

**GEOSYNTHETICS**



**The Difference We Make**



**TenCate Geosynthetics Americas – The World Leader.** Headquartered in Pendergrass, Georgia, TenCate is the world's leading developer, manufacturer and provider of geosynthetic materials. Our 300-year history as TenCate is marked by the consistent development of geosynthetic solutions engineered to withstand nature's most extreme, challenging and unpredictable forces. When landforms shift, rain falls, or ice forms, TenCate Geosynthetics is prepared to provide reliable solutions that withstand not only nature, but the test of time.

We know that being the global leader in geosynthetics comes with great responsibility. That is why we take great pride in our products, our people and our commitment to quality. In response to the increasing demand for geosynthetics, TenCate Geosynthetics has created three distinct global product brands:

## **TENCATE** **Mirafi®**

Mirafi® geotextiles are engineered to provide high-performance system solutions for Roadway & Railway Construction, Water Management, Environmental Waste Management and Erosion Control applications.

## **TENCATE** **Miragrid®**

Miragrid® geogrids are highly advanced soil reinforcement products for Mechanically Stabilized Earth applications.

## **TENCATE** **Geotube®**

Geotube® containment technology is engineered to provide innovative solutions to the Hydraulic & Marine Protection and Environmental Protection & Remediation markets.

The products within these three brands enable our customers worldwide to increase overall performance, reduce costs and achieve what was once thought unachievable. Our products make a difference...to our customers and to the environment.



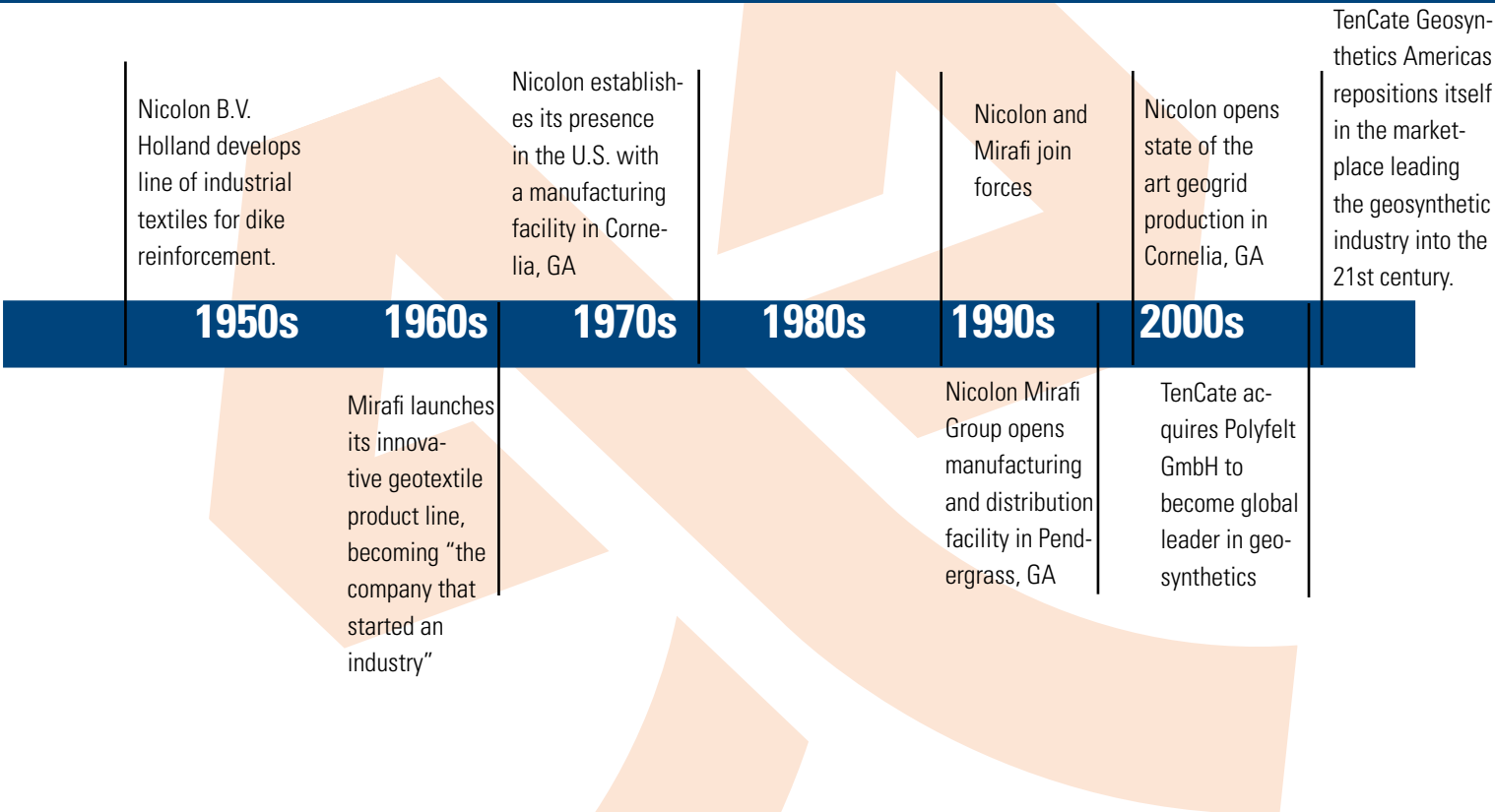


Koninklijke TenCate nv, corporate headquarters in Almelo, the Netherlands.

**Our History** The Holland Flood of 1953 launched TenCate’s quest for innovative product development. The country’s leaders turned to Nicolon B.V. of Holland for its revolutionary new industrial materials that prevented flood damage and insured the strength and stability of Holland’s dike systems.

TenCate’s North American history began in the late 1960s in Charlotte, NC, with the development of a new fabric called Mirafi® that used an experimental line of MIRAcle Fibers. In 1980, Nicolon Corporation, a division of Royal Ten Cate (USA) Inc. opened in Cornelia, Georgia in response to the growing demand for advanced geosynthetics in North America, as well as the world. The brand name Mirafi® is now widely recognized as “the company that started an industry.”

