

 **TENCATE**
Geotube®

GEOSYNTHETICS
Containment

Geotube® Shoreline Protection



Protective & Outdoor Fabrics
Aerospace Composites
Armour Composites

Geosynthetics
Industrial Fabrics
Synthetic Grass

 **TENCATE™**
materials that make a difference

For More Than 40 Years, We've Protected Shorelines, Rebuilt Beaches, and Reclaimed Land From The Sea

Fighting and controlling the power of water is a daunting task. But more than 40 years ago, we developed a technology that could be used to stop storm damage, protect the environment, build custom structures, and even build islands where they didn't exist before. Geotube® containment technology is a proven, cost-effective method for a variety of shoreline protection and marine construction projects. Geotube® technology has been used to produce sand dune cores; wetlands and other habitats; jetties, dikes, and groynes; underwater structures—and to even raise brand new islands from under water.

Developed using input from the U.S. Army Corps of Engineers, Geotube® technology is cost-effective, durable, easy to install, and highly flexible. It's been proven in applications around the world and is installed in more than 50 countries. Better yet, Geotube® technology has literally saved millions of dollars for companies and individuals.



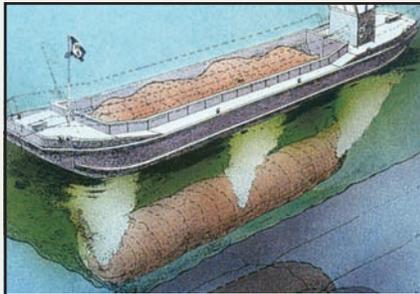
Underwater Structures

Containment Systems That Can Be Dropped In Place

Another aspect of Geotube® containment technology is the Geocontainer® unit, which is specially designed to be filled before being placed in the water. Special split bottom barges are used to fill the containers, which are sewn shut once filled, then reinforced with rope ties.

When the barge moves to the proper position, the bottom opens and the container slides through and settles to the bottom. Containers can be placed in position with a high degree of accuracy.

Geocontainer® units used for underwater structures can create dikes, close openings, contain dredge spoils or other materials, or change water and wave action.



Geocontainer® unit being dropped from split bottommed barge.



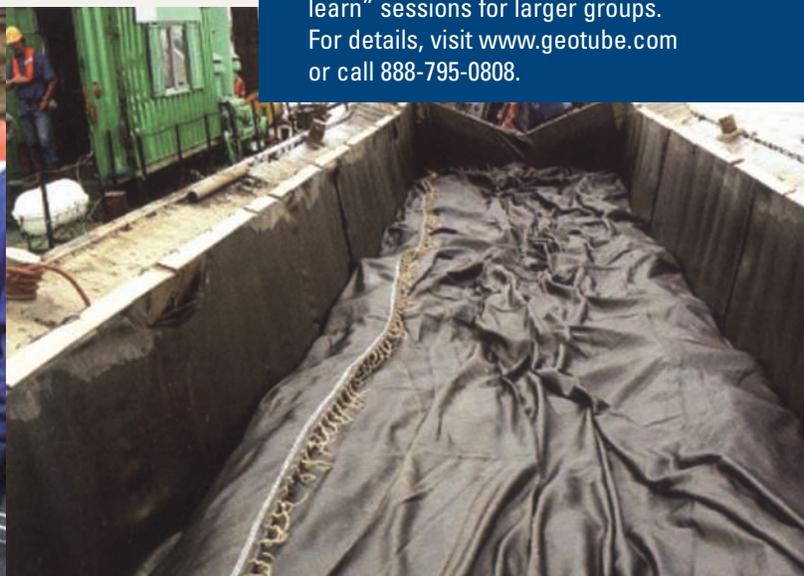
Case Study

application	Underwater Structure
location	Twielenfleth, Germany
product	Geotube® Technology

Instead of using costly rock to create underwater structures in the River Elbe, Geocontainer® units were utilized to contain dredge spoils and produce effective, long-lasting structures. Over a period of six months, more than 600 Geocontainer® units each containing 350 cubic meters of sand and silt were used in the construction of the sill. Two split-bottom barges were utilized to fill the Geocontainer® units and drop them into place.

See Our Presentation

To learn more about Geotube® technology, we invite you to look at our CD presentation, which provides detailed information. We can even schedule “lunch and learn” sessions for larger groups. For details, visit www.geotube.com or call 888-795-0808.





Jetties

Versatility In Construction

Geotube® containment technology is often used for jetty construction, because of its flexibility in design, cost-effectiveness, and speed of installation. In many areas, there is not enough rock nearby to allow jetties to be built from stone, and Geotube® technology can be used so that sand and soil from the immediate area produce a stable structure. This can save significant amounts of money over trucking in materials.

