After an eventful year, we look back with a positive feeling on the year 2015. Demand from the market for our geosynthetics was good and we increased sales over the previous year. It is particularly gratifying that after a period of adversity in the market we registered positive trends. This includes growth in Spain and Portugal, two countries that had been severely affected by the financial crisis.

However, markets in and around Russia continue to be an issue: The weak ruble and the current political situation continue to be hindrance to successful market development there. Also, major problems in raw materials markets over the past year have presented a number of challenges. Several suppliers announced a “Force Majeure” situation declaring that, because of an unforeseeable event, they no longer needed to adhere to the agreed upon quantities in the raw materials orders.

This led to a shortage of raw materials across the entire plastics market. Supplies distributed what raw materials they could release more or less evenly, which resulted in our requirements not being met on time.

In parallel, the prices of these raw supplies rocketed upwards, deviating from the relatively low price of oil.

Geosynthetics industry customers subsequently experienced longer delivery times and some delivery delays. The whole European market, and some markets outside Europe, suffered under the situation.

We would like to take this opportunity to apologise sincerely to our customers.

Preamble

Whether such an exceptional situation could re-occur is something we cannot foresee. From a manufacturer’s point of view, we can only seize the opportunity to raise stock levels at the end of this year so that we can better compensate for possible shortages of raw materials next year. With the purchase of a 30,000m²-sized building next to our location in Espekkamp-Fiestel, Germany, we are now able to store even more goods than before, thus securing more timely availability and delivery in 2015, even if the market for raw materials challenges again.

Also of note, we have produced our BentoFlex® geosynthetic clay liner (GCL) in Kuala Lumpur, Malaysia since 2011. This year, we added a new production line for nonwovens to the site. The carding machine has been running since August and produces both the pre-products for the bentonite mat and a range of different nonwovens for the Asian markets. Both the bentonite mats and the nonwoven fabrics are CE certified and meet NAUE’s high quality standards. Our thanks go to the NAUE team responsible on site for the speedy construction and commissioning of the plant, and we wish the NAUE Asia sales team every success in the selling of nonwovens ‘Made in Malaysia’.

The year 2016 sees three important trade fairs for NAUE. The first of these is IFAT in Munich and takes place from 30.05.-03.06.2016. IFAT is the world’s leading trade fair for water-, sewage-, waste- and raw material-management. The second is the Baugrundtagung in Bielefeld, Germany from 14.-17.09.2016. The Baugrundtagung is the biennial conference of the German Geotechnical Society (DGTV). The third is the 6th European Conference on Geosynthetics (EuroGeosynth), which is being organised by the Turkish Chapter of the International Geosynthetics Society (IGS) in Istanbul from 25.-28.09.2016. We will be represented with a stand at all fairs and hope to welcome many NAUE News readers.

But now, first of all, Christmas is just around the corner. We would like to thank all our customers for their excellent cooperation and for the trust they have placed in us. We thank our motivated employees for their commitment and reliability. And we wish our staff, their families, and of course all readers of NAUE News a very Merry Christmas. May you enjoy time to relax and unwind, and may you have good fortune in the coming year.

Concrete pavements in highway construction have many advantages, including strength and durability. To ensure this, however, a soft nonwoven fabric is required beneath the hard pavement. The use of NAUE Secutex® concrete nonwoven on the A4 near Kirchheim in Germany exemplifies this roadway-improving application.

The A4 autobahn was completely renewed between the Kirchheim junction and the Bad Hersfeld exit. It was widened from four to six lanes and a hard shoulder was added. A special feature of the 6-km-long section was the rehabilitation of the Aschaltal Bridge. Built from 1938 to 1942, the viaduct with its distinctive limestone base structure was preserved and given a new superstructure. Because the pavements were widened from 9 to 14.5m, they now cantilevered almost 5m over the old bridge structure.

The pavement was constructed with concrete, due to the high volume of traffic. Concrete pavements require longitudinal and transverse expansion joints (in contrast to asphalt). Water can infiltrate through these and damage the substructure at the interface between the road base and the concrete pavement. This is true for unbound and bound base layers.