In 1991, Nicolon Corporation and Mirafi® formed the Nicolon/Mirafi® Group. As part of Royal Ten Cate’s worldwide structure, the Nicolon/Mirafi® Group is now known as TenCate® Geosynthetics Americas. By offering progressive system solutions in a diverse range of applications and markets throughout the world, TenCate® continues to set the standard as the foremost leader in the geosynthetics industry.



## The Difference TenCate Geosynthetics Make...

### Roadway/Railway Construction



#### University Road Replacement

|             |                        |
|-------------|------------------------|
| application | Subgrade Stabilization |
| location    | Bluford Street, NC     |
| products    | Mirafi® RS580i         |



#### Frost Heaves in Alaska

|             |   |
|-------------|---|
| application | Subgrade Stabilization & Base Reinforcement |
| location    | Dalton Highway, AK                          |
| products    | Mirafi® H <sub>2</sub> Ri                   |

### Pavement Solutions



#### Composite Paving Grid Installation

|             |                            |
|-------------|----------------------------|
| application | Pavement Restoration       |
| location    | Macon, GA                  |
| products    | Mirafi® PGM-G <sup>4</sup> |



#### Illinois Road Repair

|             |                           |
|-------------|---------------------------|
| application | Pavement Restoration      |
| location    | Martin Street, Newton, IL |
| products    | Mirafi® MPV500            |



## Engineered Earth Structures



### Cherry Island Landfill

|             |  |
|-------------|--|
| application | Reinforced Steepened Slope                       |
| location    | Wilmington, DE                                   |
| products    | Miramesh® GR, Miragrid® 20XT,<br>Mirafi® PET1170 |



### Virginia Roadway Expansion

|             |                                |
|-------------|--------------------------------|
| application | Geogrid Reinforcement for Wall |
| location    | Fredericksburg, VA             |
| products    | Miragrid® geogrid              |

## Shoreline Protection/Marine Structure Construction



### Port of Lake Charles Protection

|             |                                     |
|-------------|-------------------------------------|
| application | Subgrade Stabilization/Separation   |
| location    | Calcasieu River, Foreshore Dike, LA |
| products    | Mirafi® FW404 & HS900PP             |



### Atlantic City Boardwalk Protection

|             |                        |
|-------------|------------------------|
| application | Sand Dune Construction |
| location    | Atlantic City, NJ      |
| products    | Geotube® Containers    |

# Roadway/Railway Construction

Mirafi® geosynthetics enhance the performance and the design life of transportation engineering structures such as roads, railways, airfields and earthworks. For these applications, Mirafi® geosynthetics are installed as separation and filter layers in areas where groundwater is a problem. TenCate Geosynthetics offers the ideal characteristics of robust mechanical properties coupled with high water flow capabilities.

## Roads/Airfields

Mirafi® geosynthetics are placed on the subgrade to provide separation of the base layer and subgrade, provide stabilization of the soft subgrade and to provide reinforcement to the base course, therefore extending the life of the pavement.

## Earthworks

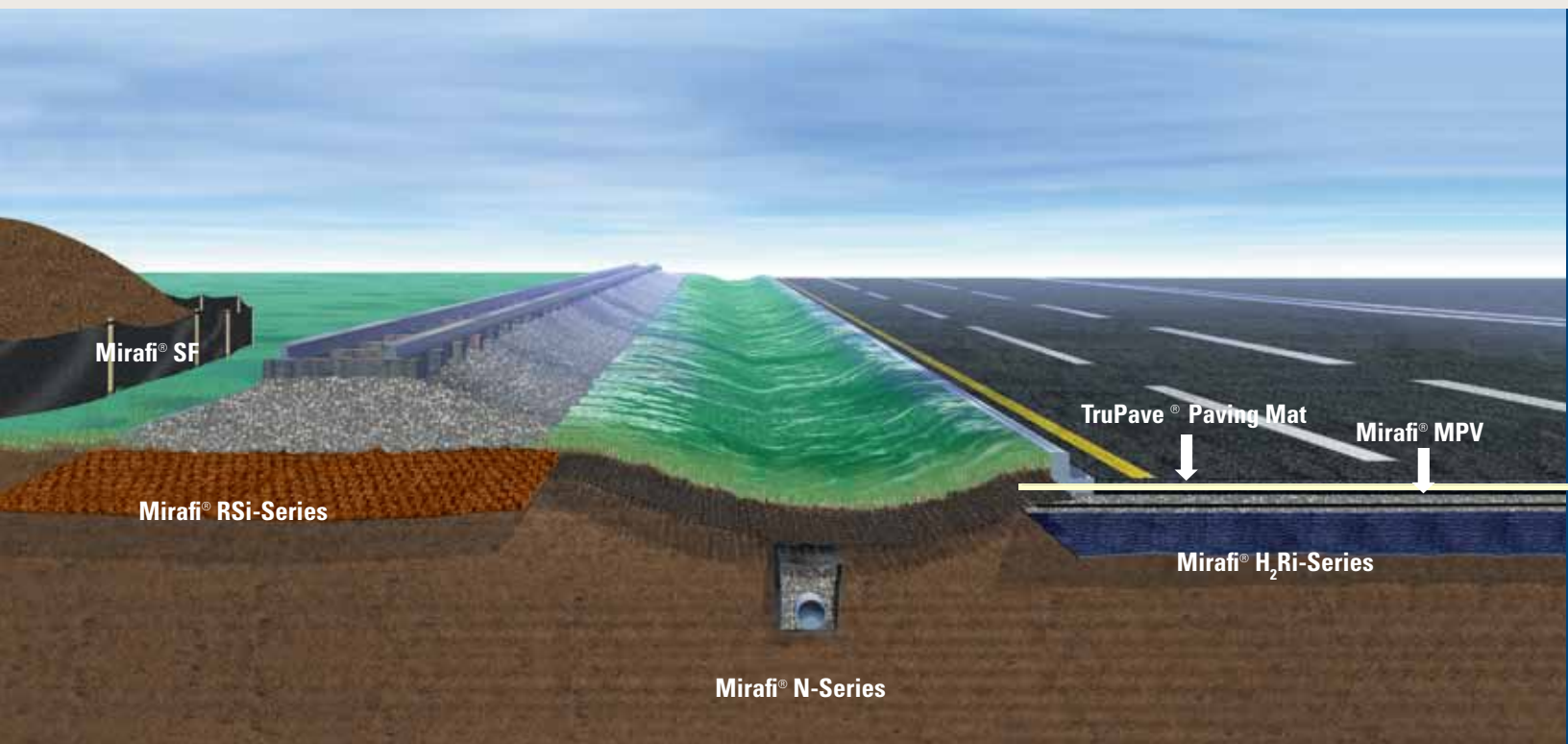
In earthworks construction, Mirafi® geosynthetics are placed between two different kinds of fill to ensure that intermixing does not occur during placement and compaction, maintaining the distinct layer boundaries between dissimilar adjacent earth-fill materials and their structural integrity.