Geotube® technology also allows great versatility in construction. Because units can be custom sized to various lengths and circumferences, less material may be needed. Also, because Geotube® units can be filled quickly in place, construction time can be reduced dramatically.



Geotube® unit being held in place by steel frame as it is filled.

Case Study

application	Marina Construction
location	Stella Maris, Ecuador
product	Geotube® Technology

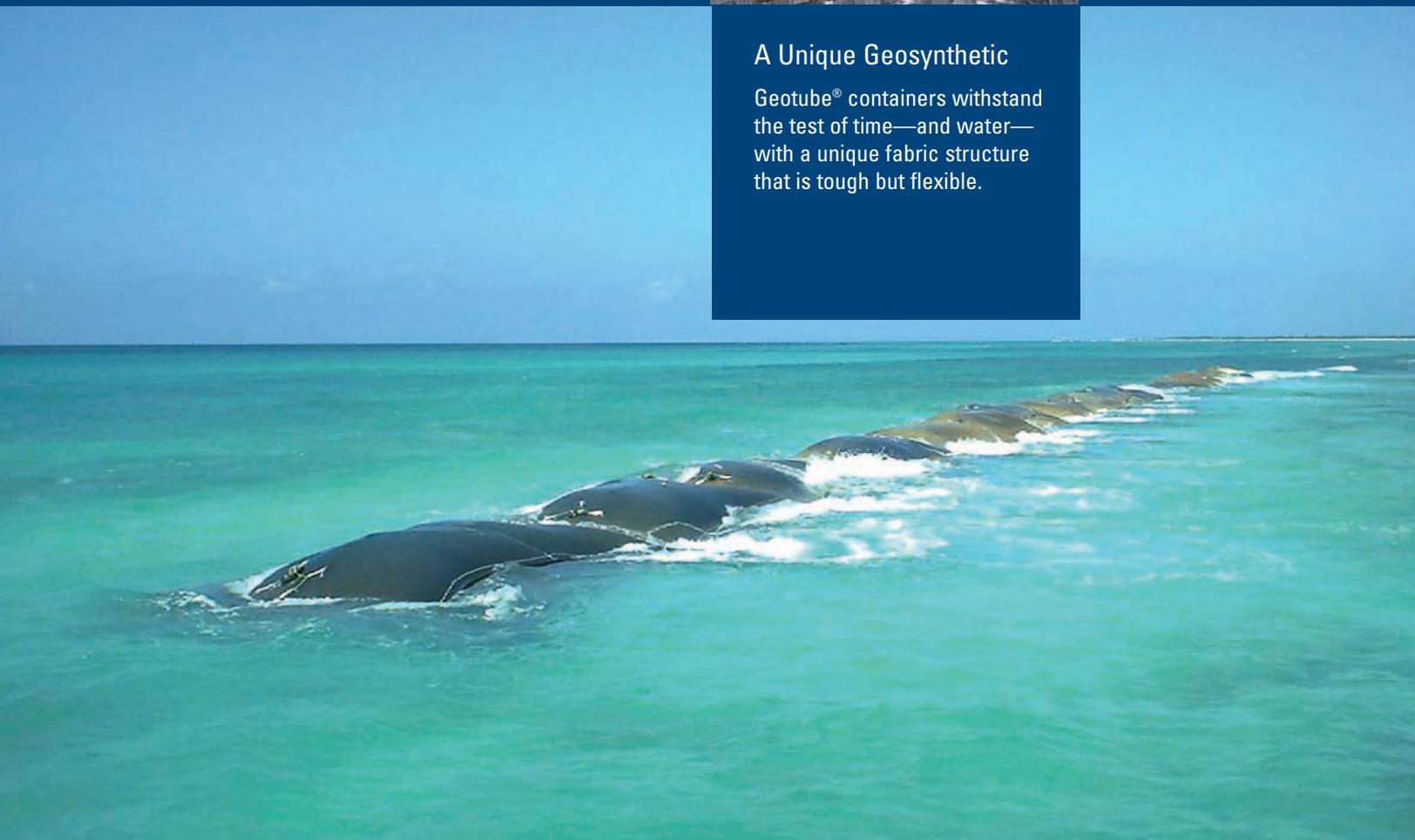
Stella Maris, a luxury resort on the Pacific Coast of Ecuador, used Geotube® technology to construct the cores of two jetties because there was not a nearby source for rock. Geotube® units were filled with sand dredged from the ocean at the site. The units were stacked in a "pyramid" method to build up the jetty core. To keep the individual 70' long Geotube® units straight during filling (while being pounded by waves), a steel position frame was used. A total of 6,000 lin/ft of 45' circumference Geotube® units form the core of the jetties which were then covered with rock to provide permanent protection. The Geotube® units were strong enough so that heavy construction machinery could drive on top as the structures were being built.





A Unique Geosynthetic

Geotube® containers withstand the test of time—and water—with a unique fabric structure that is tough but flexible.





