

# GEOSYNTHETICS FOR ENVIRONMENTAL INFRASTRUCTURE

TenCate Geosynthetics Engineering Solutions



Dewatering  
Marine  
Waterways & Rivers  
Erosion Protection

Pond Capping  
Subgrade Stabilization  
Liner Protection  
Engineered Structures

 **TENCATE**  
GEOSYNTHETICS



# DEWATERING

## Cleaning your environment

TenCate Geotube® dewatering technology has become the dewatering method of choice for organizations around the world.

There are no belts or gears. Geotube® containers are available in a variety of sizes, depending on your volume and space requirements. Geotube® systems can even be mounted in mobile roll-off containers that can be transported around your property as necessary. It's one of the most versatile dewatering technologies available, and one of the most effective! Volume reduction can be as much as 90%, with high solid levels that make removal and disposal easy.

Geotube® dewatering technology is a three step process: Filling, Dewatering, and Consolidation. During Filling and Dewatering, the Geotube® unit is subjected to multiple cycles of filling and drawdown until it reaches full capacity.



Geotube® GT500



### 1. Filling

Sludge is pumped into the Geotube® container. Environmentally safe polymers are added to the sludge, which make the solids bind together and water separate.



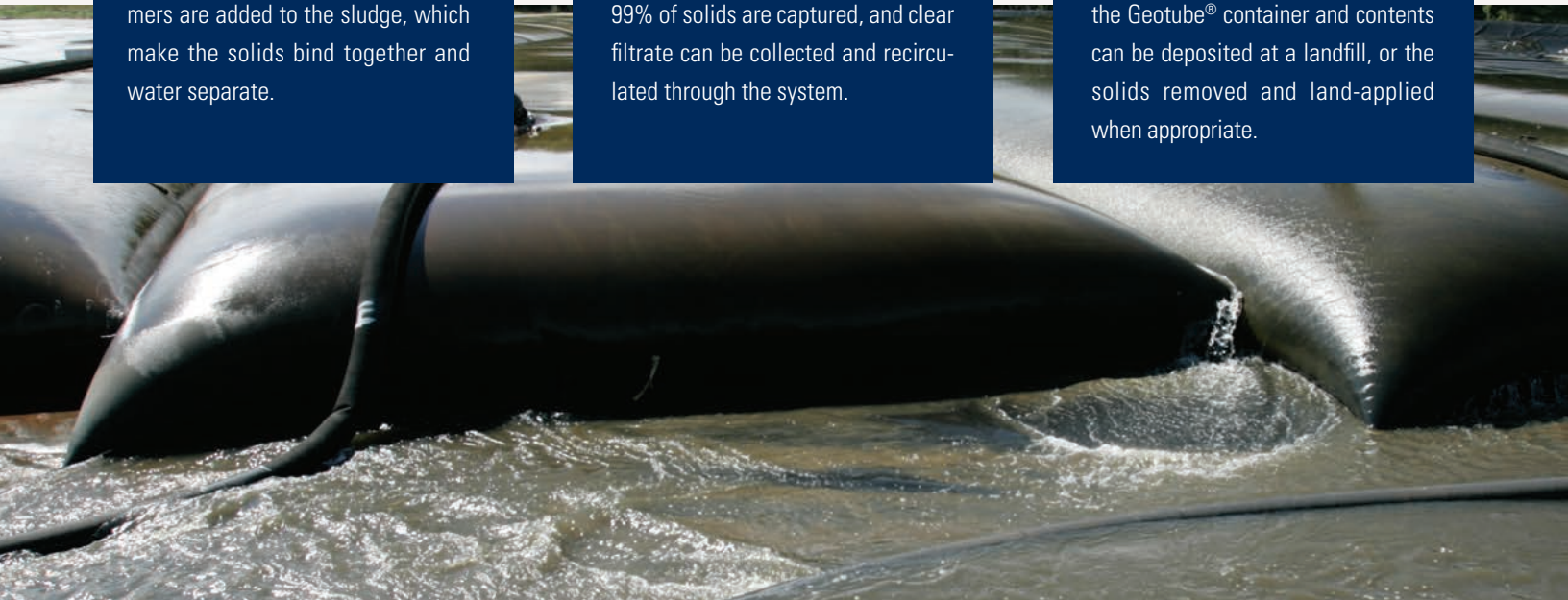
### 2. Dewatering

Clear effluent water simply drains from the Geotube® container. Over 99% of solids are captured, and clear filtrate can be collected and recirculated through the system.



### 3. Consolidation

Solids remain in the bag. Volume reduction can be up to 90%. When full, the Geotube® container and contents can be deposited at a landfill, or the solids removed and land-applied when appropriate.



# DEWATERING – INDUSTRIAL & MUNICIPAL

Cleaning your environment