Pinching leads to erosion

If water has infiltrated and the pavement is subjected to loading by heavy traffic, the water which has penetrated into the structure is squeezed towards the joints and can develop such high velocities that it can erode the bound base layer and underside of the concrete pavement. This is especially of concern if infiltration affects the joints between the longitudinal and transverse expansion joints. Under this pressure, some of the water is forced out along the longitudinal joints. This leads to dirty strips on the road and erosion under the joint.

Intermediate layer of nonwoven fabrics

There are several ways to relieve infiltrating water at the joints and to enable seepage. One of these is a full-area installation, directly under the concrete, of nonwoven fabrics capable of conducting water in their plane (in accordance with the German Beton-StB 07 and TL-Beton-StB 07). This process has proved its effectiveness. The following benefits have been demonstrated by measurements:

• Complete separation between base layer and concrete
• “Soft” buffer between base layer and concrete and, thus, a softer bearing layer
• Drainage of penetrating liquids
• Prevention of erosion in the road base, in particular in the area of the joints
• Prevention of crack propagation in both directions, both from the joint into the base layer and from the base into the concrete pavement

So the main functions of the concrete nonwoven are drainage, separation, and filtration. When a nonwoven fabric is used, nothing of bound base courses is no longer required.

To take advantage of all these benefits, however, the nonwoven must fulfill exact specifications. NAUE Secutex® K 501 is the special concrete nonwoven fabric that was used on the A4. It is made entirely of polypropylene (PP), because it is resistant to the alkaline present in cement concrete. Additional defined properties are, for example, the behaviour under load, the minimum strength and the extensibility and, of course, the drainage and filter properties.

The client in the designated section was the State of Hesse, and a joint venture under Bickhardt Bau AG was responsible for construction. Installation was carried out by Bausanierung & Dichtungsbau Heinz Berger, a specialist installer of concrete nonwovens and similar products.

In accordance with design specifications, the nonwoven was placed under tension in the length axis of the road to avoid development of wrinkles. The overlaps in both length and transverse directions were approximately 20 cm. Fourfold overlaps were not permitted, so attention had to be paid to offset jointing at the ends of rolls. At the edge of the concrete, the fabric projected by about 10 cm to ensure that water can escape. The rolls were secured by nailing along their outer edges and along the overlap.

In light of these requirements it is clear that every effort must be made to avoid trapping the concrete nonwoven fabric. Driving tight curves, turning, and abrupt braking and accelerating are prohibited on the fabric.

To ensure this and to preserve the quality of the nonwoven on the A4 project, installation was carried out no earlier than one day before concrete placement. Immediately before the concrete placement, the fabric had to be moistened, so that it would neither be penetrated by concrete slurry nor absorb water from the concrete as it was placed.

Then, the huge pads arrived and were installed with the two-layer concrete package to a total thickness of 27cm.

A total of 64,000m² of NAUE Secutex® K 501 concrete nonwoven fabric was installed.
Defending England’s coast

From the arrival of the Romans to the Saxons and Normans clashing upon the shore, and from the Spanish Armada to Napoleon and two World Wars, England has a long and well-known history of coastal defense. Today, coastal protection remains a high priority—though it now focuses on erosion and flood control and civil infrastructure. The West Sands Beach Project at Medmerry near Selsey and Sussex on the southeastern coast is the largest privately funded coastal protection scheme of its kind in the UK’s history.

The Medmerry project is an extraordinary managed realignment scheme that is part of a wider program of integrated inland and coastal sea defenses. More than 93,000t of rock have been shipped from Norway to create two breakwaters on a two-acre footprint, 600m apart, with 3,000m² (nearly half a million) tonnes of sand and shingle deposited to form a beach.

Roughly 300 properties including numerous farms are located along the 650ha of low-lying land along this stretch of coast. A wastewater treatment plant and an electrical substation are also located inland and have been threatened by the area’s poor flood defenses. For many years, a raised shingle beach (more than 15,000t of shingle) has been used as defense, but flooding has caused significant damage, with the last flood season (2008-2009) causing more than £5m of damage between Selsey and Bracklesham.

This new, far more extensive approach is a major effort by the Environment Agency to establish real long-term protection for the coastline.

HafenCity Hamburg: Reinforced in more ways than one

Secugrid® – invalid in the expansion of the main southern road artery

With difficult subsoil and being situated atop a new subway tunnel and next to an existing railway line, the new roadway artery of Hamburg’s HafenCity has not exactly chosen the easiest conditions. But those responsible for HafenCity are known to be innovative, and that’s why they rely on NAUE Secugrid®: it reinforces and stabilizes the subsoil on challenging construction projects.

