Description of Alternative Devices for Shoreline Stabilization

An attempt was made to contact all companies whose products are listed. Not all were successful and the best available data is listed here. Where no information was available, the installation section is left blank.

Devices Placed in the Water Breakwaters Artificial Seaweed

Devices Placed on the Beach Groins Seawalls Dewatering Dune Stabilization Other

I. Devices Placed in the Water A. Breakwaters

Function

- Shore parallel structure placed offshore, either submerged or floating.
- Dissipates wave energy by forcing waves to break. This creates a "wave shadow" causing sand deposition.

Associated Problems

- Wave action may cause scour in the vicinity of the device.
- May increase downdrift erosion by removing material from littoral current.
- May impact water quality because of reduced water circulation.
- May endanger swimmers or boaters.

Device	Installation	Manufacturer's Claims
Atlas Shoreline Protection System - Stacked timber, laid horizontally, held together by steel supports. Arranged in a sawtooth pattern on the nearshore, parallel to beach.		• Prohibits erosion & allows for accretion inward & outward of system. • Long life, low maintenance.
Beach Prisms - Concrete locks, with a triangular cross-section. Each unit is 6' high, 12' long and 84" wide with a concave, openwork front face.	• 1988 - Chesapeake Bay	• Openwork face allows more water to flow through, which reduces scour.
Beachsaver reef - Interlocking, concrete units, triangular in cross-section. Each is 10'long, 6' high, 16' wide. The front face is ridged to reduce wave reflection, with a slotted opening at the top.	• 1993 - Avalon, NJ • 1994 - Cape May Pt. & Belmar/ Spring Lake, NJ	• Water flows through slotted openings at top, sand is suspended & carried forward by incoming waves. • Stabilizes beach nourishment, requiring less sand for renourishment. • Attracts wildlife.
Menger Submerged Reef - Triangular in cross-section; welded iron frame covered with steel screen mesh & concrete. Submerged offshore by filling with sand.		• Prevents sand from washing seaward by slowing wave energy • Units can withstand severe weather changes, because the materials expand and contract. • Re-usable; not permanent • Environmentally friendly because it can be moved with ease.
MOTO - Primary function is to harness wave energy but also acts as a breakwater to reduce		• Waves lose power by creating energy, thus reducing erosion. • Provides clea3n energy and fresh

coastal erosion. Installation- 3 toroids, 10' in diameter weighing 4 tons each, placed at least 20' deep.		water.
Pep Reef- Concrete units, triangular in cross-section, 6' high, weighing 20 tons. Placed 2-4' below surface at low tide.	• 1988- Palm Beach, FL (Privately funded) • 1992-1993 - Palm Beach, FL (*removed in 1995 because of increased erosion) • 1996- Vero Beach, FL	• Builds trough and bar areas beyond the foreshore which shifts the foreshore outward. • Stabilizes the shoreline. • Reduces wave energy 40-70%. • Can be relocated easily. • Shelter and habitat for animals.
Sealift-Shoreline breakwater, triangular in cross-section, place beyond foreshore where it is shallow at low tide. Angled, so as to slow wave energy.	• 1990 - proposed for Palm Beach	• Pollution free installation. • Waves lose much of their destructive power. • Reduces long term erosion. • Compresses the configuration of wave cells.
Shoreprotector -Submerged sand fence, place 400' offshore. Made of openwork steel frame with 4 baffles on each side; 7' tall, 16' wide at base, weighing 650 lbs.	• 1975 - Virginia Beach, Va. Removed due to failure. Installation cost: $108,000 Removal cost: approx. $67,700	• Flexible design. • Removable.
Surge breaker -Permanent, steel reinforced "prisms", 4' high, 4' wide and 6' deep; placed in 3-8' deep water. Can	• 1976- Highlands Park, IL • 1979- Bayou State Park, FL	• Simulates offshore sandbars and reefs. • Stimulates accretion, reduces erosion.