## INDUSTRIAL

For many industrial applications, dewatering is unavoidable. TenCate Geotube® dewatering technology can provide a quick lagoon cleanout solution, or add capacity by making drying beds much more efficient without disrupting operations, without complicated and expensive equipment, and in a cost-effective way.

## MUNICIPAL

Geotube® dewatering technology has been used in water and wastewater treatment applications including lagoon, tank, and digester cleanouts. It can provide dewatering and containment in one operation, with 85% to 90% reduction of BOD in the effluent.



## Case Study

<b>application</b>	Dewatering Adhesive Production Residuals
<b>location</b>	Panama City, FL
<b>product</b>	Geotube® Dewatering Technology

The residual material left over from Arizona Chemical’s adhesive production process contains inorganic compounds and is too abrasive to dewater with a belt press. Geotube® dewatering technology proved a more effective solution.

The dewatered cake solids from Geotube® dewatering technology far exceeded any other form of dewatering previously utilized. This increase in efficiency saved 38% over belt press dewatering—plus a 50% reduction in time to complete the job. Because the dewatering efficiency was so much greater and the cake solids drier, there was a 40% reduction in disposal costs.





# DEWATERING – MINING & MINERALS

Cleaning your environment

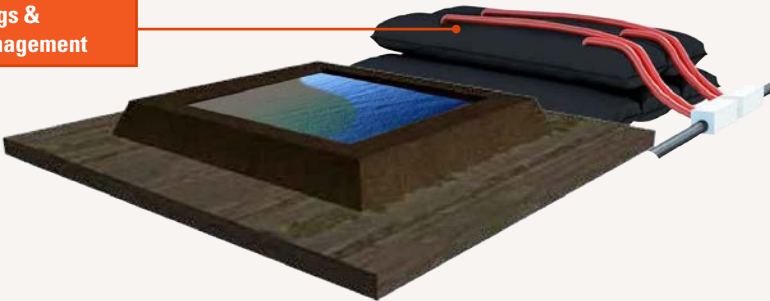
## MINING & MINERALS

Geotube® dewatering of tailings and mine waste is a proven, economical dewatering solution across many waste streams, including acid mine drainage. Mining companies have used Geotube® dewatering technology on their sites for many different applications, such as dewatering of tailings, sediment ponds or other mine waste.

