



ENVIRONMENTAL INFRASTRUCTURE

Solutions overview



Progress through performance
A **Low&Bonar** solution



Index

Introduction	3
Project approach	4
Our solutions for all your environmental infrastructure needs	6
Applications	
1. SUDS Green landscaping and water retention ponds	8
2. SUDS Soakaways and pervious pavements	10
3. Recycling plants	12
4. Dewatering tubes	14
5. Urban development	16
6. Slope and rockfall protection	18
7. Avalanche mitigation bunds	20
8. Wind farms	22
9. Water edge protection	24
Enka Solutions product overview	28
Our areas of expertise	29
Enka Solutions values	30

Introduction



The environmental sector is the fastest growing of the Civil infrastructure sectors as we seek to address the multiple issues posed by man-made pollution and population growth by reducing the environmental impact of our activities and preserving scarce resources by adopting sustainable development wherever possible.

The global population doubled in the second half of the 20th Century from 3 billion to 6 billion people and is expected to grow to 9 billion by 2050. Increasing global industrialisation and the pressure to produce sufficient food, clean water and energy whilst maintaining our natural resources has placed new pressures on how we plan, build and operate our infrastructure going forward whilst every effort is being made to redress the balance in areas where our past activity has had an effect on the environment.

New forms of sustainable energy generation are being used to reduce our reliance on limited fossil fuel resources including waste and biomass plants, wind farms and solar and tidal power generation.

Waste disposal in landfills has become a last option with increases in recycling and reuse of waste or reassignment through composting or power generation whilst our existing and new landfills need to be protected to ensure they do not add to environmental issues.

Our industrial revolution and our reliance on fossil fuels to date has led to the emission of greenhouse gases, which have significantly contributed to changes in our climate. Changing weather patterns have seen increased incidences of drought, flooding and severe storms, which test our existing infrastructure.

Rising sea levels will drastically affect low lying and coastal areas, whilst more intensive farming techniques which saw the removal of trees and hedgerows have affected the water runoff from high ground, along with the increasing urbanisation of formerly green sites which can increase localised runoff in severe weather and lead to flooding with disastrous consequences if drainage systems and river management are not treated holistically.

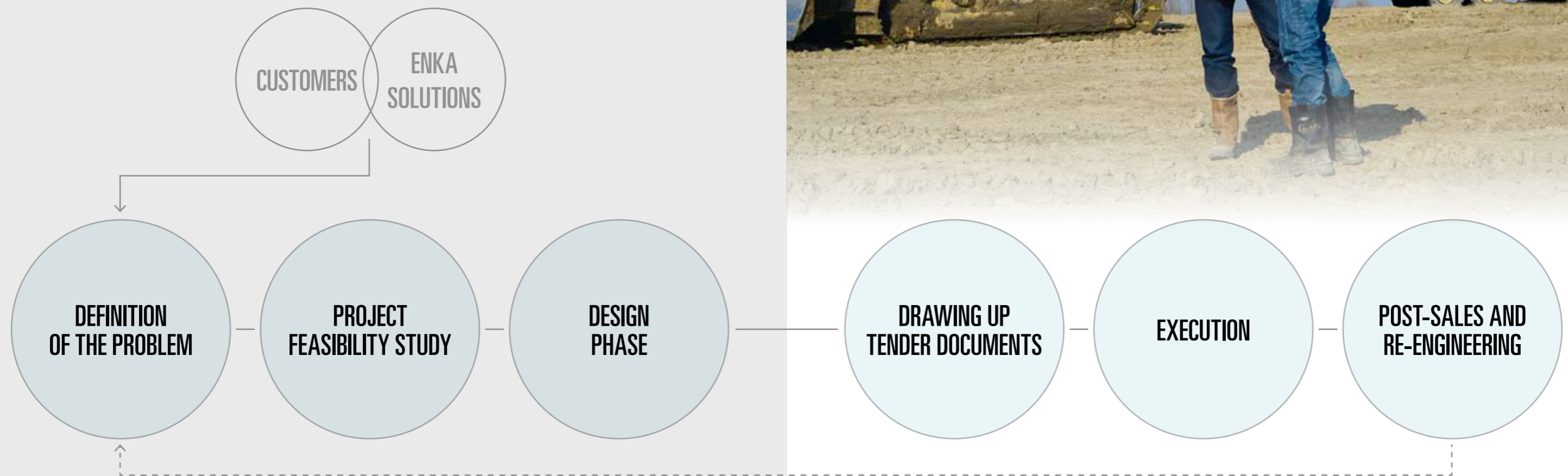
New developments are increasingly located on brownfield sites and may need to take into account previous usage and potential contamination in addition to the need for construction to be carried out using more sustainable technology. Future infrastructure demands need our projects to demonstrate not only cost and time savings, but also to reduce the whole life carbon footprint of projects by a minimum of 50% and many nations are beginning to include these requirements within all new procurement documentation.

“At Low & Bonar, we are proud that our geosynthetics have a long history across the whole range of environmental projects and that the necessary cost, time and embodied carbon savings required for the sustainability of our infrastructure have been delivered time and again through effective geosynthetic application.

All Enka Solutions environmental capabilities are demonstrated in this brochure apart from landfills. A separate brochure for landfill applications is available.

ENKA SOLUTIONS PROJECT APPROACH

We monitor and supervise your project from the initial definition of the problem all the way through to the post-sales phase. Our specialist engineers will provide the appropriate type of support required for each individual step of your project.



From our many years of **international experience**, our specialists have accumulated the necessary expertise **to provide all the support you need** with regard to defining a problem and to gathering the necessary data that will lead to the creation of the appropriate framework.

We provide **advice and contribute possible solutions** for specific problems or applications. If desired, we can also provide training on specific topics associated with the use of geosynthetics in civil engineering.

In this phase we work out the best possible solution in conjunction with the customer. We provide **tailored advice** by means of calculations for the **all-round solution** and delivering drawings, sketches and models. An optimal mix of products is sought for the specific situation, including the relevant cost calculations.

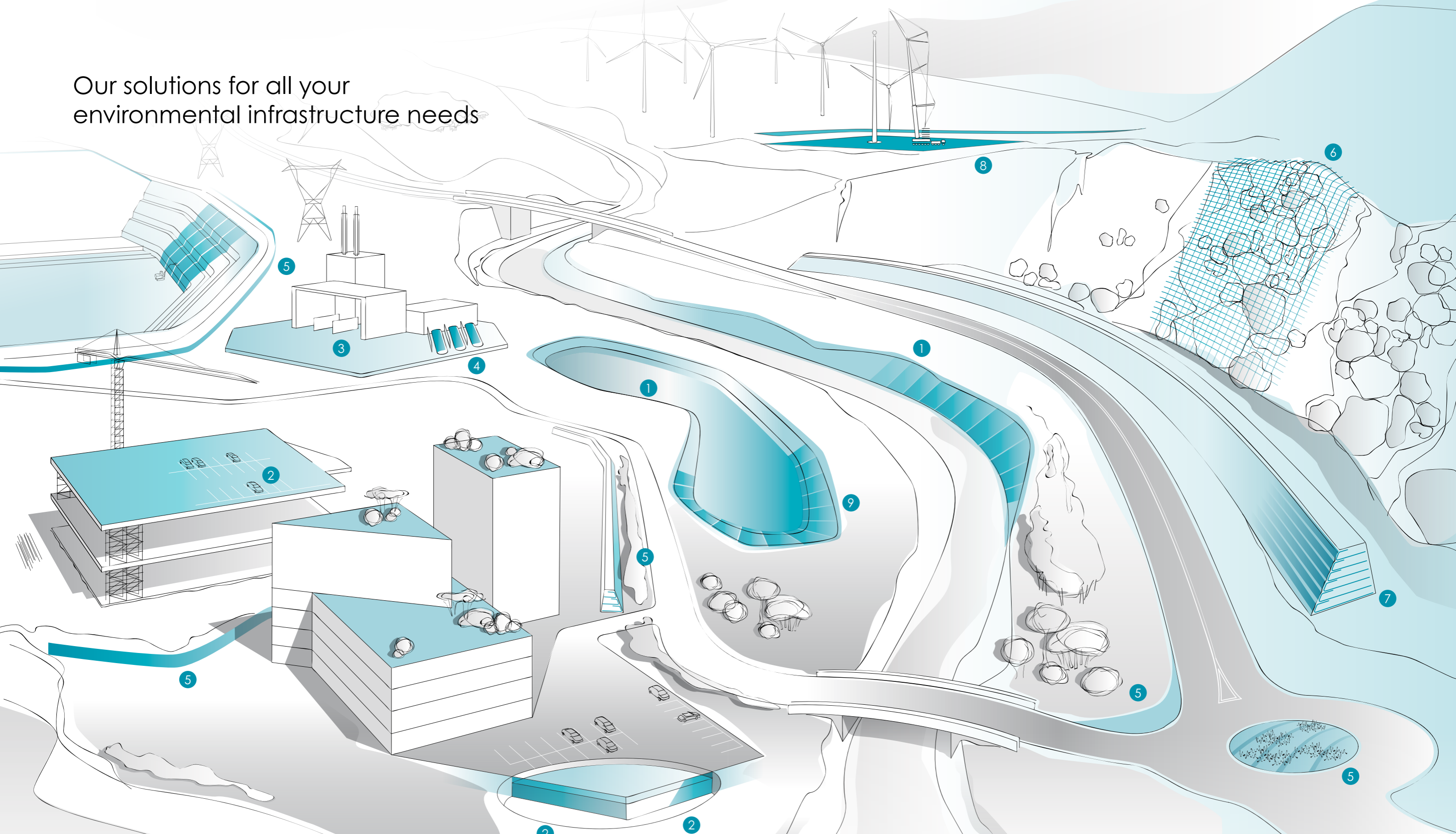
We can either deliver **standardised specification documents and drawings**, or draw up a set of **project-specific installation instructions**.

