

SINGAPORE, SINGAPORE

GeoBarrier System at Cheng Soon Garden



Case Study

Project:	Cheng Soon Garden
Year Completion:	2021
Material:	Geotextile GeoBags
Designer, Distributor & Contractor:	Hocklim Engineering Pte Ltd

The Challenge

As Singapore is located in the tropical region characterized by intense rainfall, it experiences two monsoon seasons yearly. During the wet monsoon season, slope failures occur frequently, especially to slopes which have high pore water pressure buildup. Due to a period of continuous torrential rainfall, our client's boundary retaining wall collapsed.



Figure 1: Cheng Soon Garden's retaining wall before the collapse



Figure 2: Collapse of Cheng Soon Garden's retaining wall

The brick retaining wall which failed to hold up against the continuous torrential rainfall had spurred our client to explore a new concept and design for a retaining wall system. The client decided to use the GeoBarrier System and engaged Hocklim Engineering Pte Ltd to design the system that is not only effective in preventing future slope failure but also enhances liveability by adding more greenery to the house's parameter wall.

The Solution

The GeoBarrier System is a retaining structure that consists of 3 key components. The first component is the GeoBags which is made from 100% monofilament polypropylene engineering fabric that has a high tensile strength and is highly permeable, which is important for allowing rainwater into the GeoBags and supporting plant growth.



Figure 3: GeoBags made of 100% monofilament polypropylene engineering fabric

The second component is the GeoGrid with one end sewn onto the bottom of GeoBag while the other end is extended into the slope, creating an interaction between the soil and the GeoGrid material. By utilizing the friction generated from this interaction, the GeoGrid improves the overall structural rigidity of the GeoBarrier System.



Figure 4: Parts of a GeoBag

The third component is the aggregate material. The GeoBarrier System comprises of 3 main layers – an exposed vegetative layer using approved soil mix (ASM), fine-grained layer, and coarse-grained layer. The fine and coarse-grained layer has distinct hydraulic properties that creates a “barrier effect”, allowing the rainwater to be drained away keeping the water levels in the soil low to prevent any slope failure.

The ASM and fine grains are filled in the GeoBags while the coarse grains are laid behind the fine grain layer (refer to Figure 5). Users can opt to use natural resources, e.g. sand and gravel or be more environmentally friendly by using recycled aggregates such as recycled concrete aggregates (RCA).

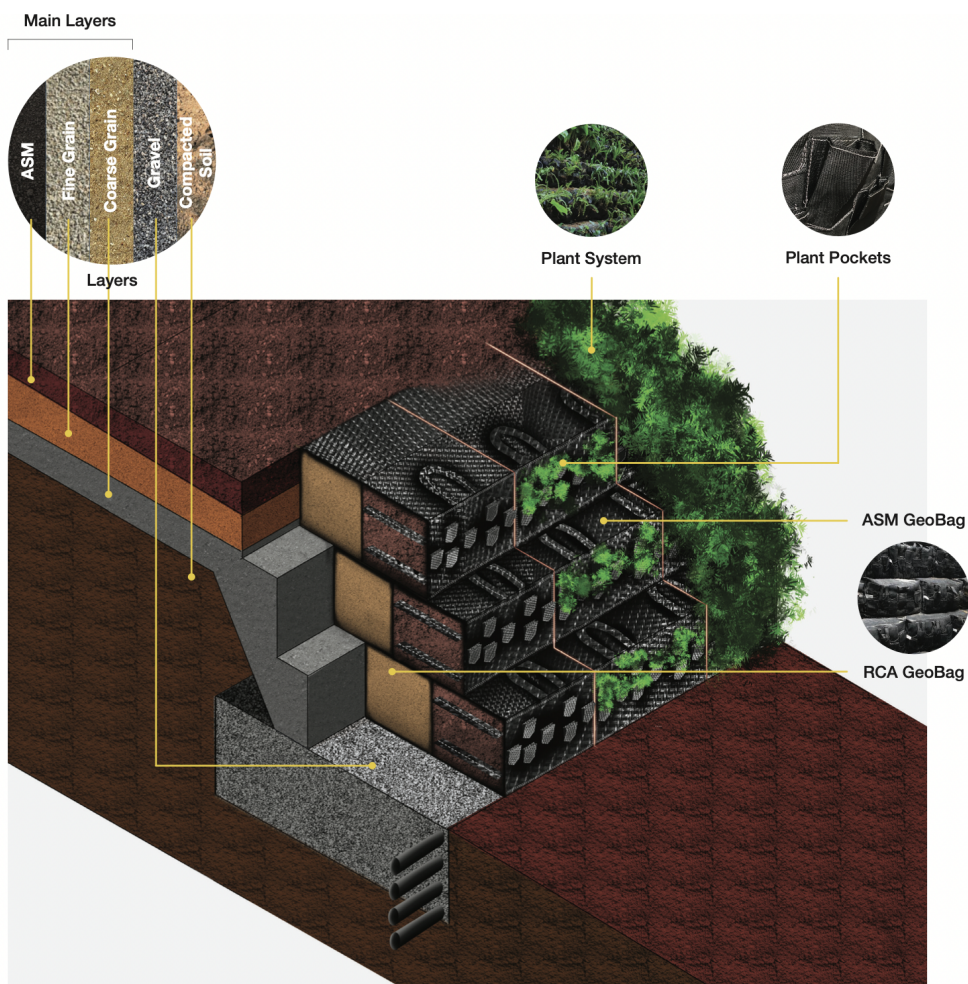


Figure 5: Isometric View of the GeoBarrier System



Figure 6: Building of the GeoBarrier System



Figure 7: Engineers ensuring the bags are compacted properly

For this project, two layers of GeoBags were arranged in a brick-like interlocking pattern to increase the stability. After the two layers of the GeoBarrier System were arranged, various varieties of plants were carefully selected and placed into the planting pockets of the GeoBags adding greenery and aesthetics to the residence.

With the installation of the GeoBarrier System, it is not only successful in mitigating the torrential rainfall by draining away excess sub-soil and surface water efficiently but also allows different varieties of vegetation to grow around the house's parameter wall enhancing the liveability, making it a reliable and effective climate resilient solution.



Figure 8: Varieties of plants planted in the GeoBags



Figure 9: GeoBarrier System surrounding the parameter of the residence