To filter, drain, protect, reinforce, seal and contain in hydraulic engineering.

HUESKER
Engineering with Geosynthetics
Geosynthetics in hydraulic engineering

Nowadays there is widespread use of geotextiles in hydraulic engineering to reduce construction costs and improve long-term performance. Whether in construction work on canals, rivers, ports or on coastal protection schemes - wovens, nonwovens, geogrids or geocomposites can be found in all these areas. These materials fulfill various functions: separation, filtration, drainage, erosion protection, reinforcement, sealing and fill containment. Selection and specification of the most appropriate geotextile for the application is critical.

The aim of this brochure is to provide information on the most important application areas for geotextiles in hydraulic engineering. Due to the numerous possibilities available this selection is of necessity incomplete.
HaTe® wovens and mesh fabrics in hydraulic engineering

The success story of geotextiles in construction began more than 40 years ago with the use of synthetic wovens and mesh fabrics in hydraulic engineering. Today, wovens are used as synthetic filters, e.g. on beds and slopes affected by water movement; wherever fluctuating hydraulic gradients and reversing water flows occur, it should be possible to form a secondary soil filter.

By lining drainage trenches or slopes HaTe® wovens can replace expensive graded granular filters. They are also introduced as filter tubes for vertical aggregate drains.

Wovens can be prefabricated with fascines attached as a foundation for groynes or breakwaters in coastal protection work. For this purpose the wovens are made up on a slipway, towed through the water to the installation location, loaded with stones and sunk.

HaTe® woven meshes are used as erosion protection on slopes, which are to be covered with vegetation. The flexibility of these specially developed mesh materials enable water plants and grasses to root through without any problems.

Wovens and mesh fabrics made from mono- and multifilament yarn, and even tape or fibrillated yarn, can be used for the various types of application. The selection of the fibre raw material, fabric strength and mesh size can be engineered for each application.
Nonwovens are often used to separate two layers of granular material of different grading. The properties of a nonwoven can be selected according to filter rules. Robust needled nonwovens with minimum thicknesses of 4.5 - 6.0 mm are preferred as filter layers below stone armouring on inland waterways and coastal protection. Here the filter layer is stressed by turbulent currents at the filter/soil boundary due to rapidly changing pressures and flow directions. Selection of the nonwoven for this type of application follows the code of practice 'Use of Geotextile Filters in Waterways' issued by the Federal Hydraulic Engineering Office (BAW).

For use on slopes the nonwoven filter layer can be combined with a layer of coarse fibres (5 - 25 mm thick) to provide a friction layer, thus maintaining a stable boundary between filter and soil and avoiding soil contamination in the filter.

Composites, comprising coarse fibres to provide a drainage layer, and nonwoven filters on each surface, are used to drain off leachate or ground water.

HaTe® nonwovens and composites are manufactured in a weight range of 150 g/m² to 3000 g/m². HUESKER Synthetic supplies nonwovens tailored for most filter applications in hydraulic engineering.
Stabilenka® and Comtrac® for reinforcement

Reinforcement elements are often required in the foundations of groynes, breakwaters and similar constructions, if built on soft ground. A similar situation exists in land reclamation, constructing embankments on ground with a low-bearing capacity. Geotextile reinforcement can also be used to stabilise hydraulic fill or to cover soft spots.

For such applications a high modulus, low elongation at break, Stabilenka® polyester woven is chosen with tensile strengths up to 1000 kN/m. Or, depending on the requirements of the application, Comtrac® can be used; a high strength knitted fabric, tensile strengths up to 700 kN/m, which can be combined with a nonwoven with tailored filtration properties.

Stabilenka® or Comtrac® can be prefabricated for ease of installation under water.
Sandbags and -tubes

Geotextile sandbags and -tubes facilitate the use of locally available sand to provide construction elements or structures for coastal protection.

Sandbags are used mainly for temporary repair of defences damaged by flooding or storms. Sandbags can also be used to counter erosion problems on rivers and small harbours.