We prepare for the **execution of the project** by providing clear installation instructions. If desired, we can also organise **project-specific installation training sessions**. Our customers can also rely on on-site support.

Once the project has been completed, we will be happy to assist our customers with any future challenges. We make use of the expertise gained during the execution of specific projects to further streamline our solutions and develop new products.



Our solutions for all your environmental infrastructure needs

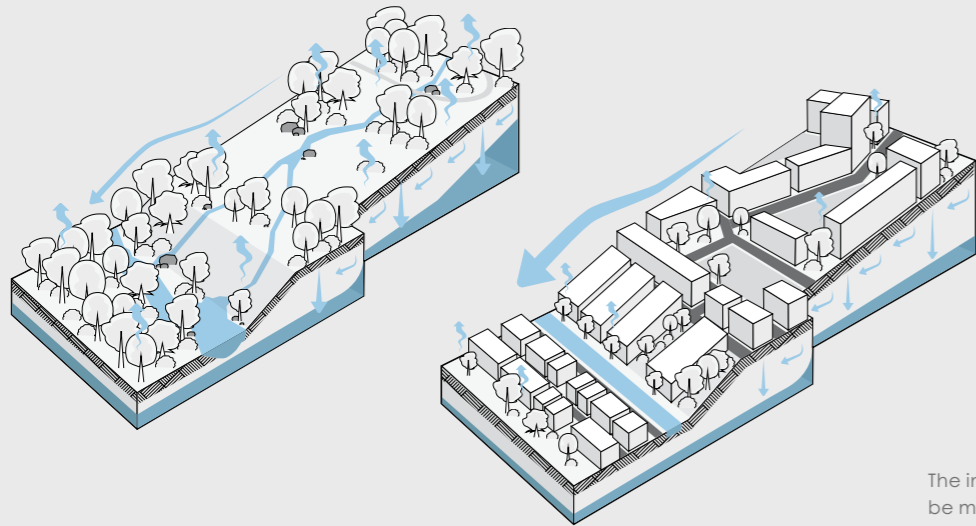


- 1 SUDS Green landscaping and water retention ponds
- 2 SUDS Soakaways and pervious pavements
- 3 Recycling plants
- 4 Dewatering tubes
- 5 Urban development
- 6 Slope and rockfall protection
- 7 Avalanche mitigation bunds
- 8 Wind farms
- 9 Water edge protection

1. SUDS

Green landscaping and water retention ponds

Excess rainwater may cause flooding within existing locations or proposed developments especially in urban areas. Serious consideration must also be given to overloading of sewage treatment plants. These risks will be reduced by the application of Sustainable Urban Drainage Systems (SUDS). **SUDS replicate as closely as possible the natural drainage of a site** with a holistic approach to water management for instance with the installation of water retention ponds.



The increase in run-off in urban areas can be managed by the use of SUDS at multiple points within the drainage cycle.

The SUDS approach means the inclusion of **materials to slow run-off, attenuate of collected water and manage discharge** to either drainage systems, water courses or into the natural soil. Geosynthetics can be used in the construction of many aspects of the SUDS.

Green landscaping is an essential part of the SUDS approach. Changes can be made or existing landscaping protected to manage the flow of natural watercourses in and around the development. The use of Enkamat on the banks of rivers or streams **will help to stop erosion and therefore maintain the flow of these watercourses**, allowing it to cope with the run-off water as required. The use of Enkamat and Enka-Tex can stop erosion and therefore further changes to the geometry

of a bank. They can also help with maintaining filtration of water that is added to the watercourse through the banks of a river.

Detention basins are created to hold water until the natural soil is able to allow permeation of the water held within it. The application of Enkamat and Enka-Tex within man-made detention basins is the same as within a natural watercourse.

FUNCTIONS:

- Separation
- Filtration
- Erosion control



Enkamat®



Enka®-Tex nonwoven



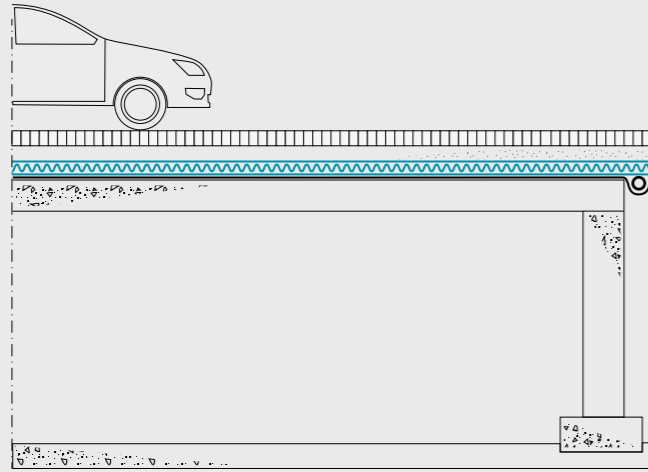
Relevant products:

- Enkamat®
- Enka®-Tex nonwovens



2. SUDS Soakaways and pervious pavements

Due to our changing climate **flooding is becoming an increasingly regular phenomenon and overloading of sewage treatment plants a risk** for the environment. Soakaways and pervious pavements are examples of Sustainable Urban Drainage Systems (SUDS) that deal with excess rainwater in urban areas or proposed developments. SUDS replicate as closely as possible the natural drainage of a site.



Permeable paving allows for the passage of water from the surface into managed drainage. The use of Enkadrain ensures a consistent flow volume of water even under loading.

The SUDS approach means the inclusion of materials to **slow run-off, attenuate collected water and manage discharge** to either drainage systems, water courses or into the natural soil. Geosynthetics can be used in the construction of many aspects of the SUDS.