Mineral Processing



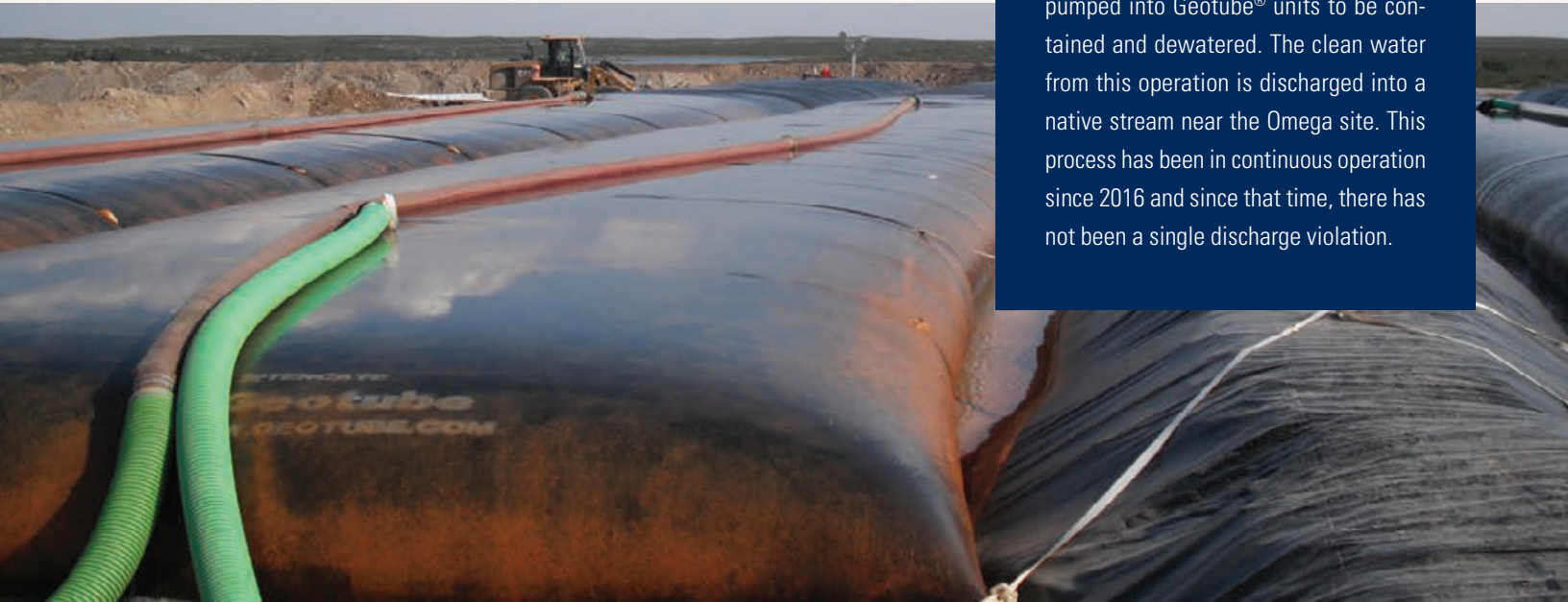
Tailings & Water Management



## Case Study

<b>application</b>	Dewatering of Acid Mine Tailings
<b>location</b>	Morgantown, WV
<b>product</b>	Geotube® Dewatering Technology

Acid mine drainage (AMD) has been an environmental issue for years in the Appalachia region, primarily caused by abandoned coal mines. As part of an effort to remediate the impact on local streams and groundwater, the WVDEP put a plan together in order to treat the AMD generated from these abandoned mines. The Omega Mine facility in Morgantown, WV is part of this program and treats approximately 288,000 gallons of AMD per day. The pH of the AMD is raised and a sludge containing all of the pollutants is generated in the clarifier. The sludge is pumped into Geotube® units to be contained and dewatered. The clean water from this operation is discharged into a native stream near the Omega site. This process has been in continuous operation since 2016 and since that time, there has not been a single discharge violation.