As the largest inner-city development project in Europe, HafenCity Hamburg continues to grow. Connecting this new district to Hamburg’s transport infrastructure is an important task. Two major projects stand out: the extension of the U4 underground line to HafenCity and the expansion (plus some new construction) of the Versmannstrasse. The latter takes traffic three challenges here:

- Subsoil with settlement-prone layers of backfill, tidal mud, and peat of varying consistency
- The tunnel for the new subway line directly under the Versmannstrasse
- An existing Deutsche Bahn main line that runs parallel to the road

It was therefore necessary to consider total settlement and differential settlement, as well as their potential impact on existing structures. For most of the road, the expected total settlements were largely anticipated by accelerating consolidation of the subsoil. However, this was done by surcharge loading in conjunction with prefabricated vertical drains (PDVs). Construction site: further complicating for that location in the rise of the subway tunnel as it connects with the Elbe bridges there at ground level.

Stability – a bridge between rigid and soft

The tunnel was secured by lateral diaphragm walls on both sides and a pile foundation underneath. These were necessary but relatively rigid system solutions on the soft subsoil. Preloading was not an option here, as lateral stresses and the associated horizontal displacements had to be prevented both along the path of the subway line and in the tracks themselves.

What the site needed was a system which could provide a transition between the “soft” preload embankment and the “rigid” underlayer during construction of the breakwaters. Terrafix® B 813 is a unique geo-synthetic. Two geotextiles encapsulate a sand layer. The increased density allows it to sink in water for easier installation and material control during such hydraulic engineering applications.

In “sinking” underlayer, Terrafix® B 813 provided an efficiency that has made the installation process significantly quicker than that of a conventional geotextile. This also resulted in welcomed project cost savings.

Full construction of the beach at Medmerry took place from April to September with an eight-week window for the geotextile installation. More than 34,100m³ of Terrafix® B 813 were installed.

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The project engineer (Atkins) specified NAUE Terrafix® B 813 to be used as the filter/separating geotextile between the Norwegenrock (which includes up to 100 boulders) and the sea bed. The geotextile had to be robust enough to cope with such loading. It also had to be installed underwater during construction of the breakwaters.

Geotextile Terrafix® B 813 provided an efficiency that has made the installation process significantly quicker than that of a conventional geotextile. This also resulted in welcomed project cost savings.

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Engineering Brisbane's new parallel runway on soft subsoils

Australia’s importance as a global centre for tourism and business travel has been growing at an extraordinary rate. Since 1998, the passenger volume at Brisbane Airport—Australia’s third largest by passenger volume (behind Melbourne and Sydney)—has grown by 12.8% to 21 million passengers (2012). By 2035, the volume growth will be even larger.

The Brisbane Airport Corporation expects to handle 50 million passengers by 2035, a 138% increase over today.

To safely accommodate the increase in passengers and the larger, more advanced, more frequent arrival of jets, the Brisbane Airport Corporation (BAC) invested in the construction of a new parallel runway (NPR) system.

It wasn’t simply a matter of replicating the airport’s current success to available land ready to build on, though. The airport’s site includes soft subsoils. The long-term design needed to factor in this challenging subgrade. A geosynthetically reinforced improvement strategy was utilized to make the construction of the site possible.

Converting a former river delta

The airport lands are set upon 2,700 hectares (6,672 acres) of former river delta. The soils are weak and often saturated. The local infrastructure community must plan for soil improvement or have significant measures built in to remove the water prior to construction.

Traditional replacement and strengthening strategies, such as the time-intensive use of lime or cement stabilization, are expensive.

To use a strategy of soil replacement for the airport’s large site and to meet the high stability and safety criteria for the new parallel runway, those traditional methods were not considered economically feasible; certainly not for the whole site. The long-term planning warranted upgrading Brisbane’s airport infrastructure, but the cost of doing so was now too steep.

A major challenge in the engineering works was the need to pump in sand across the land from Moreton Bay (some 4.5km away) to cover 360 hectares (900 acres) on which the NPR would be constructed. This represented one of the largest dredging operations ever proposed in Australia. The 5.1 sand/water mix required a large-scale pipeline, one which had to cross very soft soils, adjacent to a wastewater treatment site, and the active Brisbane Airport.