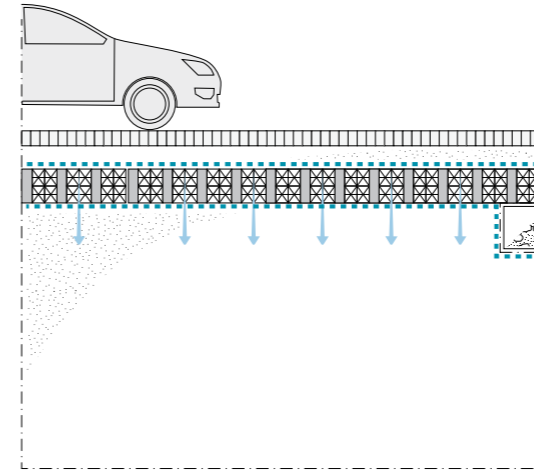
The purpose of a soakaway is to either hold water as it permeates into the natural soil, or to create a pathway to a soil with higher permeability to allow water to drain more freely. These can be vertical or horizontal with the most well-known version of the SUDS being the horizontal "milk crate" soakaway placed under a pavement. Enka-Tex is used to wrap the crates as a filter to **stop the ingress of soil or other particulates** that will affect the long-term performance of the soakaway. By stopping the ingress,

the need for maintenance is reduced and a constant flow or volume of reduction can be maintained.

Pervious pavements are used to **control water running from surface to drain on large hard landscaped areas** for instance car parking areas or concrete cellar roofs. This requires a material that allows flow underneath the surface to enable drainage to soil or soakaways. The use of Enkadrain, which maintains flow even under substantial loads is of great benefit. A filtering fleece as part of the Enkadrain composite **prevents any aggregate in the water from entering the core**. Furthermore, the thickness of Enkadrain also allows for attenuation in the event of unexpected levels of water being present, allowing a managed flow and discharge.

FUNCTIONS:

- Drainage
- Separation
- Filtration



If the permeability of soil is low, attenuation crates can be used to store water before it is drained which reduces the risk of flooding at the surface. Enka-Tex is used to form a separation and filtration layer that will stop the ingress of soil or other particles that would reduce volume or performance of the crates.



Enka®-Tex nonwoven



Enkadrain® Wide

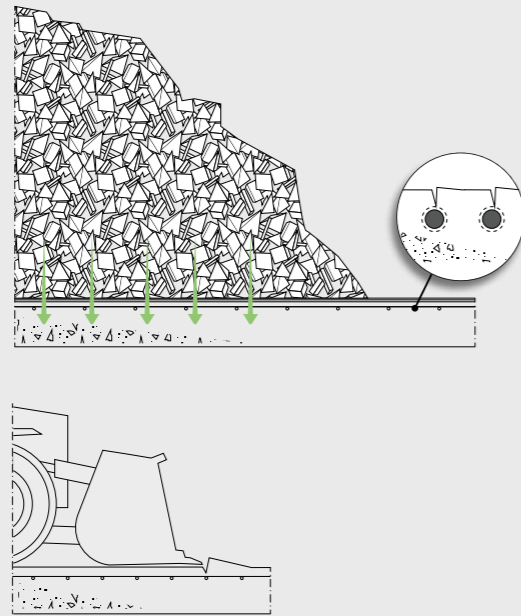
Relevant products:

Enkadrain®
Enka®-Tex nonwovens



3. Recycling plants

Recycling and reduction in waste going to landfill has become a major issue of social responsibility and, as such, the construction of waste recycling and energy from waste facilities has become a growth industry. Concrete is commonly used within these facilities as construction material but **can be subject to deterioration** because of the harsh environment inherent to waste.



Leachates from domestic waste can penetrate concrete and accelerate the corrosion of any steel reinforcement. With the expansion caused by the corrosion of the steel the concrete service will eventually crack and spall, a process which can be exacerbated when the blades of the waste handling equipment snag on any fractured concrete or exposed rebar.

Concrete as a material has high strength in compression but is weak in tension. Due to this, welded steel mesh has traditionally been placed within the matrix to reinforce it and to prevent failure. If a concrete slab is ground bearing, then the **design calculation may allow for the elimination of any welded steel mesh** in the bottom half of the slab. This means that "reinforcement" would only be needed in the top half to prevent shrinkage cracking.

The presence of liquids and leachates within waste facilities, for instance from orange juice, milk and wine, can lower the alkalinity of the concrete and therefore will lead to **corrosion and subsequent spalling and failure**.

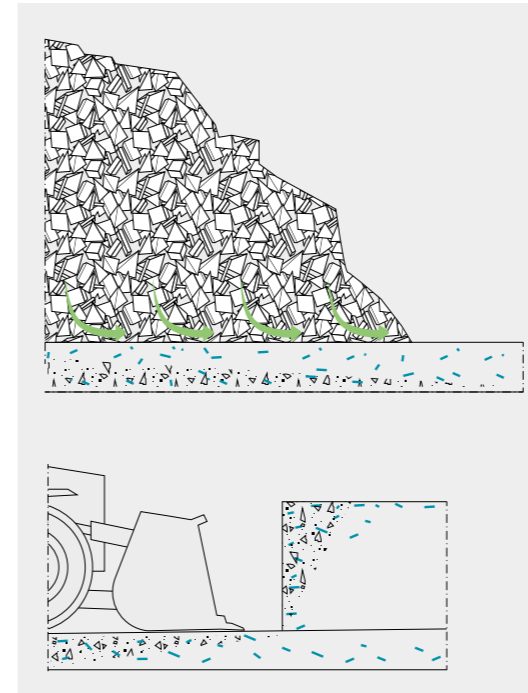
The use of Adfil Durus Macro fibres and Adfil Micro fibres can eliminate some of the potential problems associated with the use of concrete within this application, as well as **improving the properties** of both the wet and hardened concrete.

The introduction of Adfil Durus Macro fibres as the reinforcement material may eliminate the requirement for welded steel mesh and, as such, eliminates any issue that may arise from the presence of acids. Adfil Durus Macro fibres are manufactured from 100% polypropylene and are therefore **unresponsive to acids, liquids and leachates**.

Adfil Micro fibres are added at a rate of 0.91 kg/m³ to the concrete mix to improve the properties of the wet concrete. In the hardened concrete, the fibres will **improve the abrasion and impact resistance and the resistance to freeze-thaw**.

FUNCTIONS:

- **Eliminating welded steel mesh reinforcement**
- **Reducing plastic shrinkage**
- **Enhancing residual flexural strength**
- **Improving freeze-thaw resistance**
- **Increasing impact and abrasion resistance**



The use of Micro fibres enhances the hardened properties of the concrete and this creates a more durable surface. Macro fibres are used to reduce or eliminate the need for traditional steel mesh reinforcement which could erode and create spalling.



Adfil Durus® Macro Fibre



Adfil Micro Fibre

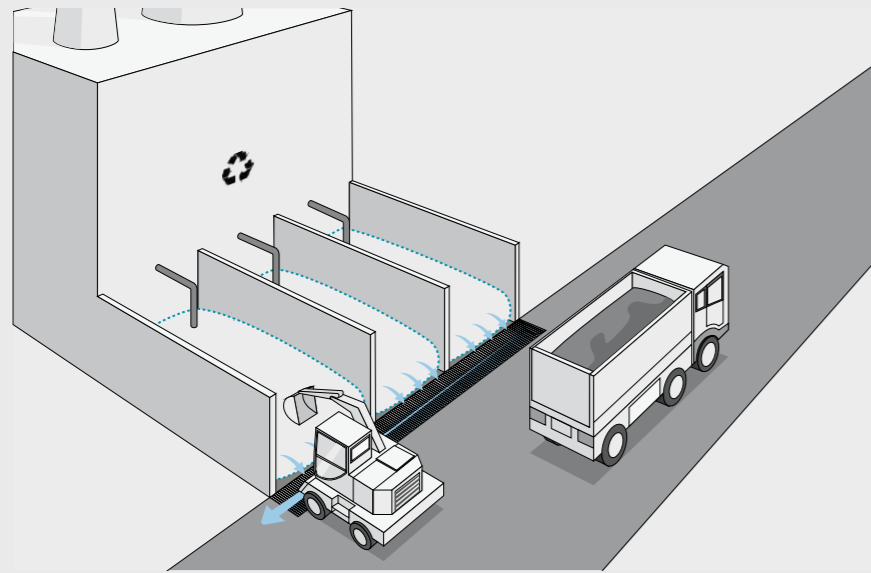
Relevant products:

- Adfil Micro fibres
- Adfil Durus® Macro fibres



4. Dewatering tubes

Fly ash or pulverized fuel ash (PFA) from the combustion process in power stations needs to be contained and treated onsite **to avoid air pollution and to minimise environmental issues** it may pose around the plant. Proper treatment enables it to be reused as a lightweight fill material or partial concrete replacement.