## Subsurface Drains

Mirafi® geosynthetics filter and allow groundwater to pass into the subsurface drain without eroding the soil, and thus ensuring long-term performance of pavement and earthworks structures.

## Railways

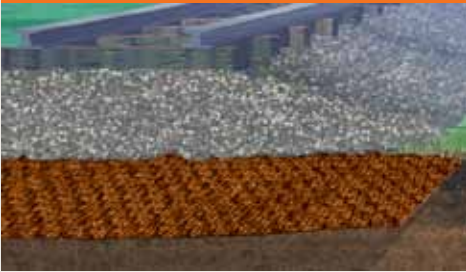
In railway tracks, Mirafi® geosynthetics are placed between the existing formation and the ballast layer to prevent the subgrade from pumping into the ballast layer, thereby maintaining structural integrity and increasing the periods between track maintenance.



## Products

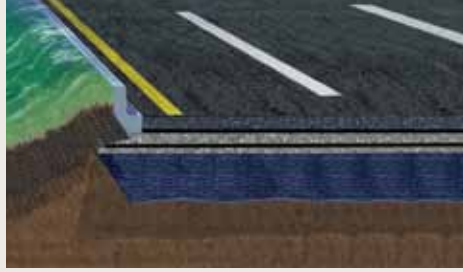
The comprehensive range of TenCate's transportation engineering solutions is unmatched in the geosynthetics industry.

### Mirafi® RSi-Series



Mirafi® RSi-Series geosynthetics make the difference for varying application needs including: base course reinforcement and subgrade stabilization for road, runway and railway construction; embankment stabilization on soft foundations; reinforcement for mechanically stabilized earth (MSE) structures; liner support, voids bridging, reinforcement over soft hazardous pond closures and other environmental market applications.

### Mirafi® H<sub>2</sub>Ri



Mirafi® H<sub>2</sub>Ri-Series woven geosynthetics are ideal for soil stabilization and base course reinforcement applications where differential settlement occurs due to heaving in the subgrade soils. Mirafi® H<sub>2</sub>Ri-Series geosynthetics are used for varying application needs including: base course reinforcement and subgrade stabilization for road, runway and railway construction; frost heave/frost boils; embankment stabilization on soft foundations; reinforcement for mechanically stabilized earth (MSE) structures; liner support, voids bridging, reinforcement over soft hazardous pond closures and other environmental market applications.

### Mirafi® N-Series



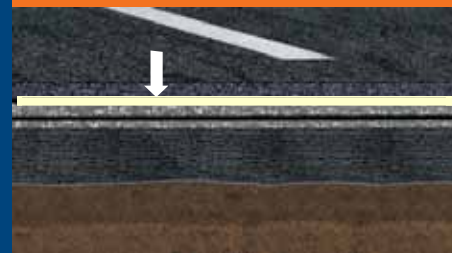
Mirafi® N-Series nonwoven polypropylene geotextiles are staple fibers used for soil separation and drainage. They combine high tensile strength, along with excellent physical and hydraulic properties. This aggressive geotextile is designed to handle many environmental problems found in roads, embankments, airfields, landfills, and sports construction projects. Produced from polypropylene staple fibers, Mirafi® N-Series geotextiles combine high water flow rates and durability while providing excellent soil retention.

### Mirafi® MPV



Mirafi® MPV nonwoven asphalt overlay fabric consists of needle-punched heat-set polypropylene. This polypropylene is known to be essential in fabric overlay pavement performance due to its strengthening of entire pavement systems and its lengthy performance life. Mirafi® MPV asphalt overlay fabric provides a waterproof barrier to protect sub-grade soils from surface water and a stress-relieving interface to retard reflective cracking and improve fatigue resistance.

### Mirafi® PGM-G<sup>4</sup>



Mirafi® PGM-G<sup>4</sup> is a composite paving interlayer comprised of a lightweight polypropylene paving fabric reinforced with continuous filament fiberglass, mechanically fastened in the machine, cross and bias angle directions. This unique, patent pending paving interlayer is designed for highly distressed pavement conditions and in addition, the material will provide a moisture barrier against further moisture intrusion. The lightweight polypropylene fabric requires less asphalt tack, saving on installation costs without compromising performance.

### Mirafi® SF



Mirafi® Silt Fence controls sediment runoff from construction sites - its woven structure captures fine-grained sediment, while allowing storm water to pass through at a moderate rate of speed, without erosion.



# Engineered Earth Structures

Miragrid® XT geogrids and Mirafi® geosynthetics are used as integral components in mechanically stabilized earth structures, such as steepened slopes, retaining walls, embankments on soft soil foundations, void spanning, and veneer reinforcement due to their high-tensile strength, low elongation, and low creep properties.

## ■ Steepened Slopes

To steepen soil slopes, Miragrid® XT geogrids are placed in layers during construction to provide tensile resistance and enhance stability. The facing of the slope can be grass or another facing material. This technique enables slopes to be constructed to any height at any slope angle.