be joined by steel cables for higher energy environments. Recommend installing 2 systems parallel to each other.	• 1984- Kuala Regional Park, Oahu, HI	• Will work on any beach. • Will withstand extreme weather. • *In 8 months beach accreted 50' in width in IL.
Temple Beach System - Reinforced concrete, triangular in cross-section, placed at mean low-tide/12-18" below high tide, parallel to the shore. Metal rods are used to anchor.		• Does not interfere with boaters, bathers or turtles. • Mitigates against storm damage. • Moves high & low tide line an average of 200' outward. • Protects beach nourishment.
Waveblock - Modularized, permeable, steel reinforced concrete. Structure is an angled tower.		• Absorbs wave energy before it reaches the shoreline.
Waveshield - Floating system made of steel; each unit is 80' long, 20' wide & 18' high, weighing 40 tons. Unit of 3 compartments. Best in 25-30' deep water.		• Provides protection against wave damage and erosion. • Breaks 8-10' roller waves. • Economical, simple & easy to make. • Can be floated to any location, thereby avoiding high accretion on the landward side.
Wave Wedge - Concrete, interlocking units; triangular in cross-section, weighing 5,000 lbs. Three slots/holes on the front face.	• 1985-Michiana, MI	• Slots on front absorb energy. • Builds up foreshore & sandy beach. • Restores sand lost during storms.

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B. Artificial Seaweed and Others

Function

- Low-lying devices that are anchored to the seafloor.
- Designed to slow waves and reduce energy, causing sand carried by waves to be deposited.
- Also designed to slow return wave energy, so that sand carried off the shore by return flow is deposited nearshore.

Associated Problems

- Devices are placed in shallow water and may be hazardous to swimmers and boaters.
- Many lack the weight or design to be suitably anchored and do not withstand storms.
- Creates debris on beach when washed out by storms.

Device	Installation	Manufacturer's Claims
Beach Cones - Concrete donut 6" high, 2' across, 40" across the bottom weighing 92 lbs. each.	• 1992 -Shell Island in Lower Plagumines, LA	• Provide hard bottom stabilization for sand accretion. • No loss during Hurricane Andrew of an installation that included 300 cones and 13-72 cu. yds. of sand. • Average accretion, 6', max gain 3'.
Beach Protector Tire Mat -Tires anchored to each other & to the seafloor in a section 30-60' wide & at least 1 mile long. Can be shorter if between 2 promontories & close to end of one of the promontories.		• Slows the return of "sand laden" waves.
Burns Beach Erosion Device - Concrete Block (5'x 2' x8") with rubber tire strips (1"-2" wide)		• Dissipates wave energy reducing offshore transport of sand.

attached to me top of the block. Acts as artificial seaweed.		• Allows for greater accretion of sand during storm conditions. • May provide protection for turtles & substrate for crustaceans.
Cegrass - Synthetic seaweed made of foamed polypropylene, attached to open grid mat, held to seafloor by ballasts. The length of the mat is tailored to the environment.	• 1985-Germany, to fix scour caused by pipeline • -Italy • -Wetlands in Europe	• Reduces nearshore current velocities, thereby sand is dropped in sandbars which build up to 1.6m high. • Reduces offshore sand movement and scour.
Coil System - 9-gauge wire, 24-30" in diameter, intertwined with smaller wire, attached to the ocean floor. Installed between inlets, 500' to 2000' from shore, in grid system 100' between units, which are placed at an angle to the shore.		• Sand is captured within the coil grid and returned to the shore by tides & wind. • Coils interrupt ocean currents, allowing for sand to be trapped while currents pass through. • If properly emplaced, there will be no sand loss to adjacent beaches.
Seabee-A series of six sided concrete blocks, weighing 35 lbs. to 1 ton, with holes (honeycomb design) placed on slope in the nearshore. 20% of construction material is recycled ash.	• 1989, Tidewater Community College-Portsmouth. Monitored by VIMS.	• 20" of sand and silt collected between 1989 and 1996 on Tidewater Test Site. • Reduces energy of wave run-up, causing sand to be deposited.
Seascape -Synthetic seaweed. Plastic filaments attached to a bag which is filled with sand to	• 1981- Cape Hatteras, NC • 1983/1984- Barbados	• Controls shoreline erosion. • Fronds reduce current flow, sand is dropped.

anchor3 the device.		