# MARINE

## Restoring your environment

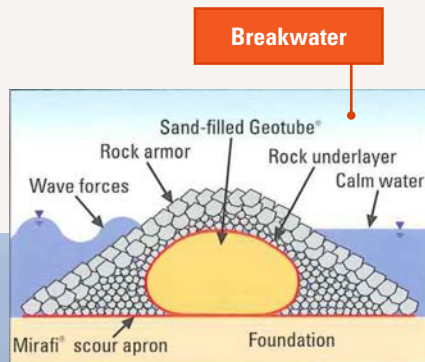
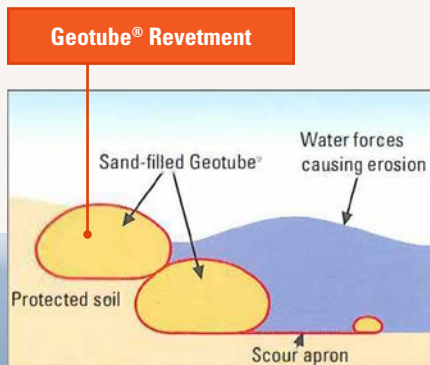
TenCate has geocontainment solutions for many coastal and marine engineering applications. Here, the geocontainment solutions contain local sand-fill to provide permeable, mass-gravity structures that are resistant to erosion. These geocontainment solutions allow the movement of water while at the same time prevent loss of the sand-fill from the containers. These solutions, utilizing TenCate's Geotube®, Geocontainer® and Geobag® units, can be employed above, at and below water level. TenCate's geocontainment solutions utilize the contained local sand-fill to substitute for imported rock-fill and thus create greater value and better environmental practice. These solutions have lower carbon footprints than conventional, wholly rock-fill solutions and can be applied to coastal and marine structures.



## Case Study

<b>application</b>	Shoreline Protection
<b>location</b>	Quintana Roo, Mexico
<b>product</b>	Geotube® Technology

The Kanai Resort is located on Mexico's Yucatan coastline in Quintana Roo and is comprised of lush mangroves and pristine beaches. However, the property wasn't always this way. Prior to development the natural preservation was under attack from the encroaching sea. And, the beach was practically nonexistent. All of this due to years of constant storms with increasing intensity. In response, Kanai development stabilized the beach along the coastline. The solution incorporated Geotube® marine structures to build a sand dune as well as three partially submerged detached breakwaters. Selecting a Geotube® solution was a major economic benefit as the cost was less than half of other design alternatives.





# MARINE—WATERWAYS & RIVERS

## Building your infrastructure

TenCate Geotube® systems are manufactured in our world-class production facilities, and they replace rock in erosion protection works for waterways and impoundments. TenCate has the widest range of engineered fabrics and composites for the fabrication of Geotube® geocontainment systems. These engineered fabrics are designed for strength, robustness, abrasion resistance, UV resistance, etc. for the most demanding site conditions.

For TenCate Geotube® geobag systems, sand filled mattress systems and dyke systems high tenacity woven polypropylene fabric is used. Special fibers and yarns may be incorporated to form engineered composites for additional engineering functions. For example, TenCate Geotube® sand filled mattress systems uses a special “mulch-integrated” composite on the exposed surface to provide a surface environment that will speed up vegetation growth. TenCate Geotube® dyke systems can also be manufactured with a coarse grain fiber substrate that enhances resistance to sand abrasion, debris impact resistance, etc.



## Case Study

<b>application</b>	Coffer Dam
<b>location</b>	Rio Grande do Sul, Brazil
<b>product</b>	Geotube® Dewatering Technology

TenCate Geotube® containers were used for building a coffer dam in the Patos Lake. Designed to be a temporary structure, the technology helped to contain the sand that was dredged to create a stable platform that was used to execute the main dock. These works were part of the construction process of the shipyard EBR - Estaleiros do Brasil, located in Sao Jose do Norte, Rio Grande do Sul, Brazil.

Geotube® units were aligned and stacked to create a 2,000 linear feet “L” shape structure. The structure was finished in three months and met the execution schedule for the project.





# MARINE—EROSION PROTECTION

Protecting your structures

TenCate Geotube® sand filled mattress is the ideal choice when riverbanks, waterway sections and impoundment slopes require erosion protection with a long term vegetation cover in place. It is economical, easy to install and uses simple equipment without the requirement for skilled labor. Sand filled mattress is manufactured with a special substrate integrated to the upper surface for instant green effect, providing a surface texture that enhances the rapid establishment of vegetation and shielding UV attack.