Traditionally, treatment consisted of filtering the vented fumes from the furnace and then flushing the fly ash into settling ponds where it would gradually be deposited on the pond bottom before eventually being removed for processing or disposal. The space needed for these settling ponds and the risk of contamination from them is **not the most sustainable solution**, especially since the PFA removed from the settling ponds would ultimately need dewatering anyway.

The dewatering of the ash to enable it to be **reused as a bone dry construction material** can alternatively be achieved by using geosynthetic tubes. These tubes can be used to remove water from any sludge in a variety of

applications; from removing potential contaminants from sludge dredged from lakes or riverbeds to treating mine tailings or the fuel ash from either coal or biofuel fired power stations. **Dewatering tubes provide a more efficient, cost-effective and sustainable technology.**

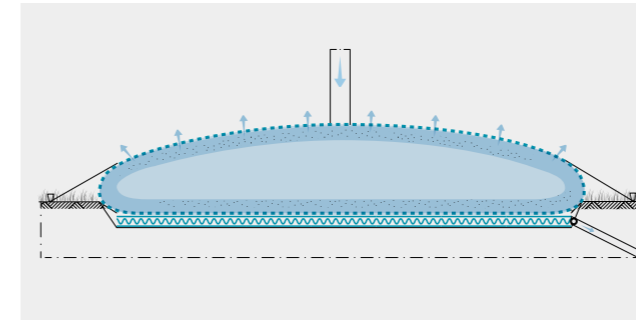
Volume reductions up to 85% are achieved from the pumped sludge to deliver the bone-dry end material. The sludge pumped towards the Enka-D-Tube is maintained in solution through the addition of either a bentonite or polymer flocculant. Inside the tubes, a natural filter (cake) is created against the special woven fabric the tube is fabricated from; **this fabric ensures water permeability and filtration** in the initial stage.

Dewatered slurry can be easily excavated from the Enka-D-Tubes. Tubes can be positioned in bays to facilitate ease of use typically with one tube being filled, one standing whilst dewatering and dry tubes being excavated and removed before a new tube is installed for filling.

Thereafter, the cake helps to filter the sludge. **Clean water will run out of the tube** and is gathered in cut-off drains to guide it back to the plant or mine for reuse. In order to facilitate an optimal run-off from the full circumference of the tube, Enkadrain can be rolled out under the tube.

FUNCTIONS:

- Filtration
- Containment
- Drainage



Enka-D-Tubes are pumped to 70-80% capacity enabling rapid dewatering of the slurry aided by the use of Enkadrain beneath the tube to enable dewatering through the full circumference.



Enka®-Tex woven for Enka®-D-Tube



Enkadrain® Wide

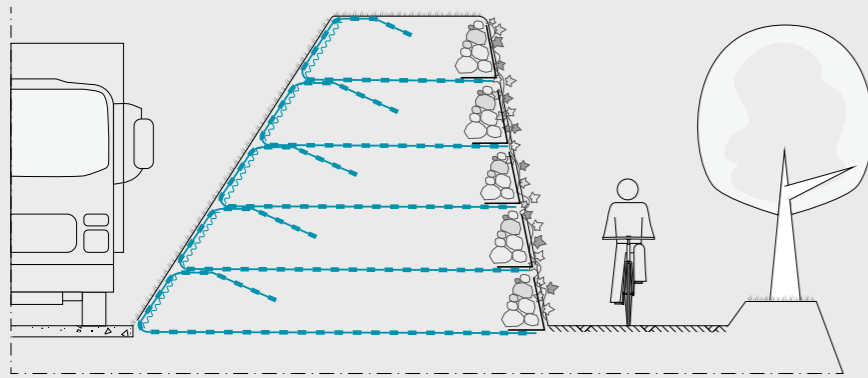
Relevant products:

Enka®-D-tube
Enkadrain®



5. Urban development

The nature of urban development has been forced to change in order to suit the increasingly crowded environment. For example, where once older industrial sites would be left derelict, **brownfield redevelopment is now the norm**. This requires careful investigation to map out potential hazards and specific design to accommodate and remediate the site before construction.



The noise of intensive traffic has become a serious issue in crowded urban areas. Reinforced sound bunds allow for an aesthetical solution with efficient use of available surface.

Dust and run-off from construction sites is always an issue in urban environments where mud and silt from the site could carry contaminants from the disturbed ground beyond the site boundaries. There it **could contaminate or completely block drains and watercourses**. Increasingly, we see the use of geosynthetics as cut-offs around the site boundary to carry any site runoff back into the site water treatment facilities.

Enka-Tex woven geotextiles are being used as silt screens along the site boundary and as dust and debris screens around scaffolding, particularly where old structures are under demolition.

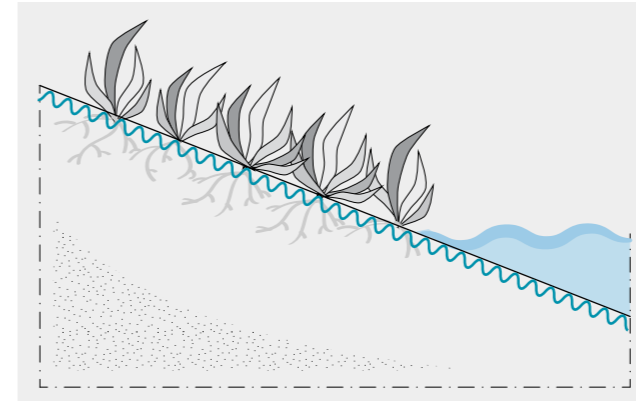
Similarly, noise and visual intrusion from new developments can affect the neighbouring environment. This intrusion can be minimised through the **effective use of noise and site bunds**, which can also be used to contain site-won fill material to avoid the need to remove from site and dump potentially hazardous material. Using Enkagrid, bunds can be constructed with steep and even vertical sides and combined with attractive stone or vegetated finishes to enhance the aesthetics of the site and the neighbouring area.

Additional installation of Enkamat will **support the growth of vegetation** on steep banks up to 60 degrees.

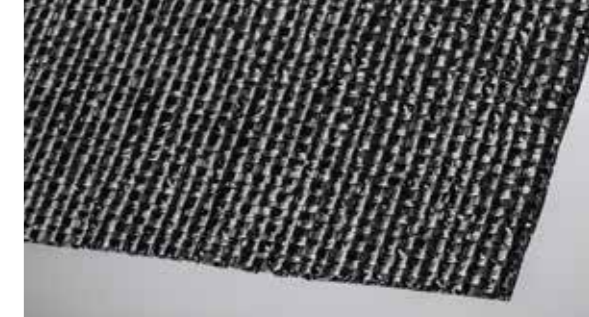
Landscaped and planted areas on new sites can **be protected from weed intrusion** to maintain the desired planting regime and minimise maintenance costs using a biodegradable woven ground cover of vegetable origin such as BonarAgro Duracover as weed-stop barrier.

FUNCTIONS:

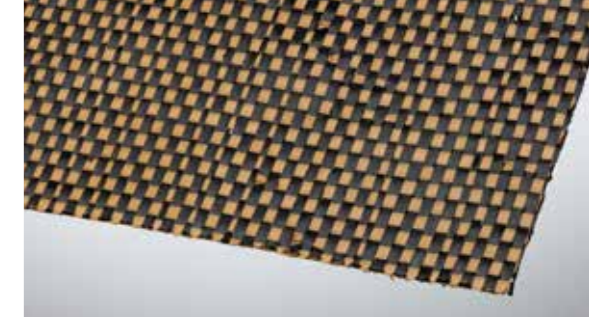
- Filtration
- Separation
- Reinforcement
- Erosion control



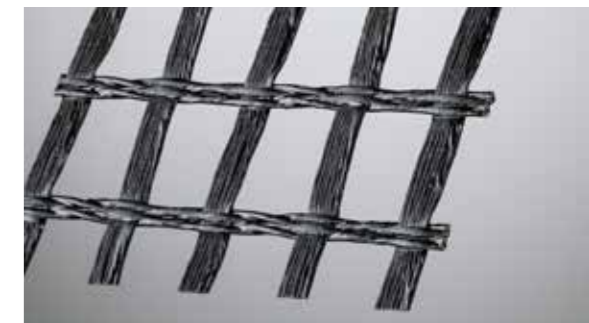
The three dimensional Enkamat provides immediate protection, allows for fast growth of vegetation and offers a long-term strong foothold for vegetation root systems on dry and wet slopes.