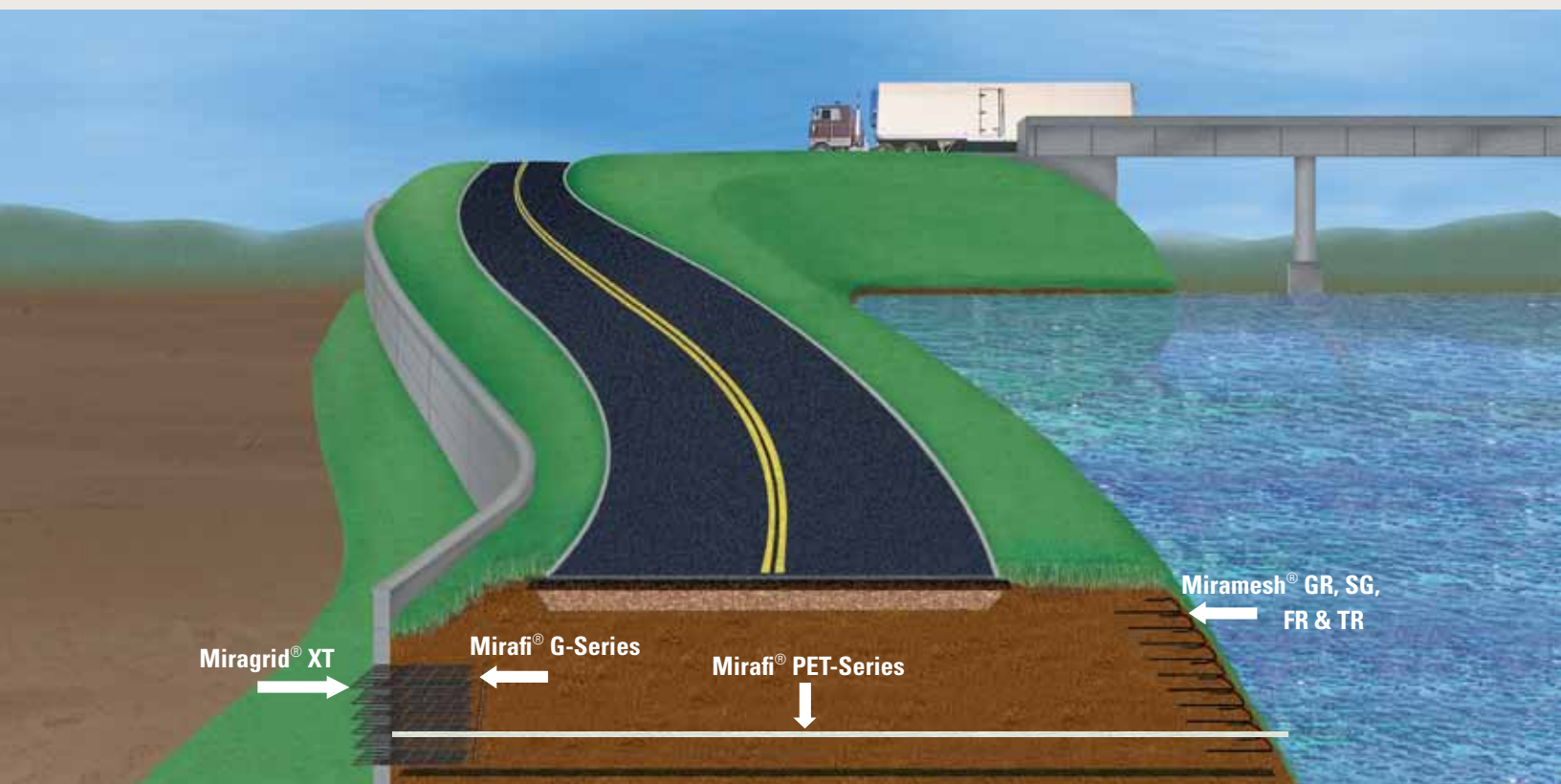
## ■ Retaining Walls

Miragrid® XT geogrids are used to provide stability to temporary and permanent retaining walls. Retaining walls constructed in this manner are economical, efficient and aesthetic.



## ■ Embankments on Soft Foundation Soils

Mirafi® geosynthetics are placed at the base of embankments to provide stability and limit differential settlement. Depending on the specific application, the product may be placed directly on the soft foundation, over foundation piles, or over areas subject to void formation prior to the placement of the embankment fill.





## Products

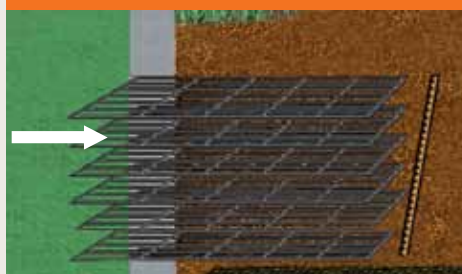
TenCate's reinforced soil engineering products provide tensile resistance to the soil which enhances its shear strength characteristics.

### Miramesh® GR, SG, FR & TR



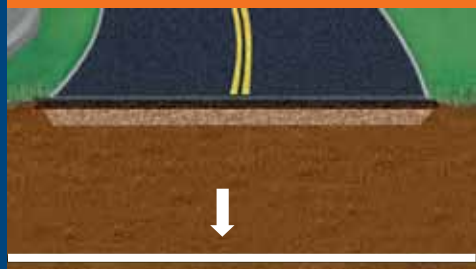
Miramesh® GR, SG, FR and TR biaxial geosynthetics are used as a face wrap material for slope and wall applications. Miramesh® GR provides surface erosion protection, which facilitates vegetation growth and secondary reinforcement. Miramesh® GR and SG are produced from highly UV-stable, green polypropylene yarn to provide a long-term grass green appearance. Miramesh® SG is a synthetic grass face combining Miramesh® GR with synthetic grass green fibers to produce a finished grass face without the need for vegetation. Miramesh® FR is a fire resistant biaxial mesh facing to protect the MSE structure from damage in case of exposure to flames such as wildfires. Miramesh® TR is a black mesh facing offering high biaxial tensile strengths for temporary applications.