The sand filled mattress is delivered in rolls which can be easily transported to site. Laid with parallel tubular sections running down the slope, each are hydraulically filled with sand through the top openings. The sand is introduced through a small hopper and washed down with water pumped from the waterway or impoundment. Adjacent rolls of sand filled mattress are joined by seaming on site. Finally, the sand filled mattress is anchored in a trench at the top of the slope.



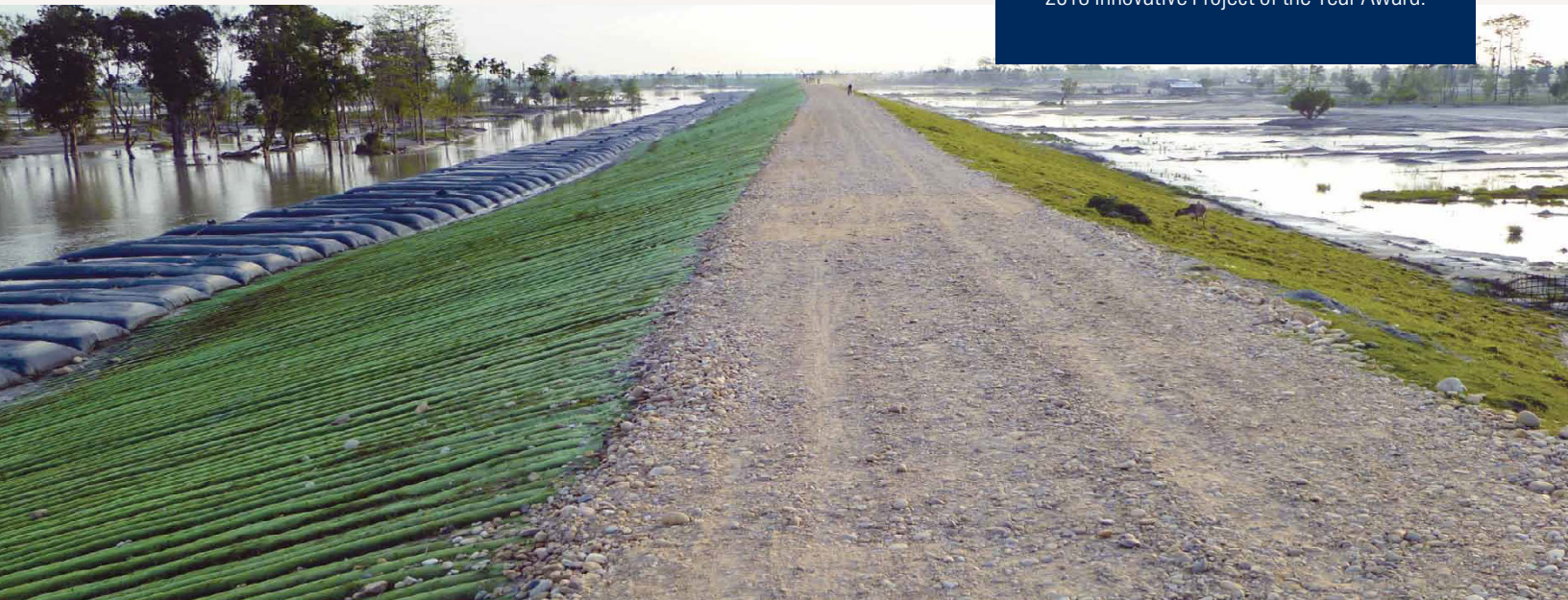
## Case Study

<b>application</b>	Waikiki Beach
<b>location</b>	Honolulu, HI
<b>product</b>	Geotube®

For years the very popular Kuhio section of Waikiki Beach has been experiencing erosion to the point it was dangerous to lay on the beach due to all of the exposed rock and debris.