Enka®-Tex woven



BonarAgro Duracover®



Enkagrid® G

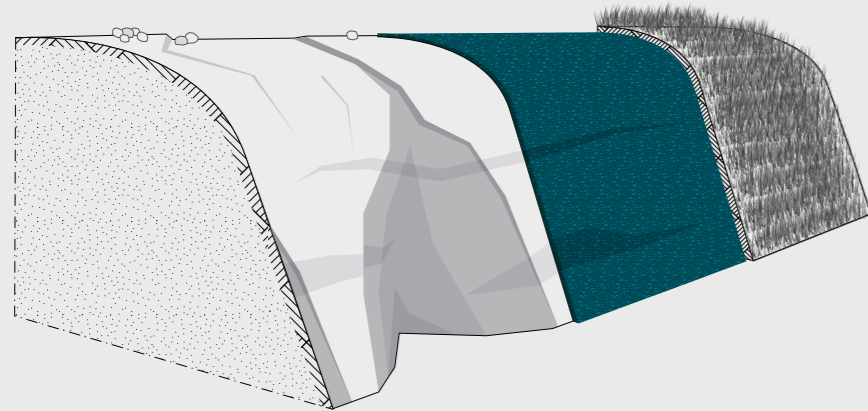
Relevant products:

- Enka®-Tex wovens
- Enkagrid®
- Duracover®
- Enkamat®



6. Slope and rockfall protection

The face of a slope and its geometry can be critical to long-term performance and any **change to its angle or shape may even lead to failure**. Progressive surface erosion poses risks to the stability and in the long term can lead to falls of debris, rocks and boulders with the associated threat to neighbouring areas.



On weathered rock surfaces fine grained soils and small stones are washed out by wind and rain undermining the establishment of vegetation. The use of a pinned Enkamat facing or a filled Armater mat can provide the necessary stability to allow vegetation to mature.

Surface erosion is usually a progressive mode of failure with the minor pitting of an unprotected soil surface progressing to the formation of runnels, which concentrate run-off flow and lead to deeper channels forming an eventual loss of stability.

Progressive surface erosion can lead to delays whilst clearance and repairs are undertaken and could also lead to the failure of structures on top of the slope. The natural defence against either water or wind erosion is the root matrix of grasses, plants and trees, which hold the soil together. This is only possible after a period of growth time and the slope face will remain unprotected until then. The Enka Solutions range of **Enkamat erosion control products protects the slope immediately after construction** by creating an artificial root matrix on the face

of the slope by protecting and by locally embedding the soil. The open nature of Enkamat with over 90% voids and high filament density ensures embedding of the topsoil. It enables hand seeding, planting or hydroseeding to establish vegetation without impeding root growth or passage of moisture.

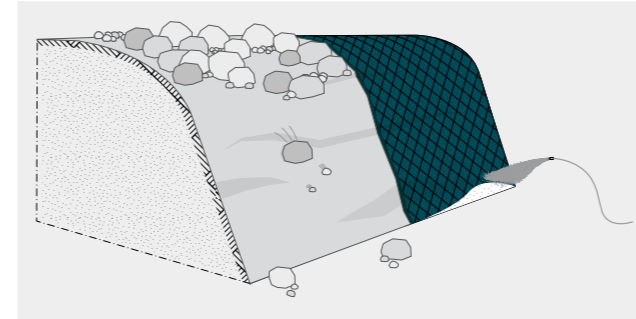
Rocky slopes with stones and boulders can be dangerous, when **due to water and wind erosion, rocks and stones get unstable** and roll down from the slope. This instability may cause damage and accidents when there is, for example, a road or residential area at the foot of the slope.

On rocky slopes, the reinforced and flexible Enkamat W or R is pinned to ensure close contact with the ground. It **functions as a flexible grip layer**

in which soil is retained and seeds germinate easily. When a slope is very steep, Enkamat may be mulched or hydro-seeded.

Enka-Net woven materials **protect soil surfaces from direct rainfall** and prevent soil from washing out of the slope face prior to vegetation taking hold.

Armater is an open, three-dimensional honeycomb matrix of nonwoven material which, when pegged to a slope surface, physically **embeds individual cells of topsoil or granular material** at the slope surface, intercepting and preventing the continuation of any runnels and enabling the flow of surface water without allowing the soil to be transported.



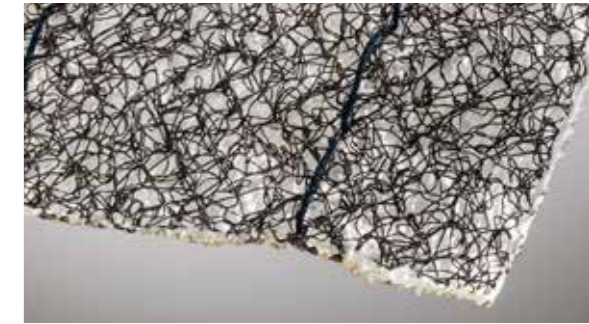
On rocky surfaces bolting, anchoring and wire netting may be required to ensure larger stones are not dislodged. Enkamat pinned behind the face netting will retain smaller stones and particles and provide a growth medium where vegetation can establish through hydroseeding or hand planting.

FUNCTIONS:

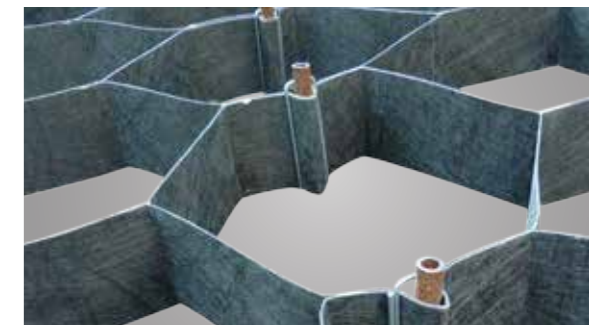
- Surface stabilisation
- Support of vegetation
- Prevention of splash, rannel and gully erosion



Enkamat®



Enkamat® W



Armater

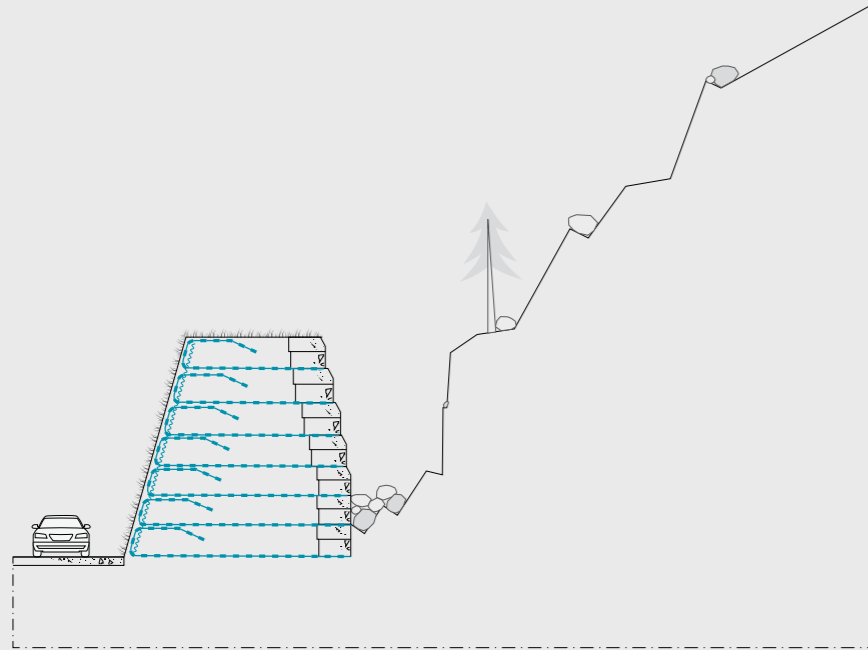
Relevant products:

- Enkamat®
- Enkamat® W
- Enkamat® R
- Armater®
- Enka®-Net



7. Avalanche mitigation bunds

As urban development or leisure activities move into more mountainous regions, the risk posed to buildings and particularly to motorists on roads built into the mountain sides is increased by rockfalls and avalanches.