II. Devices Placed on the Beach A. Groins

Function

- Perpendicular to the shoreline, placed on the beach extending into the water, or submerged.
- Designed to trap sediment that is moving alongshore in the littoral current.

Associated Problems

- Cause erosion of downdrift beaches.
- May create rip currents that are hazardous to swimmers.
- Nuisance to recreational beach use.

Device	Installation	Manufacturer's Claims
Brush Fence - Christmas trees or discarded lumber laid out in a "crib" fashion.; 4' wide, 72' long.	• Jefferson Park, LA	• Protects the shoreline.
Holmberg Undercurrent Stabilizer -"Interlocked network of geotextile forms injected with concrete." Site specific design with longshore & offshore components laid perpendicular & parallel to the waterline. Accretion template which builds the submerged nearshore profile.	• 1982-Manasota Key, FL • 1983-Michigan near Buffalo; Captiva, FL and Ogden Dunes, IN.	• Slows currents so that inlets & jetties don't divert sand. Nearshore sand stays nearshore. Sand coming from offshore no longer transported downshore by littoral currents, therefore beaches accrete. This induces nearshore shoaling.
Parker Sand Web - Series of fish nets (50-100' apart) perpendicular to the shore, strung from the high tide line, into the	• 1987- Pelican Bay Beach, FL. Had to be removed after 20 days because	

water. Nets are made of heavy nylon material. Work similar to a groin, trap suspended sand.	the installation did not have a permit.	
Shoreline Construction Corp. groin - Low profile sill and groin system. Sill placed at an angle to the shore; acts as an artificial bar. Groin, perpendicular to the shore on either end of the sill & in the middle. The groin directs the flow of the sediment & water & reduces currents.		• System is at or below the water level, so waves can still overtop which eliminates scouring, flanking and reflection. • Eventually the whole system is covered by sand.
Stabilito - Plastic groin/artificial ripple, 5m long, 1.8m wide, 60 cm high; placed perpendicular to shore on a submerged beach or dune.		• Slows & "elevates" currents, thereby creating sand ripples. • Stabilizes coastlines, riverside erosion and dunes.

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B. Seawalls

Function

- A wall placed at the base of a bluff, at edge of shoreline property or at the landward edge of a beach.
- Designed to protect land from the impact of wave energy.

Associated Problems

- Cause both active and passive erosion of the front beach. Cuts off local sediment supply.
- Active: waves that hit are reflected and wash downward, which increases scouring at the toe of the wall.
- Passive: seawalls prevent beaches from migrating landward; a natural response to sea level rise.

Device	Site	Manufacturer's Claims
High Energy Return Wall - Concave seawall that causes		• Reduces toe scour common with traditional seawalls.

wind and water to work against each other, thereby flattening the sea surface. Individual sections are 33' by 44' at base. Wall is 30'. Perforations in "splash pad" allow for water to pass through & sand to be deposited on back side of wall.		• Causes beach accretion.
Marine Bin Walls - Steel bin filled with "granular material" to withstand freezing & thawing. Placed at shoreline or base of bluff.	• Protects homes. • Best suited for Marine construction.	
Ravens Retaining Wall - Aluminum, corrugated retaining wall placed at the water's edge at the base of a bluff.	• unspecified	• Protects property from slippage & erosion by tides.
Wave Buster - Seawall with angled top to reduce wave reflection. Associate drainfield above & behind bluff to reduce hydrostatic pressure. Base secured with geotextile bed.	• Great Lakes- unspecified	• Deflects water up & back without reflecting the waves- reduces toe scour.
Z-wall - Low-lying concrete wall placed in a saw-tooth pattern at the base of a bluff or, ideally, offshore, submerged halfway.	• 1973, Buttersville Park, Luddington, MI	• Reduces erosion & encourages the build-up of sand in front of the wall. • Redirects wave energy so that sand is dropped.

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C. Dewatering

Function

- A drain and pump system extracts water from the beach allowing for more percolation of incoming waves.
- When water percolates through the sand, the sand being carried by the incoming wave is deposited at the surface.
- With dewatering devices, there is a pump placed at the high tide line which withdraws water collected in underbeach drainfield
- As the groundwater is pumped out, it is funneled to the ocean or collected as a resource.