The scale of the pipeline and its necessary infrastructure (e.g., access road), as evaluated by traditional soil stability means, threatened the airport expansion budget.

The utilization of a geosynthetic reinforcement system was then proposed as an alternative, one that would ensure pipeline stability, economical construction works, and safe expansion of the runway capacity to happen today; thus, secure tomorrow’s airport and local prosperity.

Uniquely, as shown by Gireaud and Han, the stresses imposed on a subgrade are less in a geosynthetic-reinforced pavement than in an unreinforced pavement. For the Brisbane project, this was key to facilitate a technical solution for the soft subgrade conditions encountered on site and secondly to achieve a financially viable design of the project system on which the NPR depended.

Creating terra firma

Two characteristics were required in the site reinforcement solution: improved subgrade strength and prevention of long-term weakening of soils through the mixing of fines between subgrade and base course aggregate. For geosynthetic solutions, this meant a geogrid (subgrade improvement) and geotextile (subgrade separation and filtration performance). Today, these materials can be specified as a single layer through composite reinforcement materials.

In Brisbane, NAUE Combigrad® was selected as a primary means of soil reinforcement in the pipeline operation stabilization. Combigrad® is a composite material that utilizes the biaxial strength of Secugrid® geogrid and the durability and exceptional separation/filtration properties of a Secutex® nonwoven geotextile. The geotextile is embedded within the flat, welded, pre-stressed geogrid slabs during manufacture (as opposed to being glued or fixed in other ways to the outside of the geogrid). This structure guards against delamination and peeling of the composite layers.

The NPR pipeline design benefited greatly from the composite reinforcement material. It enabled two layers of soil stabilization in one (soil reinforcement and filter stability), which represented a significantly savings on material and soil disturbance/ replacement. It greatly saved on time.

Any savings realized were appreciated, especially in light of the fact that the composite reinforcement could not be the only layer of reinforcement. The local soils featured weakness as far down as 35m. Because of this, to reach the proper safety factor for the dredging and pipeline infrastructure, additional layers of support were included. A geocomposite (Combigrad®) was installed at the subgrade level and a geogrid (Secugrid®) was inserted in the granular layers above.

More than 100,000m³ of Combigrad® geocomposite and Secugrid® welded biaxial geogrid were used in the construction of the platform and access road for the dredging pipeline.

The importance of 2

While the Brisbane Airport Corporation has concentrated on being able to handle 138% growth in passenger travel over the next 20 years, the immediate number of concern has been 2%. This is the key to the design and the maximum elongation percentage considered in the geo- grid reinforcement design to overcome these soft soils.

Large-scale testing by Perkins and Cuello (2010 – 2014) has added to the field literature by Gireaud and Han (2004) and been further supported by Cruse and Shahrokhi (2014). These tests and designs demonstrate the importance of geogrid performance in pavement systems, with respect to durability against installation damage, minimum junction strength, etc. The required stiffness requires high strength at low elongations (0.5 – 2%). At these low strains, suitable engineering values for stability/rigidity of the geosynthetic reinforcement are found.

The Brisbane Airport Corporation has utilized both Combigrad® geocomposite and Secugrid® geogrid in the construction due to the stiffness of both products proven by their excellent strength values at low levels of strain not more than 2%.

In this phase of the development the dredge pipeline and use of geosynthetics has been essential in filling the site. Approximately 13 million cubic meters of sand have now been pumped through the line to create layers of soil on which the runway will be developed. To drain the site and to accelerate the process of consolidation the runway construction can commence, some 8,000km of geosynthetic web drains have been installed as part of this large-scale soil consolidation work.

The engineering required to transform these lands is impressive, especially for the infrastructure role to be served, but the solution is not far from reach. With these geosynthetic reinforcement materials, the long-term design is not only achievable but more economical.

Brisbane’s story of success continues.

Article courtesy of Global Geothics, NAUE’s partner in Australia.

Did you know…?

NAUE Publishes New Mining and Geosynthetics Document

Geosynthetics enhance the economic and environmental performance of mining operations, so much that the mining industry has become one of the biggest users of geosynthetic materials. International geosynthetic manufacturer NAUE GmbH & Co. KG has published a new document on “Mining and Geosynthetics.” The brochure profiles important applications and how geosynthetics help mine engineers and owners achieve their goals.