The dead weight of a reinforced soil bund can absorb the impact of larger boulders during a rockfall. The geometry can be suited to effectively dam large volumes of debris or snow avalanches thus improving safety and maintaining access to roads.

Individual boulders exposed on steep slopes can be anchored back into slopes or removed and surface debris can be contained with geosynthetics or netting, however, **large-scale surface stabilisation is often not an option** because of the scale of a project.

Rockfall arrest netting using high-strength tensioned wire screens and recoil braking devices to contain the impact from individual rock impacts is often used, but with that comes the **requirement for routine maintenance and the clearing of debris** and resetting of the fences after a rockfall which can put the maintenance team in danger.

A commonly used alternative to arrest netting is the construction of steep-sided rockfall mitigation bunds

and avalanche dams. By utilising geogrids to create a steep-sided earth mass, **an effective mitigation to rockfall risk can be created**. The maximum impact of any potential individual rock hitting the rear of the bund can be calculated and counteracted by the dead weight of the earth mass. The rear of such bunds is typically constructed at or near vertical with **a facing made from recycled tyres** which help absorb the impact and protect the rear of the bund from damage due to the edges of impacting boulders. The front faces visible to the road users or the occupants of neighbouring sites being protected by the bund are typically a rock finish or a steep, vegetated facing to **reduce the visual impact** and to blend well into the mountain environment.

An additional advantage of mitigation bunds over rockfall netting, is that the mass not only resists the impact from individual boulders, but can also **retain any fine scree, smaller stones or snow** within a larger slope failure or avalanche. The bund serves as a containment dam for the fine materials and prevents roads from being blocked and reduces the threat to lives and buildings.

FUNCTIONS:

- Protection
- Reinforcement
- Shock absorption
- Support of vegetation



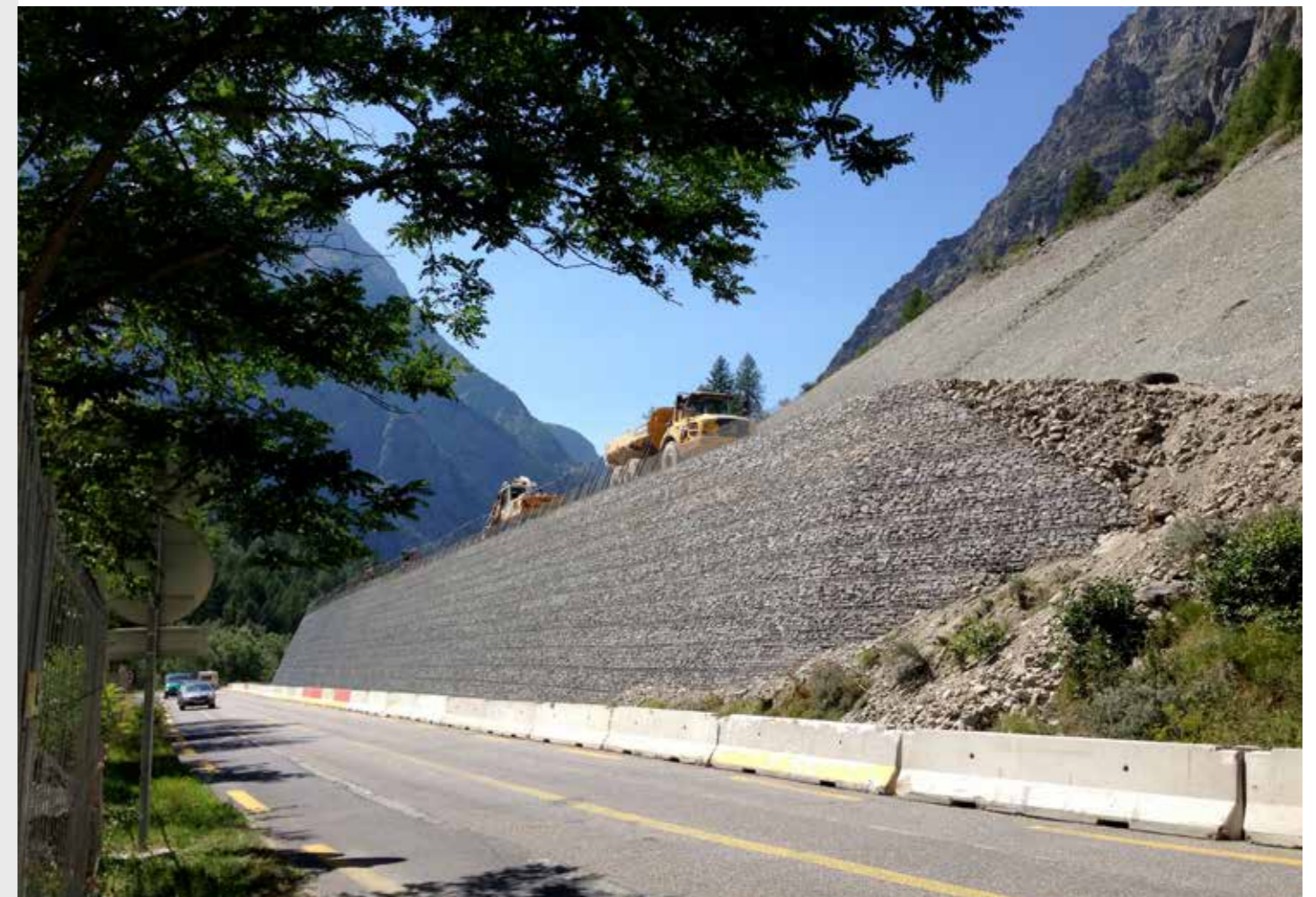
Enkagrid® PRO



Enkamats®

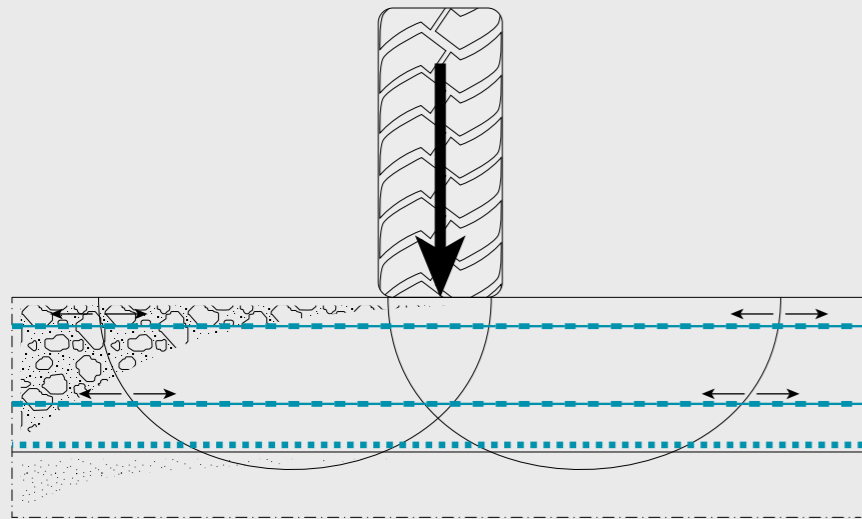
Relevant products:

Enkagrid®
Enkamats®



8. Wind farms

Wind power as a clean energy source has gained significant territory. Wind turbines are constructed creating large wind farms. **The local soil in these areas is often weak and lacking bearing capacity** for the heavy equipment needed during construction and maintenance. It is of utmost importance that working platforms, associated ramps and access roads are properly designed to ensure stability and safety.