### Miragrid® XT Geogrid



Miragrid® XT uniaxial geogrids are high performance woven polyester and polymer-coated geogrids used for soil reinforcement. Miragrid® XT uniaxial geogrids are used in Mechanically Stabilized Earth applications including internally reinforced walls, segmental retaining walls (SRW's), and steepened slopes. Miragrid® XT uniaxial geogrids provide high, long-term design strengths (LTDS) and excellent soil interaction. Miragrid® XT uniaxial geogrids are constructed of high tenacity, high molecular weight, woven polyester to deliver long-term performance.

### Mirafi® PET-Series



Mirafi® PET woven high-strength polyester geotextiles are used to provide stability and limit differential settlement when constructing embankments over soft soils. Mirafi® PET-Series geotextiles provide the highest tensile and long term design strength (LTDS) available in any geosynthetic. Mirafi® PET-Series are comprised of high tenacity and high molecular weight polyester yarns which provide excellent creep resistance, strength, and soil interaction.

### Mirafi® G-Series



Mirafi® G-Series drainage composites are made from high compressive strength cores and combined with nonwoven filter fabrics to provide clog resistance and long-term flow capacity. These products are ideal single-sided subsurface filters and are used to provide a consistent drainage medium for retaining walls, cut-off drains, and landfill closures.

# Hydraulic & Marine Protection

TenCate Geosynthetics has solutions for many coastal and marine engineering applications. TenCate geosynthetic solutions act as a permeable protection layer - a filter - enabling relatively free water movement while protecting the adjacent soil from erosion. TenCate Geotube® geocontainment technology is used as an integral component in the design and construction of a variety of marine and hydraulic engineering structures. TenCate Geotube® technology has proven to be exceptionally valuable for protecting shorelines from erosion, particularly during hurricanes and tropical storms.

## ■ Revetments (exposed & submerged)

Revetments are used to provide permeable surface protection to exposed soil surfaces. TenCate provides a wide range of geotextile and containment solutions depending on the type of revetment being constructed.

## ■ Dykes & Levees

Dykes and levees are used to prevent flooding, enable construction to occur within calm water and protect from storm activity. TenCate provides a range of containment solutions for the cores of dykes and levees.

## ■ Jetties & Groynes

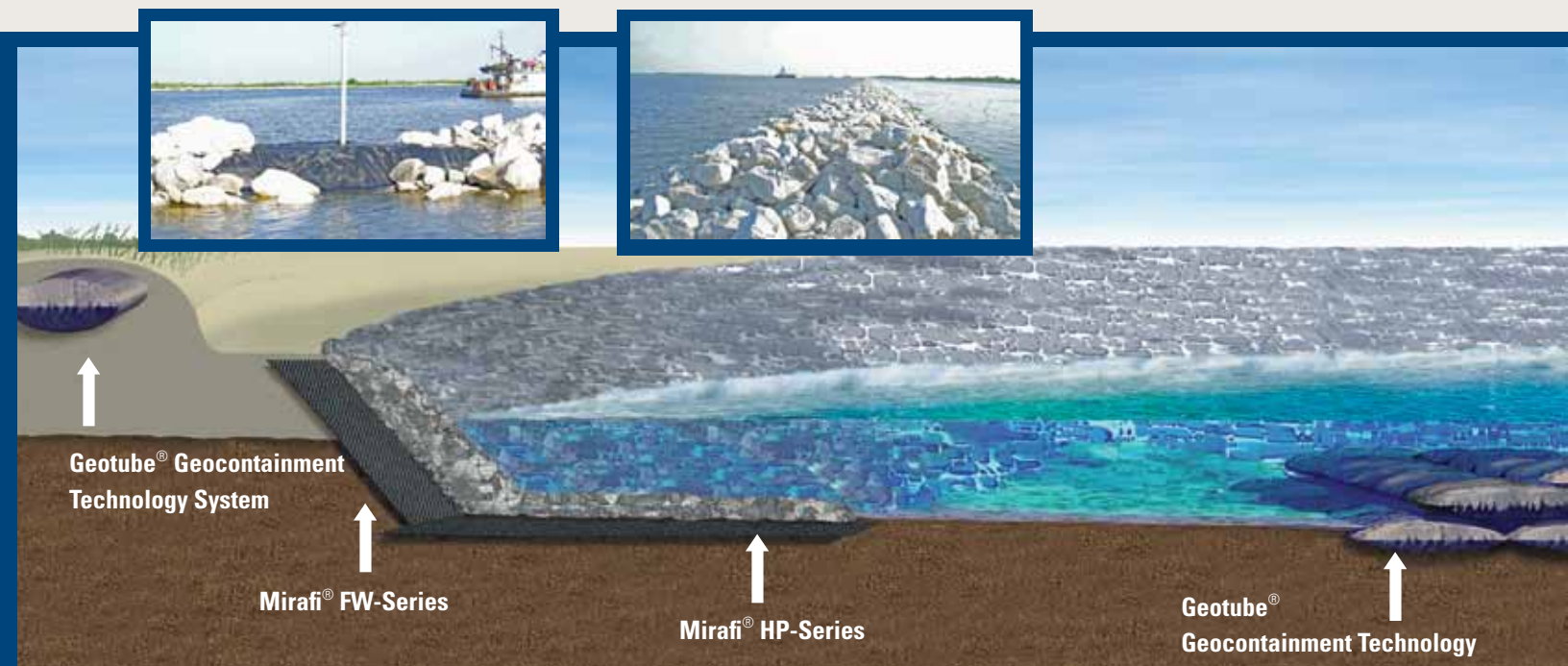
Jetties are used to provide land access for boat traffic while groynes provide erosion protection to the littoral movement of sand. TenCate provides a range of containment solutions depending on the type of jetty or groynes being constructed.

## ■ Breakwaters

Breakwaters reduce water forces offshore before they reach land thus preventing erosion. TenCate provides a wide range of geotextile and containment solutions depending on the type of breakwater being constructed.