Key segments addressed in NAUE’s publication include:

• Heap leaching
• Tailings management
• Compression ponds
• Mine closure
• Access roads and Other Geotechnical Structures

Additional information on product types and quality control is also included, such as how geosynthetic manufacturing and testing, combined with proper specification, leads to long-term field performance.

NAUE’s broad portfolio of products gives it a unique perspective in mining. The company manufactures and supports with design experience all of the geosynthetics essential to mine operations: geomembranes, geosynthetic clay liners, soil reinforcement geogrids (including composite solutions with embedded filtration and separation geosynthetics), geosynthetic drainage and venting materials, geotextiles, erosion control mats, and geotextile and geogrid materials.

From underground coal mines to mountain top gold heap leach pads, NAUE has engineered high-quality geosynthetics material NAUE’s partner in Australia.

SecuCalc 2.2 - Unpaved Base Reinforcement with Secugrid® and Combigrad® Geogrids

SecuCalc allows a generic calculation of aggregate base material in unreinforced and Secugrid® reinforced applications, such as under roadways, access/haul roads, parking lots or similar applications. Secugrid® geogrid reinforcement extends project service life, improves performance, reduces excavation, and lowers overall costs.

SecuCalc 2.2 is based on test trials and 30+ years of engineering knowledge.

And, it is easy to use.

Enter job site parameters and estimated material costs. You will then receive a comparison of an unreinforced and a Secugrid® or Combigrad® reinforced base course. This includes aggregate thickness, volume and mass, as well as the reinforced soil area in terms of m² of Secugrid® or Combigrad® material. Additionally, the software will allow you to compare different types of combination such as under roadways, access/haul roads, parking lots or similar applications.

It cannot be any easier.

Order your free of charge copy of SecuCalc 2.2 with the online request form www.naue.com/en/secucalc. Build safe and economical designs with Secugrid® and Combigrad®

To learn more about NAUE’s geosynthetics, visit www.naue.com or contact info@naue.com.
Geogrid-reinforced earth structures offer designers a number of options and thus provide a high degree of flexibility and freedom in the design of surface facings. At the Fortress of Fezyn, 10km south of Lyons in the Rhône-Alpes region, this allowed a disused military base to be converted into an attractive recreation area.

The Fortress of Fezyn was built in the 1870s as part of a chain of defence works in the greater Lyons area. For 120 years, it was a regimental site.

The community of Fezyn took over the building in 2003 and in 2009 launched a development project aimed at restoring the fortress and turning it into a tourism and leisure centre. The architecture of the fortress and its grounds, characterised by significant free space, proved ideal for the construction of equestrian quarters: the formal horse-riding area and an open riding area both lend themselves to additional outdoor activities.

Of course, the new facility planning had to carefully account for the existing building, which is considered a heritage site. Also challenging, the redevelopment needed to be visually appealing (e.g., green with vegetation) as soon as possible. The designers opted for reinforced steep slopes, which utilised the NAUE m³ Steel P system.

The system offered numerous advantages:

- Permanent stability even on slopes to 90°
- Ecological benefits associated with the use of local soils include decreased transportation pollution (and cost) and conservation of natural resources
- Extremely economical, due to the ability to utilise more affordable cohesive soils rather than dispose of or replace them with non-cohesive soils
- Quick and easy construction

The design of the geogrid-reinforced retaining structure in the old fortress area was carried out by BBG Bauberatung Geokunststoffe GmbH & Co. KG in Espelkamp-Festel, Germany. The slope has an inclination of 68° and a height of up to about 9.5m. The NAUE Secugrid® 80/20 R6 geogrid was placed in layers, each of which was covered with a 70cm thick layer of compacted fill and then folded upwards. Locally available soil was used as the fill.

Ensuring that the geosynthetic blends smoothly with the existing historical structures, such as walls, gates and balustrades, proved challenging. Here, the NAUE m³ Steel P System demonstrated its strengths.

The Secugrid® geogrid, which is made of drawn, monolithic flat bars with welded joints, is robust, and easy to handle and place on site. It is therefore more economical than traditional construction methods when steep slopes have to be reinforced.

