



# GEOCELLS for Erosion Control of Slopes

## Cellular Confinement System

A Geocell is a three dimensional Cellular Confinement System created by the interaction of soil, cell walls and geometry. The expandable, strong and cellular structure confines and reinforces a variety of fill materials and resists the downward migration of material due to hydraulic flow. HDPE geocells have excellent resistance to ultraviolet light and most naturally occurring soil conditions.

## Erosion Control

Geocells offer erosion protection for steep slopes, river banks, ditches, spillways and other exposed areas. Varying degrees of protection can be achieved by using different infill materials. Where geocells are used to create a vegetative cover, the ground conditions should be checked to ensure that the roots of seeded topsoil or small



shrubs are able to grow deeply into the underlying soil. The wall height may need to be increased if the soil conditions do not support plant growth. Granular material can be used where a non-vegetative cover is required. Concrete can be used as an infill to provide a hard, durable barrier against severe erosion.

Depending on the site conditions, the availability of suitable quality material and whether the ground on which the geocells are to be laid allows roots to penetrate into the underlying soil, options such as Riprap, Turf Reinforcement Mats, Shotcrete and Concrete Mats may be better alternatives.

## Geocell Facts

- Geocells vary in height from 50 to 300mm. Panels vary in size from 2.56 x 6.52m to 2.56 to 13.72m and consist of hundreds of individual cells.
- HDPE strips are ultrasonically bonded with a Seam Peel Strength of about 1400N/100mm.
- Geocell walls are usually made from textured HDPE to increase frictional resistance and reduce soil displacement.
- Geocell walls are usually perforated to allow for drainage from one cell to another.
- Geocells are normally used on slopes with an incline of up to 45 degrees (1:1).
- On steep slopes geocells have a tendency to collapse when being filled.
- To reduce the labour needed to fill and compact the material, equipment such as an excavator or crane-mounted skip can be used.

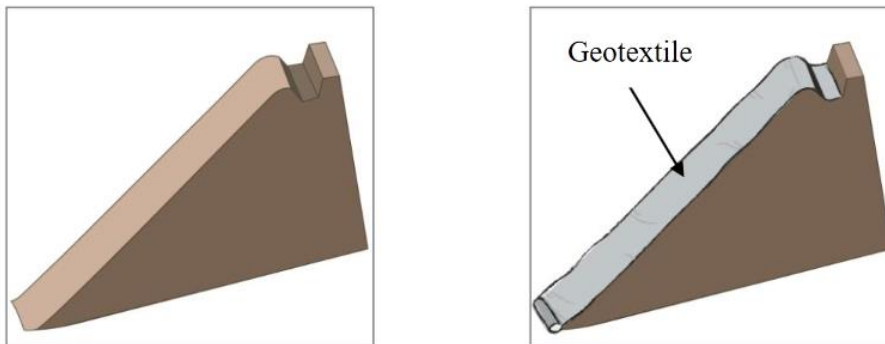


## Base Preparation

In most cases, the failure of a Cellular Confinement System is due to the failure of the subsoil. The potential for slope face failure is increased on steep, freshly graded or disturbed slopes, especially when there is inadequate slope face compaction under super saturated conditions. In such cases, soil movement is influenced by numerous parameters including the angle of the batter, soil structure, slope length and erodibility.

The subsoil should be free from buried services, existing vegetation removed and the slope shaped and compacted to achieve a generally even gradient. If required, anchor trenches, approximately 500mm wide x 500mm deep and set back 1000mm from the crest, must be excavated at the toe and crest of the slope.

If a separation or filtration geotextile is required (for non-vegetated slopes), the geotextile should be rolled down the slope and secured with crest and toe anchor trenches. Rolls should be overlapped by a minimum of 150mm and temporarily held in place using pins or sandbags until the Geocell layer is installed and the anchor trenches backfilled.