Windfarms require solid foundation platforms for the extreme heavy equipment during erection and maintenance of mills. Enka-Tex and Enka-Force separate and reinforce the backfill at the intersection of the weak subsoils and horizontal Enkagrid layers reinforce the foundation platform preventing differential settlements.

The construction of wind farms demands the use of heavy equipment in order to lift heavy power generating turbines. Enka Solutions reinforcement products offer cost-saving and risk-reducing solutions for working platforms and associated access roads.

Traditional methods to improve bearing capacity of weak soils in rural areas involve large excavations to exchange the weak soil with well graded material. Alternatively, rigid inclusions like steel or concrete piles are also applied. These inclusions transfer high surface loads to lower ground layers. Both methods are associated with a **high material demand, large lead times and high embedded carbon content**. In contrast to these traditional methods, Enkagrid, Enka-Tex and Enka-Force offer effective and cost-efficient alternative solutions.

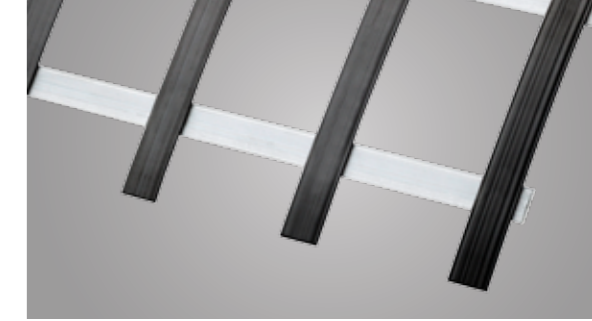
Geotextiles and geogrids are used in designed solutions to improve the local soil performance, creating a safe and economical construction site. **Risks of overturning cranes and heavy lifting equipment** and stability issues at roads and platform edges are avoided.

Enka Solutions can create a stabilised foundation covering weaker zones in the subgrade, the so-called soft spots. This reinforcement layer can be constructed with single or multiple layers of geotextile. When selecting high strength Enka-Force, these layers can also function as a stabilizing mattress bridging a grid of concrete piles. The result of using Enka-Force and Enkagrid in roads and working platforms is an **immediate increase of bearing capacity** whilst reducing the thickness of the sub-base and foundation layer.

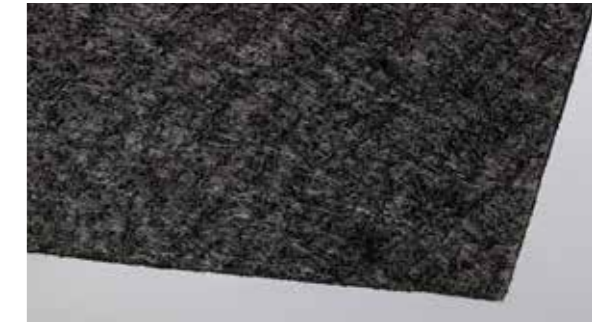
Additionally, these improvements result in a **reduction of differential settlements** and increase of trafficability and loading capacity of access roads by decreasing fatigue phenomena, i.e. rutting effects and loss of bearing capacity.

FUNCTIONS:

- Reinforcement
- Separation



Enkagrid® MAX



Enka®-Tex nonwovens

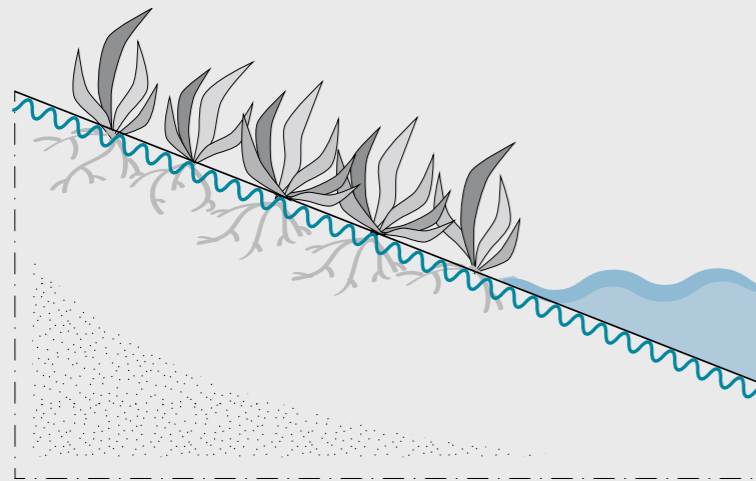
Relevant products:

- Enkagrid® MAX
- Enkagrid® G and M
- Enka®-Force
- Enka®-Tex nonwovens
- Enka®-Tex wovens



9. Water edge protection

When geomembranes are used to protect retention ponds or lined impounding reservoirs, they need to be protected against UV and mechanical damage, usually by a layer of soil. At, above and below the waterline **this soil can be subject to erosion and sliding**. On steep and long-length banks, the geomembrane itself may be subject to high forces induced by the covering layer of soil.



To avoid sliding of the cover soil on top of geomembrane slopes, the cover soil needs to be deeply rooted by vegetation. Enkamat helps to reinforce this particular zone.

Coverage of geomembranes with a layer of soil can also be desirable for aesthetic reasons. However, **the friction between a smooth geomembrane and soil is often too low**, allowing the soil to slide off. In these cases, Enkamat provides stability and support for vegetative growth.

Geomembranes are highly vulnerable to mechanical damage and constant stress. **High loads and longterm creep failure may be avoided** by the use of Enkamat W or Enkamat R. The installation of these geocomposites at the intersection of the membrane and soil cover will prevent these failures thanks to their defined tensile strengths. The three-dimensional structure of the mats provide the necessary friction with the soil and enable them to **act as griplayer**. Enkamat is anchored in a trench at the top of the slope.

Additionally, Enka-Tex installed under a geomembrane will provide **protection against mechanical damage**.

In general, densely vegetated banks are important to protect wet slopes from eroding. Enkamat and pre-filled Enkamat A20 allow vegetation to grow, offer micro stability at ground level, help seeds to germinate in a protected environment and stop erosion at, below and above the waterline of retention ponds and drinking water reservoirs. The flexibility and ease of installation make these products very **suitable to protect the area around culverts**.

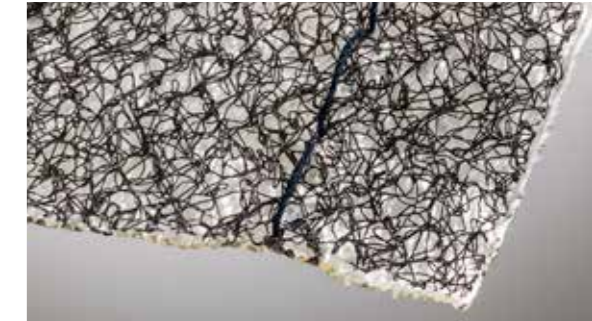
Enkamat A20 offers immediate protection against turbulent water flows around the inlets and outlets of retention ponds.

FUNCTIONS:

- Surface stability
- Support of vegetation
- Erosion control



Enkamat® A20



Enkamat® W

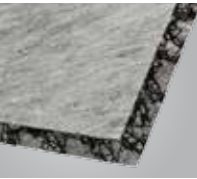
Relevant products:

- Enkamat®
- Enkamat® A20
- Enkamat® R
- Enkamat® W
- Armater®
- Enka®-Tex





Enka Solutions product overview



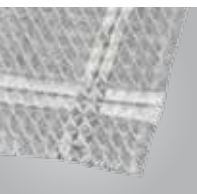
Enkadrain®

Consistent and excellent long-term performance is a key feature of the Enkadrain drainage mat. Each variant has a drainage core bonded to a synthetic nonwoven geotextile layer or is sandwiched between two such layers. Enkadrain provides solutions for groundwater issues for civil engineering and building projects, both during construction and in service. With an extensive portfolio of product types, Enkadrain is suitable for many different applications.



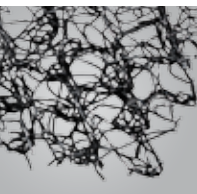
Enkagrid®

The Enkagrid product range comprises a large portfolio of rigid and flexible geogrids, their common values being the optimum soil-grid interaction delivered for each application in any soil type and their outstanding mechanical long-term durability. Enkagrid types are uni-axial or bi-axial, manufactured from either laser welded strips or woven coated yarns. When soil reinforcement or stabilization is required, our wide choice of readily available products will meet individual project needs.