## ■ Submerged (offshore) Structures

TenCate provides a range of geotextile and containment solutions to prevent erosion around offshore structures and to provide ballast weight to offshore pipelines.



## Products

Mirafi® marine engineering products offer excellent soil filtration and stabilization of shorelines and their enhanced strength prevents fabric damage during construction. Areas of product application include:

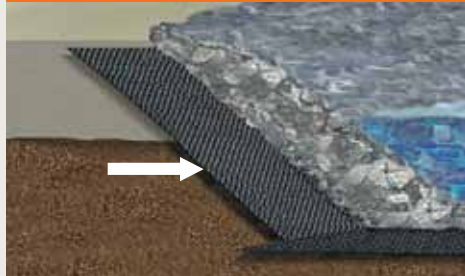
- under riprap or concrete revetment systems
- for erosion prevention of sand and dunes
- protection of slopes and around piers and abutments
- culvert inlet and discharge aprons
- floating silt curtain
- Geocontainer® to facilitate placement and retention of soil in underwater locations
- Geotube® containers for core stabilizing of jetties and beach heads

### Mirafi® HP-Series



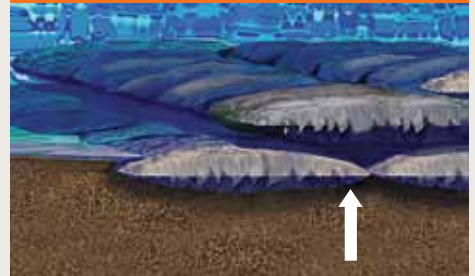
Mirafi® HP-Series high performance geotextiles are used to prevent the erosion of foundation soil in breakwaters and provide additional soil reinforcement. Produced from high tenacity polypropylene yarns, Mirafi® HP-Series Geotextiles are specifically designed to provide separation, filtration, and reinforcement for moderate to severe site conditions. The combination of high tensile strengths and excellent filtration/separation characteristics make Mirafi® HP-Series geotextiles the complete geosynthetic.

### Mirafi® FW-Series



Mirafi® FW-Series geotextiles are made of highly UV stabilized monofilament and multifilament yarns that possess unique physical and hydraulic properties not found in other woven or nonwoven geotextiles. With highly durable strengths, consistent pore sizes, high flow rates, and clog resistance, this product is perfect for shorelines and other erosion control applications. Mirafi® FW-Series geotextiles are used underneath rip rap or concrete revetment systems along inland waterways and coastal shorelines to protect spillways and cut-off drains.

### Geotube® GC



Geotube® geocontainment structures provide a more cost-effective and environmentally friendly method for the deep water disposal of contaminated soils. Additionally, they function effectively as erosion control products such as breakwaters.

### Geotube® Containment Technology



Geotube® structures, filled with locally dredged sand, limit storm erosion to the area immediately in front of itself by retaining the imported sand fill behind the tube.



Geotube® geocontainment technology structures used as jetties promote the natural restoration of shorelines by the process of beach accretion.



Geotube® structures are also used for wetland reclamation to create and retain the unique soil and water relationship that is indigenous to coastal marsh environments.



# Environmental Protection & Remediation

Mirafi® geosynthetics and Miragrid® XT geogrids are ideally suited for environmental protection applications such as landfill and waste-containment structures. Examples include protection layers for geomembrane liners, veneer reinforcement for the enhancement of material interface properties, reinforcement to steepen landfill containment slopes, reinforcement to support liner systems constructed over compressible foundations, reinforcement to reclaim tailings and other waste lagoons, and drainage for gas and liquid removal. Mirafi® geosynthetics and Geotube® containment technology have proven to be exceptionally valuable for solving difficult environmental remediation challenges.

## ■ Geomembrane Protection

Mirafi® geosynthetics act as a protection layer for geomembrane liners in landfill and waste containment facilities. It protects the geomembrane from puncture, enabling its installation adjacent to natural ground and granular layers.

## ■ Veneer Reinforcement

Miragrid® XT geogrids are used as veneer reinforcement to improve the frictional interface between a sloping geomembrane liner and the adjacent soil layer. They are used to prevent the soil from sliding along the surface of the geomembrane liner.

## ■ Steepened Slopes

Miragrid® XT geogrids can also be used as reinforcement to steepen slopes in waste-containment facilities. This enables the maximum volume to be made available for the storage of waste.

