

## COLBONDDRAIN<sup>®</sup> CX1000

### PREFABRICATED VERTICAL DRAIN

## Integrated versus non-integrated geocomposites for vertical drainage

Since its development in 1975 Colbondrain CX1000 has continually evolved to remain a state-of-the-art vertical drain and retain its position as the product setting the benchmark in the world of soil consolidation solutions. Our research & development work combines laboratory tests with extensive practical experience gained from over 300 million linear meters of Colbondrain installed worldwide. This technical note sets out the key features of Colbondrain CX1000 with the intention of clarifying the difference in specification properties for integrated and non-integrated geocomposite PVDs.

### Integrated vs non-integrated geocomposites

The original Colbondrain CX1000 consisted of a separate sheath, looped around and bonded to itself to provide separation and filtration properties around a 3-dimensional core which maintained the central void to permit vertical drainage. This form became the standard for virtually all other PVD systems that followed and as such many specifications require separate testing for the physical properties of the core and the sheath.

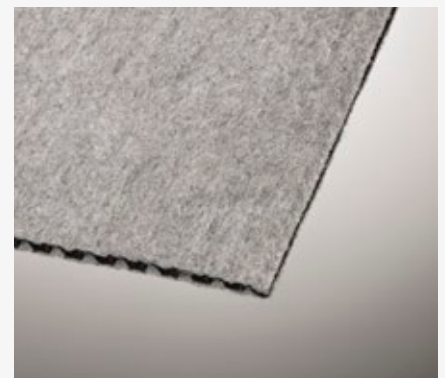
The current form of CX1000 was specifically designed to improve on a number of issues we recognised

within the installation and functionality of 'traditional' non integrated PVDs. As such CX1000 is now unique among PVDs in having a hydraulically designed 3D core which is thermally bonded to the filter fabric on either side to create a fully integrated geocomposite drain.

The resulting material will meet all required design criteria during both installation and service life even in the most exacting conditions and provides distinct advantages through its increased robustness and reduction in soft soil intrusion into the core. Care does need to be taken when looking at specifications from non-integrated PVDs however there



Original CX1000 with separate fleece and core



Current CX1000 with integrated fleece and core

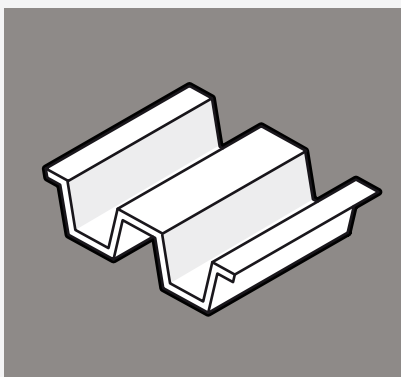
is the danger of making an 'apples and oranges' comparison.

### Increased robustness

In improving the PVD system over 40 years of supply we have looked at the advantages and disadvantages of having the core and the fleece separate and came to the conclusion that by producing an integral geocomposite drain we would more readily avoid the installation damage issues which can result in malfunctioning PVDs.

With our composite drain the whole material will take any tensile force, which provides a far more robust product more than capable of resisting the real forces generated during installation. With an integral drain it is also far less likely for the fleece to be snagged on mandril withdrawal, which on a non-integral drain would result in a rejected drain and costly downtime as the rig would need to be lowered to rectify the tangled mess of the wrinkled sheath recoiling along the core material, prior to the drain being trimmed and installation restarting.

As our technical data sheet shows, when our geocomposite is tested as a whole the tensile strength is 2.5 kN on a 10 cm strip (so 25 kN for the wide width tensile strength), the grab strength 2 kN (20 kN/m) and the trapezoidal tear strength 0.68 kN (6.8 kN/m). In developing our drain, we measured the applied tension during installation and it is typically in the order of 0.5 kN which our



#### Drainage

Hydraulically designed channel gives high in plane flow

composite material can readily take but which will tear even the strongest sheath from a non-integral PVD the instant the mandril snags the sheath.

### Reduced soft soil intrusion

The other significant advantage offered by our geocomposite PVD is the reduction in soft soil intrusion into the core since by bonding the fleece to the core each channel becomes a separate narrow span unlike the case for a loose fleece which can be readily pressed into the channels.

We have tested this phenomena in our drains with soft/soft platines to model true in soil interaction to pressures up to 1200 kPa and are satisfied that this production method gives us the most reliable form of PVD available even in the most extreme site conditions.

### Specification and QA/QC testing

During our PVD manufacturing process the geotextile (filter) fleece is physically bonded to the core and sealed along the edges to become a true composite PVD. This process optimizes the material properties and performance of the PVD and provides a superior tensile modulus and maximum discharge capacity for the 'assembled' composite PVD. Therefore generally the CX1000 properties should be tested as a composite not as separate components.

It is our position that we are providing a composite PVD – not individual components – and our QA/QC

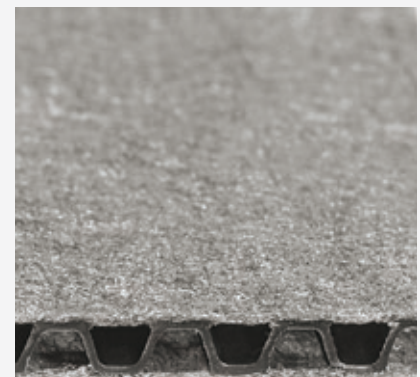


#### Installation damage resistance

Increased robustness reduces risk of installation damage as shown above on a non-integrated PVD

testing is performed on the composite PVD and not on the individual components. In reviewing or comparing PVD products, or specifications, the bottom line should be the Discharge Capacity and Tensile Strength properties of the assembled PVD. These are the true indicators of actual performance. Most specifications include both index and performance properties but it should be clarified that products having vastly different index properties can still be functionally equivalent based on the performance properties. Any confusion associated with differing properties of different components should be allayed if the composite (assembled) product meets these fundamental performance criteria of discharge capacity and tensile strength.

We are happy to provide individual samples of the virgin sheath material for verification purposes with regard to index properties related purely to the filter function of the sheath such as O90 values and permeability but stress that this material will never be separately subjected to tensile forces during installation or serviceability. As such, we strongly recommend that in QA/QC laboratory tests, where the PVD is a composite material, a sample of the full composite material is used for the tensile testing rather than trying to separate its component parts and are confident that the results of CX1000 will always be more than satisfactory.



#### Filtration

Needlepunched fleece provides filtration but is restrained from intruding into the core