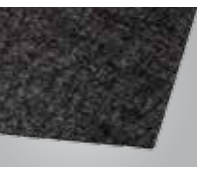
Enkagrid® PLUS

Enkagrid PLUS is a high performance knitted geocomposite for reinforcement of asphalt and soil. Manufactured from high tenacity yarns and a nonwoven geotextile, this geogrid increases the tensile strength of asphalt layers and reduces the formation of cracks. Enkagrid PLUS also provides an excellent solution for soil reinforcement, combining reinforcement, separation and filtration in one product. Both solutions contribute to a significantly longer service life of asphalt layers and road and railway foundations.



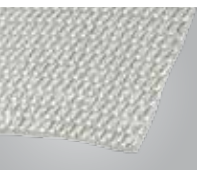
Enkammat®

Enkammat is a flexible three-dimensional mat for immediate, permanent erosion protection on many different slope types. Its unique structure creates an artificial root structure that prevents soil erosion from steep slopes, river banks, landfill containments and other vulnerable areas. Enkammat has excellent soil retention, providing the perfect conditions for vegetative root systems to develop. Embedded with soil, it forms an integrated and fully vegetated system to control erosion.



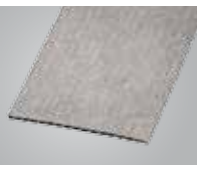
Enka®-Tex

Enka-Tex is Enka-Solutions' complete range of nonwoven and woven geotextiles. The nonwoven geotextiles are needle punched and can be thermally bonded. The Enka-Tex product range is extensive, each type having specific properties of tensile strength, weight or flow capacity. Enka-Tex is ideal for projects where erosion control, filtration, protection, drainage, stress relief, reinforcement or separation are called for.



Enka®-Force

The high modulus multifilament yarns used in the production of Enka-Force fabrics offer excellent creep characteristics, making them the perfect choice for use in soil reinforcement applications. The range has been specifically designed to exhibit high strength at low elongation. Typical areas of application include reinforced soil walls, embankments on weak soil and load transfer platforms.



Colbondrain®

When the sub-grade of a construction site is too weak to bear normal construction activity, Colbondrain will speed up consolidation considerably. Colbondrain is a tough and durable prefabricated vertical drain (PVD), designed to extract pore water from soils to achieve 90% consolidation within six months. Thanks to its high performance Colbondrain is often the chosen PVD for major, technically demanding projects.

Our areas of expertise

Our solutions offering provides answers for many different geotechnical challenges. They can be applied to what we consider our 'areas of expertise'.

AREAS OF EXPERTISE

TRANSPORTATION INFRASTRUCTURE

Our geosynthetic solutions support rails and roads throughout the world.

COASTAL & WATERWAY INFRASTRUCTURE

Geosynthetics are effective in protecting coasts and water embankments against the influence of hydraulic loadings.

ENVIRONMENTAL INFRASTRUCTURE

Our geosynthetic solutions help to create parks, playgrounds, ponds and canals to improve our residential, commercial or industrial areas.

LANDFILLS

Landfills are a common way of managing our disposal of regular waste. To ensure landfills will not cause any environmental harm, leachate and methane gas may not reach our environment.

GROUNDWORK CONSTRUCTION

When designing and constructing industrial, commercial or public buildings, special attention is required for foundation and drainage issues.

TUNNELING AND MINING

Enka Solutions' offer for concrete lining protection, railway support, rock wall covering, soil stabilization, tunnel wall drainage and protection and vibration control are amongst the best in the world.



Three fundamental values are at the core of Enka Solutions: expertise, reliability and responsibility



Expertise

We began creating our knowledge and expertise base on our products and the industry way back in the 1950's, which means that today we have a multitude of project references worldwide. Coupled with extensive research conducted internally and externally with renowned universities and specialist organisations, our Research, Development and Innovation Team is constantly working in conjunction with clients all over the world to develop new solutions to add to our range of products and applications. In addition to this, our team of experienced engineers, who provide support across all market segments, ensures that numerous innovative solutions come to fruition. We see expertise both as the foundation of our business and as an ongoing process.

Reliability

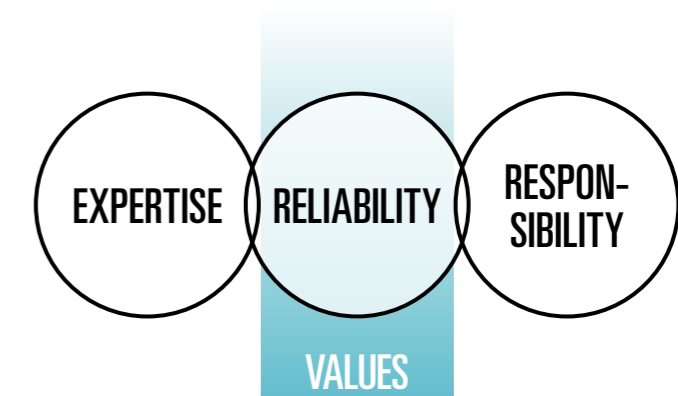
It's our daily mission to be a reliable partner for our customers in order for them to grow their business in a sustainable way. Reliability covers a range of different areas and ensures peace of mind for our partners. As well as our wide, high quality product range, we offer technical and marketing support for all market segments. All our processes are ISO 9001 certified and every single product is tested by our highly qualified laboratory staff. Furthermore, we hold specific product certifications in many different countries (e.g. Asqual, NorGeoSPec, Benor, HPQ, and BBA). Delivering what we promise is part of our nature.

Responsibility

We take our responsibilities seriously. This is why you can also rely on our solutions being sustainable. We not only examine the full product lifecycle and its impact on the environment to make continual improvements in terms of environment, nature and soil, but also ensure that we meet all legal requirements. We train and advise clients and stakeholders, and contribute to the establishment of new standards to help propel our entire industry forward into the future. It will therefore come as no surprise that safety is also a high priority for Enka Solutions. Safety is inherent to all our solutions and products, as part of our responsibility to care for both the people who use them on building sites, and our employees.

Enka®solutions
ENGINEERING NATURE

These values that are the core of Enka Solutions are reflected in our statement 'Engineering Nature', because not only is engineering in our nature, but we also see ourselves as **engineers delivering reliable solutions that respect nature.**





The Enka Solutions product range is manufactured by Low & Bonar who is a global leader in high performance materials selling in more than 60 countries worldwide and manufacturing in Europe, North America and China. Low & Bonar designs and manufactures components which add value to, and improve the performance of, its customers' products by engineering a wide range of polymers using in-house manufacturing technologies to

create yarn, fibres, geosynthetics, industrial and coated fabrics and composite materials. These materials contribute to a more sustainable world and higher quality of life. Low & Bonar is listed on the London Stock Exchange.

The quality systems of Low & Bonar facilities have been approved to the ISO 9001 Quality Management System Standard. Certificates are available on request.

CONTACT US FOR A FREE SAMPLE KIT OR TO DISCUSS YOUR SPECIFIC REQUIREMENTS

Belgium T +32 52 457 487
Czech Republic T +420 518 329 113
China T +86 21 6057 7287
France T +33 1 57 63 67 40
Germany T +49 6022 812020
Hungary T +36 49 886 200

Netherlands T +31 85 744 1300
Slovakia T +421 37 6556010
United Kingdom T +44 1482 863777
USA T +1 828 665 5050

Or contact your local distributor
www.enkasolutions.com / info@enkasolutions.com

Disclaimer

All information and product specifications provided in this document are accurate at the time of publication. As the Low & Bonar Group follows a policy of continuous development the provided information and product specifications may change at any time without notice and must not be relied upon unless expressly confirmed by a relevant member of the Low & Bonar Group upon request. No liability is undertaken for results obtained by usage of the products and information.

© 2016 Low & Bonar / SO-ENG-EI-08/2016



Progress through performance
A **Low&Bonar** solution