Geotube® sand filled mattresses were used to provide a quick, inexpensive, environmentally friendly solution. By using existing sand, the SFM was filled in place and contoured the beach to a 3:1 slope. The solution prevented further erosion and created a natural appearing beach environment.

The project was the Winner of the IAA 2018 Innovative Project of the Year Award.



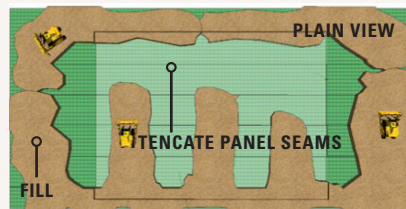


# WASTE CONTAINMENT—POND CAPPING

Restoring your environment

Pond capping with geotextiles has become a viable alternative due to many advantages:

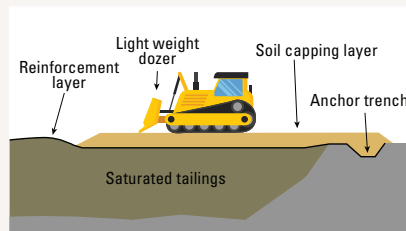
- High seam efficiency: Large factory seamed panels.
- Safe and reliable: Quickly and safely facilitates the complete closure of storage basins and ponds.
- Rapid pore pressure release: Allows water to pass through to relieve pore pressure.
- Better separation: Contains the fine-grained sludge material below, and separates sludge from clean fill above.



*Fill soil is placed over the sludge/ash pond.*

## TENCATE MIRAFI® CR-SERIES

Mirafi® CR-Series products are high performing woven geotextiles composed of high-tenacity polypropylene yarns, which were engineered to deliver increased performance, reduce costs and measurable results to provide advanced solutions.



## Case Study

<b>application</b>	Pond Capping
<b>location</b>	Midwest, USA
<b>product</b>	Mirafi® CR440

A large United States electric utility initiated the closure of a 20 acre CCR surface impoundment in 2015. Fly ash from the cut areas was to be used as fill material. The contractor quickly discovered that soft, unsuitable subgrade conditions existed below the firm, dry crust.

The soft CCR subgrade material was designed. The fill was modeled on a layer of high strength, high modulus geotextile to provide a construction platform for fill placement and to provide reinforcement for construction equipment traffic loading.

What started as a virtually impossible surface impoundment closure due to soft, saturated subgrade conditions ultimately became a relatively simple and on time construction project using Mirafi® CR440.



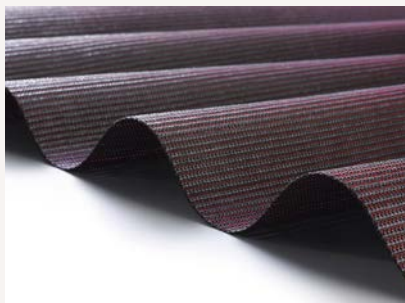


# SUBGRADE STABILIZATION

Improving your infrastructure

## TENCATE MIRAFI® RSi-SERIES

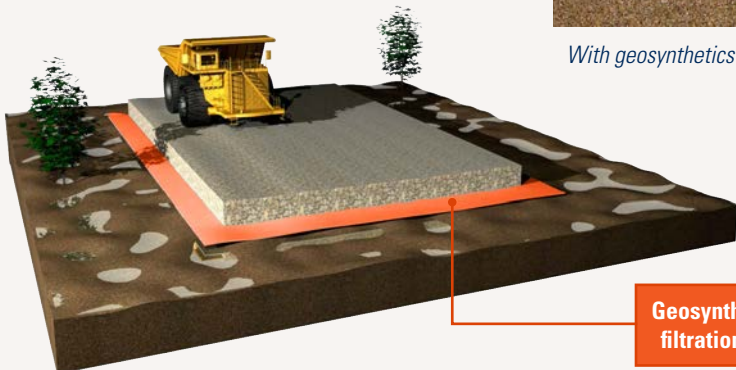
TenCate Mirafi® RSi-Series products are high strength woven geotextiles specially designed to integrate the key characteristics to maximize performance. Reinforcement (high modulus), better separation, confinement, filtration, high water flow and product identification. Extensive performance testing has been performed per AASHTO and FHWA guidelines to validate performance for both paved and unpaved roads.