## Installation of Geocell Panels

Panels are supplied flat. This makes them easy to transport, handle and install. Depending on the slope and soil conditions, geocells can be anchored using rebar J hooks, an anchor trench and/or a stretcher assembly. The geocell panels should be joined together and placed on the surface along the slope direction.

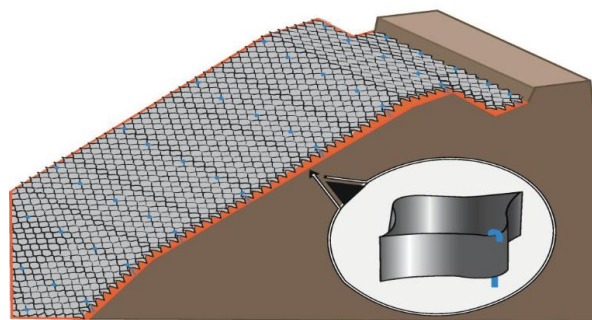
### Anchoring using rebar J hooks

Where site conditions allow, rebar J hooks can be used to secure the panels to the crest of the slope. Partially expand the geocell panels and pin the top row in place using rebar J hooks (or other approved

fixings). Spacing of the rebar J hooks will be determined by the erosion control engineer and depends on the slope gradient, cell size, soil infill depth and the sub grade soil parameters. It is common to fix every cell around the perimeter and on an orthogonal grid at 1m centres down and across the slope.

The geocell panels are expanded down the slope so that the cells are fully open but not under any stress. Pin or fill several cells around the perimeter to hold the cells in an open and fully expanded position. Once the panels are uniformly expanded drive the rebar J hooks in until the arm of the hook is flush with top of panel. The panels are then anchored with J hooks in each cell around the perimeter and every square metre inside the panel. Correctly align the outer cells of each panel. Interleaf or overlap edges of adjacent panels to nest connections. Check that each panel is level with the adjacent panel.

### **Anchoring using anchor trenches and a stretcher assembly**



Anchor the upper edge of the Geocell to the top of the slope into the prepared anchor trench (approximately 500mm wide x 500mm deep and set back 1000mm from the slope). If necessary, a PVC pipe can be used to hold the edge of the geocell panel in the anchor trench. Pouring concrete can reduce the rivet distance in the trench.

## **Infill**

Once the geocell panels have been expanded and anchored in place, they are filled with various materials depending on the project requirements:

- Seeded topsoil and sand to establish a vegetative cover. A nutrition geotextile can also be laid on the subsoil to retain moisture and fertilise the seedlings;
- Granular infill, aggregate or recycled concrete for non-vegetative slopes;
- Concrete or grout to provide hard, durable protection from severe erosion conditions. Asphalt or unbound gravel can also be applied as surface layers

The infill material should consist of free flowing particles no greater than 70mm in diameter. It should be carefully placed in the expanded cells from the crest of the slope to the toe ensuring there are no localised areas which are overloaded. Filling geocells on steep slopes requires additional labour to prevent the walls collapsing. After compaction, the geocells should be covered about 2cm higher than the cell wall.



Suitable material handling equipment such as a backhoe, front-end loader, conveyor, or crane-mounted skip can be used. It is important to keep the drop height below 1m to avoid damage or displacement of the cell walls.

## Guide to geocell selection for slope erosion control

	Cell Diameter (mm)	Topsoil infill depth (mm)	MAXIMUM SLOPE GRADIENT #				PANEL SIZE (m)	FIXING PINS/PEGS FOR SINGLE PANEL		
			V	H	%	ANGLE (°)		1m x 1m GRID	Perimeter (every cell)	TOTAL
30/10	300	100	1	2	50	26	2.56x8.35	21	73	94
30/15	300	150	1	1.5	67	33	2.56x8.35	21	73	94
24/20	240	200	1	1	100	45	2.56x6.5	17	60	71

This is guide only based on a typical friable topsoil to be vegetated. The maximum slope gradient depends on the strength of the underlying subgrade and not the Geocell or fill material. A slope assessment should be undertaken by a suitably qualified engineer to determine the maximum slope gradient.