## ■ Voids Bridging

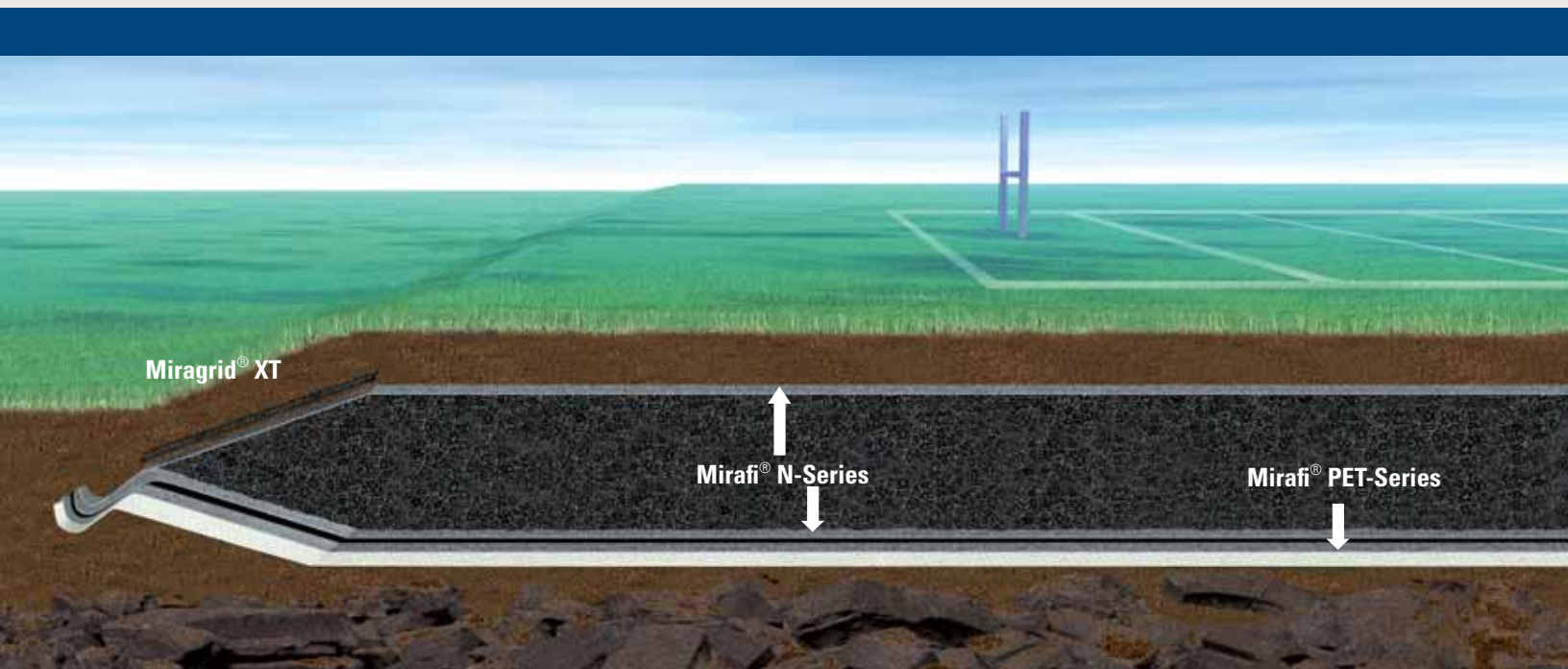
Mirafi® geosynthetics can be used to support liner systems when these are constructed over areas that are susceptible to differential settlements. The product ensures the integrity of the liner system is maintained as the underlying layer undergoes deformation.

## ■ Environmental Dredging

TenCate Geotube® technology helps to dewater and contain contaminated sediments in rivers, bays, harbors, marinas, ports, dock facilities, hydro basins and other waterways. These areas collect these contaminated sediments from industrial and domestic outfalls.

## ■ Waste Lagoon Dewatering & Capping

The early reclamation of tailings and other waste lagoons can be performed using Geotube® containment systems to facilitate dewatering. The use of Mirafi® geosynthetics with high tensile strength characteristics enable a capping layer to be economically constructed over disused tailing lagoons at an earlier stage than would be possible employing conventional techniques.



## Products

The vast range of Mirafi® geosynthetics meet environmental engineering requirements in a wide variety of landfill and waste-containment applications:

- veneer reinforcement for steepened slopes
- subsurface drainage for gas and liquid removal
- geomembrane liner reinforcement and protection
- stabilization of soft sludge for waste lagoon cappings.

### Miragrid® XT Geogrid



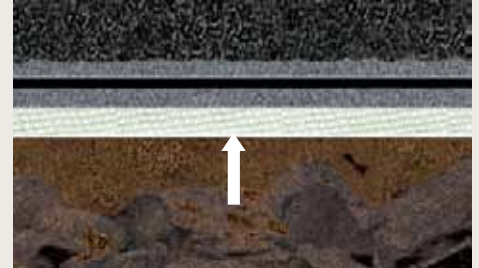
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### Mirafi® N-Series



Mirafi® N-Series nonwoven polypropylene geotextiles are staple fibers used for soil separation and drainage. They combine high tensile strength, along with excellent physical and hydraulic properties. This aggressive geotextile is designed to handle many environmental problems found in roads, embankments, airfields, landfills, and sports construction projects. Produced from polypropylene staple fibers, Mirafi® N-Series geotextiles combine high water flow rates and durability while providing excellent soil retention.

### Mirafi® PET-Series



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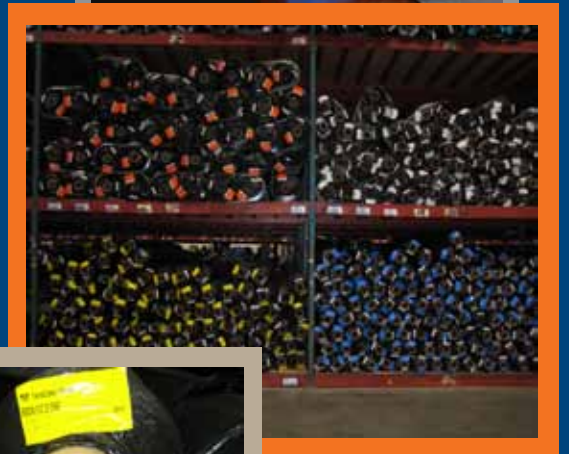
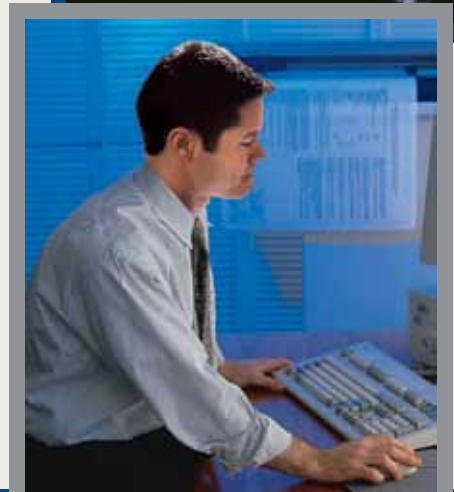
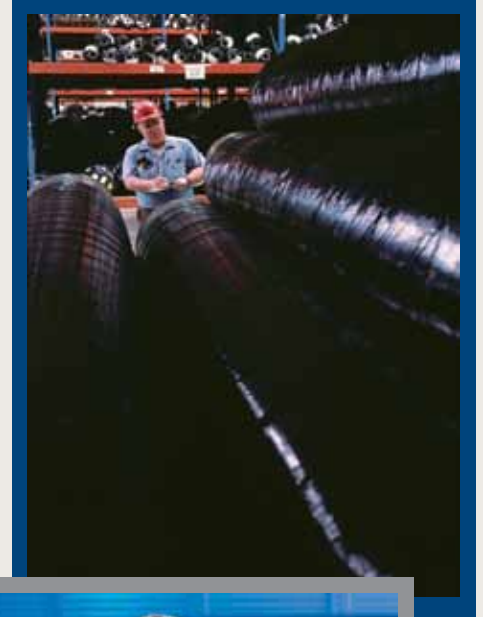
## TenCate Services

TenCate's total customer service begins with the industry's most complete line of geosynthetic solutions, complemented by our worldwide product placement through the largest distributor network in the industry. Our distributors and agents maintain a local inventory of commonly specified products to prevent costly delays and give contractors ultimate scheduling flexibility.