*With geosynthetics*



*Without geosynthetics*



**Geosynthetics for separation, filtration and reinforcement**



## Case Study

<b>application</b>	Access Roads
<b>location</b>	Everglades, FL
<b>product</b>	Mirafi® RS580i

As part of an electric utility's right-of-way access plan, structural improvements were required for the construction of a new 500kV transmission line pad. Therefore, the creation of a service road would be essential. This, posed a particular challenge, because the Levee-Midway line is located in the Everglades National Park wetlands.

The solution was to use Mirafi® RS580i as a single-layer system to provide reinforcement, separation, filtration, drainage and interaction with the local soil. Multiple panels were sewn together and placed over the soft subgrade using amphibious equipment. The fill material thickness varied from 2 to 7ft along the 28 miles of access roads and tower pads.

The use of the Mirafi® RS580i as a single-layer system reduced the time of execution providing a huge cost savings. No excavation was necessary and the solution provided comfortable and safe roads.



# WASTE CONTAINMENT—LINER PROTECTION

Protecting your environment

Nonwoven geotextiles play a critical role in the collection of liquids in waste containment systems. The nonwoven geotextiles prevent clogging of the collection pipes and drainage aggregates. The successful removal of these liquids is critical to the performance of the landfill site.

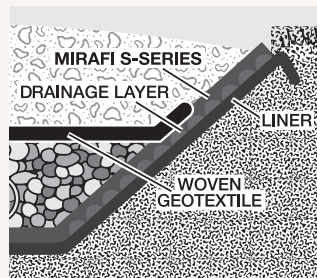
TenCate nonwoven geotextiles provide the required puncture strength and abrasion resistance to withstand installation and application stresses to create an effective long-term solution.

## TENCATE MIRAFI® S-SERIES AND PT-SERIES

Mirafi® S-series and PT-series are needlepunched nonwoven geotextiles composed of polypropylene and polyester fibers and used for protection in environmental, natural resources and energy infrastructure projects such as liner protection in solid waste landfills, fracking ponds, and other water management systems.

Mirafi® S-Series and PT-series provide:

- Exceptional durability
- High puncture resistance
- High transmissivity
- High permittivity



*Liner protection within a landfill*



## Case Study

<b>application</b>	Liner Protection
<b>location</b>	Labadie, MO
<b>product</b>	Mirafi® S1600

Due to the environmental restrictions imposed to avoid contamination of the flood zones and wetlands around the new coal ash disposal cell, a liner system was specified in conjunction with a heavy weighted polypropylene nonwoven geotextile to prevent puncture and consequently leaking.

In order to provide better cushioning to the liner, it was specified about 900,000 sy of the Mirafi® S1600, a 16 oz nonwoven geotextile.

Mirafi® S1600 provided quick installation and proper cushioning to the specified geomembrane, which will prevent sub-grade contamination of the 165 acre new disposal cell.