Case Study

application	Shoreline Protection, Beach Restoration
location	Atlantic City, NJ
product	Geotube® Technology

When erosion threatened Atlantic City's famous Boardwalk, millions of dollars of property were at stake. Hurricanes cut away so much of the sand that waves were literally washing over the Boardwalk itself. But with Geotube® geocontainment technology installed to stop erosion and allow the sand to build upon itself, there is now more than 150 feet of beach (complete with oat-covered dunes) between the Boardwalk and the water. This project has been in place for over 10 years, and is still doing its job.

Sand Dune Cores

Stopping Beach Erosion and Property Damage

Geotube® containment technology has proven to be exceptionally valuable for protecting shorelines from erosion, particularly during hurricanes and tropical storms. The process is simple: a large tube made of a specially engineered textile is filled with sand and buried under the beach. When rough weather threatens, the tube holds the sand and soil in place, preventing erosion and property damage.

Geotube® technology uses geotextile containers up to hundreds of feet in length. In most cases, installation is permanent—and invisible. However, when necessary, units can easily be removed.

In fact, one of the advantages of Geotube® geocontainment technology is that the gentle original slope of the beach can be recreated. This improves the aesthetics of the shoreline and also aids wildlife by providing a natural-seeming habitat—and blocking lights from shore that can confuse sea turtles and other creatures.



Geotube® unit being filled with sand using a hopper.



Groynes

Simple and Effective

Groynes are a quick and economical method of shoreline protection that is ideal for Geotube® containment technology. These short, perpendicular extensions from the shoreline stop lateral drift of sand and allow beaches to renourish with little or no maintenance.

Because Geotube® units can be custom sized, groyne applications can be designed for optimum performance. Geotube® units can be filled with sand from the area when allowed, simplifying the construction process. If regulations require fill material to come from another location, the units can still be filled less expensively than other construction methods.



Geotube® containers being positioned to create groyne for shrimp farm inlet.



Case Study

application	Beach Reclamation and Restoration
location	Bald Head Island, NC
product	Geotube® Technology

To stop beach erosion in this resort community, sixteen 30-foot circumference x 300 feet long Geotube® units were used to construct jetties along the shoreline. Two days after construction was completed, Hurricane Francis struck the North Carolina coastline.

No erosion occurred along the beach protected by Geotube® technology, and beach width began increasing almost immediately. Geotube® technology proved to be an extremely cost effective method of rebuilding the beach.





Case Study

application	Beach Restoration
location	Upham Beach, FL
product	Geotube® Technology

The US Army Corps of Engineers maintains Upham Beach in Pinellas County, Florida which has the worst erosion problem on Florida's west coast. Over the past 30 years, more than \$10 million has been spent on renourishing Upham Beach, only to have the sand begin washing away again with the next storm.

But Geotube® technology has eliminated the problem. Special T-head groynes 200 feet long and 190 feet wide were constructed to break up wave action. Immediately sand began accumulating behind the T-groynes and renourishing the beach. Beachgoers walk along the Geotube® units, using them as vantage points to get better views of the beach and the ocean.

Breakwaters

Changing Water's Force From Bad To Good

Wave action has long been a problem for many beach communities, as it can erode beaches or place sand where it is not needed. To address this, Geotube® containment technology has been used at locations around the world.

Geotube® containers can be placed offshore in areas where wave action is causing damage. The units disrupt the water flow and waves, and the size and location of the structures can be engineered so as to encourage beach replenishment by the altered waves now reaching the beach. Many communities have added yards of shoreline with the simple, inexpensive installation of Geotube® technology installed offshore.



Geotube® unit placed offshore for use as a breakwater.

By using Geotube® technology to change wave patterns, millions of dollars have been saved in reduced property damage or expense for renourishing beaches.

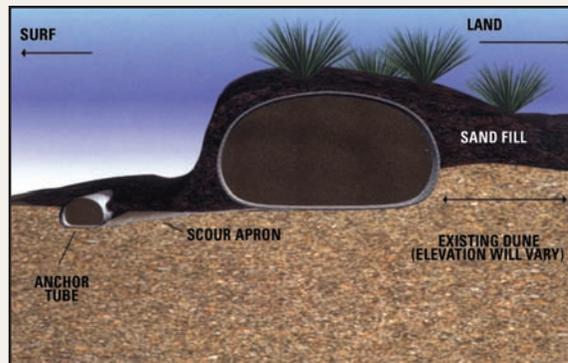


Ideal for Individual Homeowners

The simplicity of the process lends itself well to commercial properties and homeowner associations whose members are looking for solutions to erosion problems. In fact, Geotube® technology has been purchased and installed by many homeowners to protect their property and build up shorelines. A Geotube® Shoreline Protection System can be installed in a short period of time. It has qualified for installation under emergency permitting allowed for repairing storm damage. Once installed, the Geotube® unit is completely buried, and helps contribute to a gently sloping shoreline.