Within our manufacturing facilities, our uncompromising commitment to quality is evidenced by our on-line and in-lab quality control testing procedures, which are performed strictly in accordance with industry guidelines.

Most importantly, our ability to provide geosynthetic solutions is not limited to our existing product line. Because complex civil engineering projects often present problems that require non-standard products, our flexible manufacturing capabilities enable us to provide specialty geotextiles that are designed to satisfy your unique project requirements.

Because our engineers and technical support managers are experienced in both design and construction, we are pleased to provide qualified on-site assistance, project-specific consultation or expertise for group presentations.



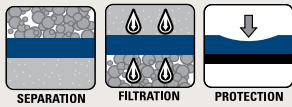


## Your Complete Geosynthetics Range

### Drainage & Filtration Geotextiles



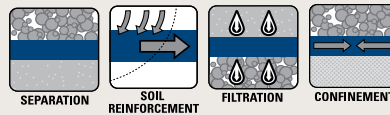
N-SERIES



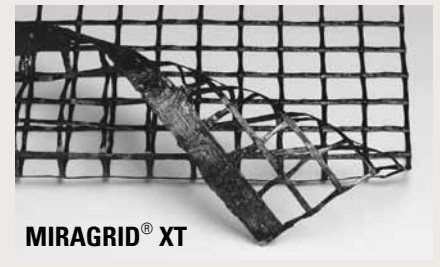
### Soil Reinforcement Geotextiles



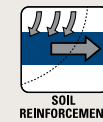
RSi-SERIES



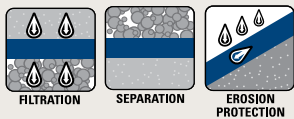
### Soil Reinforcement Geogrids



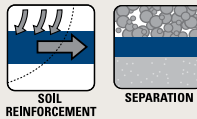
MIRAGRID® XT



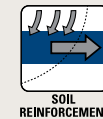
FW-SERIES



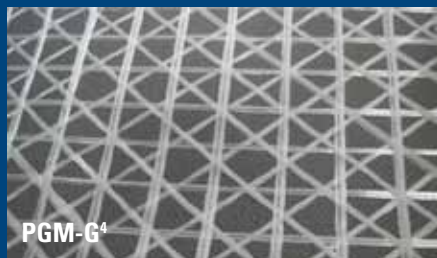
PET-SERIES



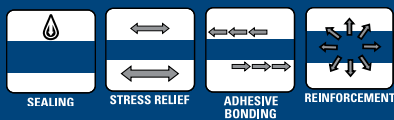
MIRAMESH® GR, SG, FR & TR



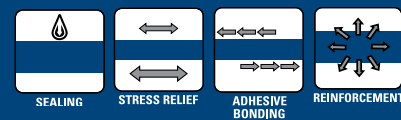
### Pavement Solutions Geotextiles



PGM-G<sup>4</sup>



PGM-G



# GEOSYNTHETICS

TenCate develops and produces materials that increase performance, reduce costs and enable people to achieve what was once unachievable. Our goal is to contribute significantly to progress in the industries in which we work.

|                           | Mirafi®<br>RSi-Series | Mirafi®<br>H <sub>2</sub> Ri | Mirafi®<br>N-Series | Mirafi®<br>FW-Series | Miragrid®<br>XT | Mirafi®<br>PET-Series |
|---------------------------|-----------------------|------------------------------|---------------------|----------------------|-----------------|-----------------------|
| <b>Transportation</b>     |                       |                              |                     |                      |                 |                       |
| Site Drainage             |                       |                              | ✓                   | ✓                    |                 |                       |
| Separation/Stabilization  | ✓                     | ✓                            | ✓                   | ✓                    |                 | ✓                     |
| Roadway/Reinforcement     | ✓                     | ✓                            |                     |                      |                 | ✓                     |
| Sediment Control          |                       |                              | ✓                   | ✓                    |                 |                       |
| <b>Marine</b>             |                       |                              |                     |                      |                 |                       |
| Armored Revetment Systems | ✓                     |                              | ✓                   | ✓                    |                 | ✓                     |
| <b>Reinforced Soil</b>    |                       |                              |                     |                      |                 |                       |
| Segmental Retaining Walls |                       |                              |                     |                      | ✓               |                       |
| Temporary Retaining Walls | ✓                     | ✓                            |                     |                      | ✓               | ✓                     |
| Steepened Slopes          |                       |                              |                     |                      | ✓               |                       |
| Embankments on Soft Soils | ✓                     | ✓                            |                     |                      | ✓               | ✓                     |
| <b>Environmental</b>      |                       |                              |                     |                      |                 |                       |
| Waste Lagoon Capping      | ✓                     |                              |                     |                      |                 | ✓                     |
| Sludge Dewatering         | ✓                     |                              |                     |                      |                 | ✓                     |
| Voids Bridging            |                       |                              |                     |                      | ✓               | ✓                     |
| Veneer Reinforcement      |                       |                              |                     |                      | ✓               | ✓                     |
| Geomembrane Protection    |                       |                              | ✓                   |                      |                 |                       |

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365 South Holland Drive  
Pendergrass, GA 30567

Tel 800 685 9990  
Tel 706 693 2226

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