Associated Problems

- Must be turned off during turtle nesting season because groundwater extraction affects the temperature of the sand.
- Has not proven to withstand storms. In Nantucket, the system broke down during every major storm.
- Swimming is prohibited in front of the installation because the pipes pose a possible hazard.

Device	Installation	Manufacturer's Claims
HDSI - Buried wells extract groundwater, thereby leaving an unsaturated zone. Waves run-up & the water percolates below ground, depositing sand.		• Easier to install & more cost effective than traditional dewatering devices. • Not susceptible to storm damage. • Environmentally friendly, even to turtles. • Can be operated at variable rates.
Stabeach - System includes a pump placed on the high tide beach with drain pipes attached. The pipes run underground & discharge into the ocean.	• 1988-Sailfish Pt., FL • 1994-Englewood, FL • 1996-Nantucket, MA	• Builds beaches while reducing erosion- less water washes back to the ocean in return flow, so less sand is carried with it. • Installation causes relatively little disturbance to the beach.

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D. Bluff/Dune Stabilization

Function

- Low-lying barrier placed on the beach to prevent erosion.
- May also aid in trapping wind blown sand to build an artificial dune.

Associated Problems

- Revetments protect only the land behind the structure, therefore the front of the beach may continue to erode.
- May lead to passive erosion in that sand is trapped by the revetments, and the beach is then unable to retreat from a rising sea level.

Device	Installation	Manufacturer's Claims
Biodune Sand Gel - Spray gel-mixture of 97% beach sand & water with non-toxic biodegradable aqueous polymer gel.	• St. Augustine, FL • Melbourne Beach, FL • Ft. Fisher, NC	• Stabilizes dunes. • Doesn't deter marine turtles. • Withstood three years of storms (dunes lost elevations, but were not undercut) • Damage can still be caused by walkover. • Does not impede growth of vegetation.
Dune Guard - Similar to sand fencing but made of polymer grid attached to poles.	• Avalon, NJ	• Captures wind blown sand. • Especially suited for storms. • Lasts longer than ordinary sand fencing, partially because it resists weathering. • Can resist 9 ton force.
Fabric Fence - Sand fence made from yarn impregnated & coated with foam vinyl plastic, attached to poles & placed at the high tide mark or base of the dune line. Rolls are 150' long, 46" high.		• Highly visible. • Easy to install. • Stable & weather resistant.
Nicolon Geotubes - textile tube made from woven polyester; 30' in circumference & variable lengths. Bags are filled with sand and placed in a trench at the toe of a dune.	• 1995-Atlantic City, NJ	• Stabilizes dunes & prevents landward erosion. • Can also be used as a groin.
Soukup Rubber Tire Revetment - Tires placed in a 16-18" deep, 15' wide trench, lined with filter cloth on the low-tide dry beach. Tires are covered with the sand that is dug out.		• Tires act as a more stable sandbag. • Stabilize the shoreline behind the revetment.
Subsurface Dune Restoration - A dune is created by burying sandbags on a re-contoured slope. Vegetation is then established	• Caledon Shores	• Dissipates storm wave energy which reduces erosion.

to protect the dune.	• 1997-Long Island, NY	• Designed for a 25 year storm. • Also allows for percolation of waves which builds up sand on the surface.
Triton Marine Mattress - Stone filled mattresses used for bluff or dune stabilization.	• Trinidad • Boston Harbor, MA	• Stabilization of bluffs & dunes. • Protection from scour.

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E. Other

Device	Installation	Manufacturer's Claims
Beachbuilder Technique - Elastomer coated industrial fabric, 25' wide, anchored from the high beach to the tide line. Uses the energy of waves to build the beach (maximum winter buildup) by preventing the removal of sand during wave retreat.		• Restricts the return flow of sand carried by a retreating wave. • "Accretion concentration of 60cu yd/ft in less than 4 days."
Stabler Disks - Concrete disks, 4' in diameter, attached to pilings & placed at the storm high tide line.	• 1993-Spring Lake, NJ • 1996-Myrtle Beach, SC	• Protects beaches & dunes by reducing storm wave energy. • Waves are slowed, sand is dropped & disks are covered.