# ENGINEERED STRUCTURES

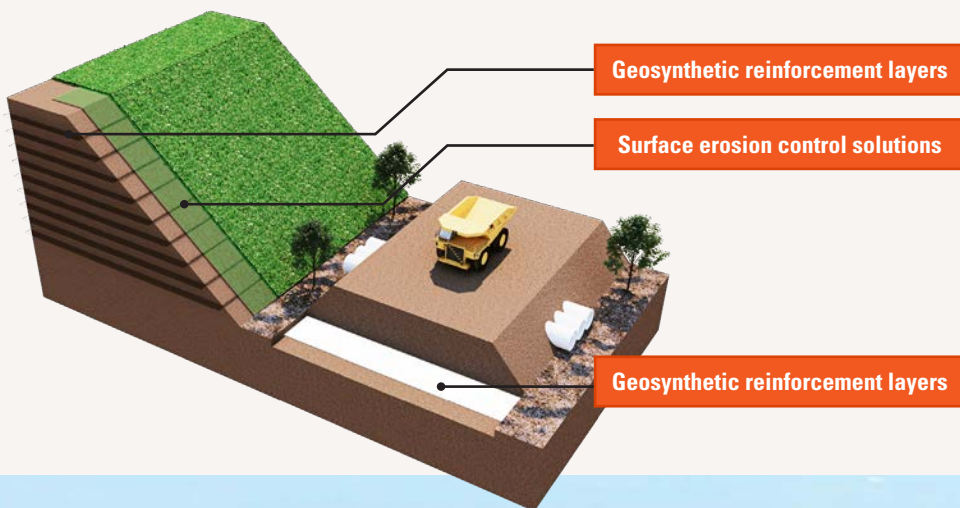
## Reinforcing your infrastructure

TenCate geosynthetics are used as integral components in mechanically stabilized earth structures such as retaining walls, slopes, and embankments. TenCate Miragrid® geogrids and high strength geotextiles provide tensile resistance to the soil, thus enhancing its shear strength characteristics. This enables walls, slopes, and embankments to be constructed cost-effectively and quickly.

TenCate geosynthetics used for mechanically stabilized earth system solutions have been designed to offer the ideal characteristics of high tensile strength, low elongation, and low creep.



*Miragrid® XT*



## Case Study

<b>application</b>	Mechanically Stabilized Earth
<b>location</b>	Wilmington, DE
<b>product</b>	Mirafi® PET1170, Miragrid® 20XT, Miramesh® GR

Cherry Island Landfill, operated by the Delaware Solid Waste Authority, has been used for municipal solid waste disposal since 1985. Built on an old dredge disposal site at the confluence of the Delaware and Christina Rivers in Wilmington, DE, the subsurface conditions at the landfill consist of very soft, compressible materials.

The only option to increase the capacity of the landfill was a vertical expansion. Over 2 million cubic yards of fill was required for construction of the berm. The berm also required over 380,000 syd of Mirafi® PET1170, 670,000 syd of Miragrid® 20XT and 315,000 syd of Miramesh® GR.




These geosynthetics allowed for a cost effective, easy to construct solution to a very challenging project. This project is one of 5 finalists for ASCE's 2012 OPAL Award for an Outstanding Civil Engineering Achievement (OCEA).

# GEOSYNTHETICS GUIDE FOR ENVIRONMENTAL APPLICATIONS

## YOUR PRODUCT SELECTION GUIDE

TenCate Geosynthetics offer a full range of products and solutions to solve geotechnical and environmental engineering problems.

Fully supported by experienced technical specialists and a global distribution network, we make a difference to your project.

										
Solutions	Functions	Geotube® Dewatering	Geotube® Marine	Sand Filled Mattress	RSF-Series Woven Geosynthetic	CR-Series Woven Geotextile	S-Series Nonwoven Geotextile	PT-Series Nonwoven Geotextile	XT-Series Uniaxial Geogrid	Miramesh® biaxial Geogrid
Dewatering	Containment	•								
	Dewatering	•								
	Protection	•					•	•		
	Remediation	•								
Marine	Erosion Control		•							
	Protection		•							
	Restoration		•							
Waterways and Rivers	Erosion Control		•	•						
	Protection		•	•						
	Restoration		•	•						
Erosion Protection	Erosion Control			•						
	Protection			•						
	Restoration			•						
Pond Capping	Reinforcement				•	•				
	Separation/Filtration				•	•				
Subgrade Stabilization	Reinforcement				•					
	Separation/Filtration				•					
Liner Protection	Protection						•	•		
Engineered Structures	Reinforcement								•	•





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