Sandbags can be supplied in various sizes up to a capacity of 20 m$^3$. Synthetic woven fabrics, which combine low weight with high strength, and, at the same time low deformation, are ideal for this application.

Sand tubes, also made of woven fabrics, measure up to 150 cm in diameter and 150 m in length. Several tubes can be sewn together and filled hydraulically. Groynes and similar structures involving these materials can be used on beaches endangered by erosion. They can also provide water enclosure systems, breakwaters and be used in the rapid repair of breached dykes.

Depending on the technical requirements, sandbags and -tubes supplied by HUESKER Synthetic are made of HaTe® woven fabrics, Stabilenka®, Comtrac® or even HaTe® nonwovens.
Incomat® concrete mattresses

Incomat® consists of two specially combined high-tensile woven fabric layers, providing formwork for concrete filling. Spacers are used to set the Incomat® thickness between 5 - 50 cm.

There are two fundamentally basic versions available for different hydraulic engineering applications:

- impermeable, rigid mattresses;
- permeable, flexible mattresses.

HUESKER Synthetic is able to supply a total of six mattress types, which can all be combined with one another.

Standard manufacturing widths of the Incomat® mattresses are 3.75 m and 5.0 m. Lengths can be provided according to the design requirements. Several panels can be joined together by sewing in the factory (or on site) and by means of factory-applied industrial zips.

Incomat® can be laid and filled above or below water. In addition to concrete or sand any free-flowing material, which can be pumped, can be used as a filler.
Incomat® for protection and sealing

Incomat® can be used as an impermeable or permeable revetment on dykes, dams, and breakwaters as well as being suitable for use as a protective layer for synthetic or bentonite liners in ground water protection measures, e.g. sealing surface water retention basins, emergency water reservoirs and liquid manure containment. These mattresses can also provide erosion protection on slopes, which are to be planted.

Incomat® is used as a flexible bed system for off-shore and coastal schemes, e.g. on dyke drainage sluices, storm water barriers and dyke sealing. It can form effective graduated spillways in river engineering. The mattress can also be used to protect beds and slopes on canals and rivers.

Another application area is to secure pipelines and culverts against flotation, and temporarily to strengthen river and lake beds under which tunnels are being driven.
Sealing with NaBento®

NaBento® clay liner is a composite in which a layer of bentonite is contained within two geotextile layers. The bentonite's main constituent is the clay mineral, montmorillonite, which, in hydrated state, produces a liner of low water permeability (lower than $10^{-10}$ m/s).

NaBento® is used for various types of sealing work in hydraulic engineering, e.g. settlement lagoons, surface water retention ponds, irrigation channels or navigation canals, as well as for run-off containment to protect ground water against contamination.

In comparison with mineral seals NaBento® offers such advantages as a simple, less weather dependant installation, self-sealing, and factory controlled quality.
Reinforcing asphalt sealing with HaTelit®

Asphalt sealing on dams, reservoirs, and even canals has proved to be extremely practical. As the asphalt seal above water level is exposed to constant temperature changes, which can induce cracking, reinforcement grids are introduced. The grid absorbs any tensile loads arising from structure settlement, which reduces the risk of crack formation in the sealing layer.

Build up of a base sealing layer

- Mastic seal 6 kg/m²
- Asphaltic concrete 6 cm
- Asphalt drainage layer 6 cm
- Asphaltic concrete, upper layer 6 cm
- HaTelit®-reinforcement grid
- Asphaltic concrete, lower layer 4 cm
- Levelling course 3-4 cm
- Sub-base layer

For over 20 years HaTelit® reinforcement grids have been used with great success to reinforce asphalt, made of high modulus polyester and bitumen coated to achieve a good bond with the asphalt.

HUESKER - engineering with geosynthetics

Today it is practically impossible to imagine hydraulic engineering without the use of geotextiles. HUESKER Synthetic has played a significant role in the development of these materials.

This brochure will show you a few of our standard products. As required you receive our detailed product portfolio. Please contact us if you would like more information on individual products or applications. Our creative and experienced engineering team is prepared to design and manufacture tailor-made geotextiles.

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