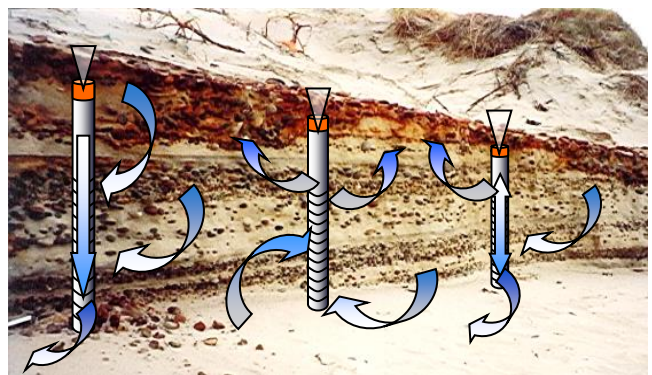
- Uses no power or other energy
- Produces no CO<sub>2</sub> during operation
- Operates under the sand and is invisible to the beach visitors
- Creates no scarps/sand walls
- Causes no down-drift erosion
- Adds sand to the beach that is similar to the original type of sand
- Is turtle friendly
- Is very cost-effective where conditions are right

In the US the PEM system is sold by EcoShore Int'l, Inc. and internationally by large engineering companies such as the Dutch Royal BAM Group with \$10 billion in annual sale which recently offered a 70 miles PEM project in Europe at a fraction of traditional beach nourishment costs.

### Restoring optimal beach drainage

In 1997 Turner and Leatherman concluded; "In a qualitative sense, the role of elevated beach groundwater in promoting beach face erosion and lower beach water table in promoting onshore accretion, is now well established." JCR,13 (4).

Over time storms and tide create layers in the beach and it takes only a few fine layers of silt or clay to reduce a beach's ability to drain during falling tide. The waves can no longer sink in and deposit the sand they contain. Instead the sand is pulled back to the sea, as described by the professors.



When PEMs are installed in a beach they penetrate and connect the different layers of material. Tiny slits in the PEMs let water in, and vertically connecting many layers. During falling tide water will naturally find the layer (aquifer) with least resistance, typically coarser material, through which it will drain. A vent in the top of the PEM allows air in as fluid escapes. This acts like the tiny air vent on a Starbuck cup lid, which also serves to equalize pressure and promote flow of a fluid.

## Project design and Installation

Initially the beach is analysed and the reason for the erosion established. The process involves desk research, site visits and potentially a Pilot Test to define if PEM is a viable solution and to define the optimal PEM configuration.

Installation involves lightweight equipment which ensures minimal disruption to the environment. In principle this could take place during nesting season as each PEM location is relatively flexible. Typically the hollow permeable PEM tubes are inserted vertically into the beach using an earth drill or water jet. The PEMs are installed in a row from the dune to the mean low waterline ensuring that the seaward PEM is always under water. Additional rows are placed along the beach. The dimensions of PEMs and configuration of the grid is site specific.



The PEMs are placed 1-3 ft. below the beach surface, making the entire installation invisible to the naked eye. The PEMs are not connected and no energy is used to operate the system.

## Environmentally attractive

The PEM system is an environmentally safe solution to beach erosion and is used in European Habitat Areas.

Turtles

No incidental takes during pumping sand as no pumping is taking place.

No false crawls due to scarps and sand walls as no sand walls are formed.

PEM is popular among turtles. The section of the beach where PEM was installed in 2009 became the most popular nesting ground for Green Turtles in Broward County, FL.

CO<sub>2</sub>

No CO<sub>2</sub> is emitted during excavating, sorting, loading, moving, transporting, reloading and spreading sand.

A minimum of 1,600 tons CO<sub>2</sub> is saved per 100,000 CY sand accreted that would otherwise be trucked in.

## International results

The PEM system has been used with success in Europe, Asia, Africa and the USA. PEM has been installed on natural beaches to regain lost sand, on nourished beaches to prolong the time between re-nourishments, in high and low energy environment (tides and waves), and beaches on mainland and barrier islands. For details see <http://ecoshore.com/projects/>

It is common that beaches are converted from eroding to accreting when PEMs are installed for several years. On the photo to the right PEMs had been installed on the highly eroding Danish West Coast for 8 years. The eroding beach no longer lost sand and a new dune emerged in front of the old taller dune.



## How do you prefer to pay for sand?

The cost of using a PEM system is much lower than traditional nourishment and payment is flexible.

- Buy - EcoShore engineer, install and maintain a PEM system. Pay for installation and 5 years maintenance.
- Lease - EcoShore engineer, install and maintain a PEM system. Monthly fee for 5 years.
- No cure no pay - Following a pre study phase payment will be linked to beach sand volume in 2,3 or...5 years.

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