Galvanised steel mesh elements form the facing of the geogrid-reinforced soil structure. A non-woven geotextile placed inside the mesh prevents fines from being washed out.

The steel-mesh elements were pre-bent to an angle of 90° and each layer was placed a short distance back from the one below. This resulted in small berms on which vegetation was established. More than 5.000m² of Secugrid 80/20 R6 were installed.

Updating Romania’s landfills

After Romania joined the European Union in 2007, the country needed to align its environmental practices with the more stringent EU requirements. Modernising and updating of environmental regulations included substantial work for Romania’s waste management industry.

New landfills had to be constructed with safer, modern designs (e.g., geosynthetic sealing systems) and old landfills that did not meet the new guidelines needed to be closed.

Waste management facilities in all 42 of Romania’s counties needed to be re-evaluated. Vaslui County, situated in the northeast, was one of the counties which needed a new landfill and which had to close and cap its previous facilities.

The project, located in the town of Rosiesti, involved an ecological landfill of approximately 110,000m², a leachate treatment plant and a sorting plant. IAS CDN S.A., one of the biggest construction companies in that part of Romania, was awarded the contract with a tight (one year) timeline. The use of geosynthetics certainly helped the project team meet its schedule.

Efficient Installation

Only 28 days were needed to complete the geosynthetic engineering works in Vaslui County. The 9.4m wide, 120m long run of 2mm Carbofol® 406 OIT s-s installation works advanced the work quickly, even with autumn rains disrupting some of the work.

The new site proved to be an easy task for the construction group, as 91,000m² of the Carbofol® 406 OIT and 115,000m² of Secudrain® R 1201 geotextile were installed quickly and securely.

An additional 10,000m² of 2mm Carbofol® 406 MF/MP GM13 was installed, too. The MF (Mega-Friction) products have a textured surface for enhanced frictional characteristics, such as on slopes. The GM13 on the product designates it meets the requirements of the internationally recognised GRI GM13 standard specification for “Test Methods, Test Properties and Testing Frequency for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes.”

The new landfill has provided Vaslui County with an EU-approved facility and safety, strong environmental engineering for local comfort.

A New Approach to Closure

Closing the old landfills in Birlad, Husi and Negresti was a more complicated operation, due to existing mineral seal options in the area. The initial technical solution for the cap, about which project backers had cost concerns, was proposed as the following:

- Covering soil – 1m
- Separation geotextile – 400mm
- Mineral layer for water drainage – 0.3m, 16/32mm ballast
- Separation geotextile – 400mm
- Mineral clay liner – 0.5m
- Mineral gas venting layer – 0.1m, 16/32mm ballast
- Leveling layer – 0.2m

The construction company was Transmit SRL, a local company from Vaslui.

Site investigations revealed that no proper clay was available close to the sites locations. Hauling in a qualifying mineral layer for the necessary gas and rainwater control was very expensive, in that part of the country.

NAUE, supported by design engineering from BBG Bauberatung Geokunststoffe GmbH & Co. KG, brought a geosynthetic design to the construction company which further on started the procedures to approve it based on its superior technical performance, ease in installation and cost effectiveness.

Though NAUE’s alternative to the traditional mineral layer has been used commonly throughout Europe and other world regions, it was new to this county, just as it was new to most of Romania and many of the newer members of the EU. The waste management sector, while in many respects more progressive in its engineering than other infrastructure sectors, is still slow to accept new approaches. Careful documentation and testing of site materials and strong proof of the engineering is required.

These are a couple of the reasons why waste management is such an effective engineering sector. Throughout the world, the modernisation of burial and closure practices has resulted in exceptional environmental control.

In Vaslui County, it was finally approved to utilise the alternative design with geosynthetics (top of bottom):

- Cover soil – 1m
- Secudrain® 111C WD 401 131C for water drainage
- Brentofol® NSP 6100 (Romanian code required 6,000g/m²) for a GCL
- Mineral gas drainage layer – 0.3m, 16/32mm ballast
- Leveling layer – 0.2m

The construction company was able to economically incorporate the design into the project’s tight budget and finalize the works.

The NAUE geosynthetic materials gave the project great efficiency, with up to 4,000m² of Brentofol® and Secudrain® package installed per day. In the end, 100,000m² of each geosynthetic was utilised to cap the old landfills sites and bring Vaslui County up to EU requirements.