A single Geotube® unit can actually protect several homes. In many cases, homeowners have worked with each other to get the protection they need and reduce their costs. Homeowner associations can help coordinate efforts between members for proper shoreline protection using geocontainment technology.

In many coastal areas, temporary permits are now in place that allow immediate installation of Geotube® geocontainment technology to protect homes that are in danger.



Geotube® sand dune cross section.



Case Study

application	Shoreline Protection
location	Bolivar Peninsula, TX
product	Geotube® Technology

Along the Bolivar Peninsula in Texas, a Geotube® technology project used 18,000 linear feet of Geotube® units to protect homes from damage from a series of tropical storms. After Tropical Storm Allison in 2001, residents reported that not a single dollar of property damage occurred behind the line of defense created by the Geotube® units installed along the beach.

The project was so successful that another 15,000 linear feet were installed. Today, more than 20 miles of Texas shoreline are protected with Geotube® technology.





Case Study

application	Wetlands Creation and Beach Restoration
location	Corpus Christi, TX
product	Geotube® Technology

Shamrock Island, off the coast of Texas, was literally eroding into the sea. To reclaim the land, 3,000 linear feet of Geotube® units were installed along the island's shoreline to provide erosion protection and to create new wetlands.

After the Geotube® units were in place, sand was pumped in behind them to create wetlands areas. Marsh grass was then planted to develop the area into a bird sanctuary. The project has worked so well that it has been recognized across Texas and the nation as an example of environmental success.

Wetlands Creation

An Effective, Sound Way To Build Habitats

Because Geotube® containment technology is simple, cost-effective, and environmentally sound, it has been used in many areas for rebuilding wetlands habitats for birds and other species.

Geotube® units can be installed quickly, and they can be used to create miles of artificial shoreline if needed, while allowing sand to naturally collect behind them. Units can be covered or left exposed, with proper UV protection, and provide erosion protection in all types of weather.

Better yet, birds and other wildlife find the exposed Geotube® units ideal places to rest, sun, and fish.



Protective cover shields Geotube® containers from sun's damaging UV rays.



Island Creation

Making Land Rise From The Sea

Geotube® containment technology has been used for many ambitious projects, but perhaps none as bold as creating entirely new land. Geotube® technology has been used for island creation because of its ease of installation, ruggedness, and cost-effectiveness.

Miles of Geotube® containers can be used to produce durable shorelines that can be filled in behind the units to produce stable land for building. Skyscrapers have been constructed on property reclaimed from the sea by using Geotube® technology.

Geotube® containers can be stacked several high to produce the elevation necessary for backfilling and land creation. The containers can then be covered with rip rap, sand, or other soil to hide them and produce natural looking shorelines.



Geotube® containers are stacked to produce this protective structure.



Case Study

application	Creation of Island for Upscale Community
location	Amwaj Island, Bahrain
product	Geotube® Technology

As part of a \$1 billion project to reclaim land and build an exclusive community with upscale residences, luxury apartments, and a marina, the developers of Amwaj Islands selected Geotube® technology as a way to literally build islands from the sea.

A total of 60,000 lin/ft of 45' circumference Geotube® units were stacked two layers high to create containment dikes, and sand was filled in behind them to a height of over three meters above sea level. Work could be completed so quickly that the shoreline for the island was created in five months' time.



TenCate™ develops and produces materials that function to increase performance, reduce cost, and deliver measurable results by working with our customers to provide advanced solutions.

TenCate™ Geosynthetics N. America

3680 Mount Olive Road
Commerce, GA 30529
USA

Tel 706 693 1897
Toll free 888 795 0808
Fax 706 693 1896
Email: e.trainer@tencate.com

TenCate Industrial Zhuhai Co., Ltd.

South of Nangang Road W,
Harbour Industrial Zone,
Zhuhai 519050
China

Tel: +86-756-886 1616
Fax: +86-756-886 1610
Email: info.zhuhai@tencate.com

TenCate Geosynthetics Europe

Sluiskade NZ 14
Postbus 236
7600 AE Almelo
The Netherlands

Tel +31 546 544811
Fax +31 546 544490
Email: e.zengerink@tencate.com

TenCate Geosynthetics Asia Sdn Bhd

14, Jalan Sementa 27/91, Seksyen 27,
40400 Shah Alam
Selangor Darul Ehsan
Malaysia

Tel +60 3 5192 8568
Fax +60 3 5192 8575
Email: info.asia@tencate.com

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BRO.SHORE0608

3680 Mount Olive Road
Commerce, GA 30529

Tel 888 795 0808
Tel 706 693 1897

Fax 706 693 1896
www.geotube.com



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