ENVIROGRID®

INSTALLATION PROCEDURE

Prepare the site by removing all vegetative cover, debris and any unacceptable soils from the area where the EnviroGrid® cellular confinement system is to be placed. Replace any removed soils with acceptable materials and complete all earthwork, including toe-in trenches when required for slope or channel lining applications, in accordance with the job specifications.

If geotextile is required by the job specifications, installation should be accomplished in accordance with the manufacturer's recommendations.

Partially install stakes or J-hooks, leaving a protruding length of the cell depth plus approximately 2in (50mm), along the top edge of the area in which the EnviroGrid® is to be installed (or in the toe-in trench). A string or chalk line may be used to align staking locations and borders.

EnviroGrid® sections should be stretched past the designed length (typically, 20ft [6.1m]), then allow to settle back to the designed length. Set the end cells of the EnviroGrid® sections over the previously installed stakes and complete installation of the stakes or J-hooks flush with or slightly below cell walls.

Adjoining EnviroGrid® sections must be level and flush with each other. Overlap the sides of the EnviroGrid® sections and butt the ends together. Secure adjoining sections to each other using a pneumatic stapler, hog rings or other means as required by the job specification.

Install the balance of the stakes or J-hooks as required by the job specifications.

When the EnviroGrid® has been properly laid in place, the system should be infilled using the materials specified in the job specifications.

To prevent possible damage to the system, limit the drop height of the infill to no more than 3ft (1m).

Infill should be delivered to the EnviroGrid® from the top of the slope or channel to the base using a front end loader, back-hoe, bucket excavator or conveyor.

When using sand, granular or top soil fills, overfill the EnviroGrid® sections by 1in to 2in (25mm to 50mm) to allow for settling and compaction.

Sand and granular fills should then be blade compacted to the top of the cells. Top soil fills should be compacted with the loader or backhoe bucket or with a tamper plate.

Concrete fills should be manually raked and machine finished.

ENVIROGRID®

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ENVIROGRID®

EROSION CONTROL APPLICATION OVERVIEW

Many variables affect the installation and performance of geocellular confinement systems, including slope grade, subsurface stability, infill material, rainfall and artificial watering conditions, hydraulic characteristics of ground water flow and subbase anchoring quality. Due to the large number of factors, it is difficult to apply exact parameters to individual applications without depending on engineering, design and environmental inputs of on-site professionals.

THREE BASIC FORMS OF EROSION CONTROL PROTECTION

1. GRANULAR

- Reduces hydraulic energy, limiting forces within cells or under cells.
- Directs flow at the surface of the cell, eliminating flanking and undercutting.
- Controls individual particle movement caused by gravity and water flow.
- Results in a flexible and durable system.

2. VEGETATION

- Reduces hydraulic energy, limiting forces within cells or under cells.
- Increases natural resistance and protects root system.
- Directs water flow over the top, rather than through the mat.
- Prevents gutting and rills.
- Helps reduce moisture loss.

3. CONCRETE

- Controls piping and undercutting by allowing cells to conform to subgrade.
- Acts as a series of expansion joints, providing a flexible form.
- Develops vent structures where needed.
- Provides stability for steep slopes and for continuous flow channels.

APPLICATIONS

SLOPES

Design of cellular confinement systems for slopes requires analysis of several site characteristics. The length, height and angle of the slope and the failure angle of existing fill on the slope are important factors in determining the appropriate cell depth and anchoring design.

EnviroGrid® improves the performance of vegetated slopes by reinforcing root systems and directing hydraulic flows over the top of cells, with the cells acting as a series of check dams; thereby preventing formation of rills and gullies.

EnviroGrid® improves the performance of granular filled slopes by controlling the migration of fills that would otherwise be initiated by hydraulic and gravitational forces. This is accomplished by dissipating hydraulic energy in and underneath cells and by confinement of fill material within cells.

CHANNELS

EnviroGrid® cellular confinement systems offer a large array of methods for solving difficult situations with channel bottoms and slopes where minimal to severe erosive forces are at work, with either intermittent or continuous flows.

Cellular confinement allows the use of various types of infills, including vegetation, aggregate, concrete or combinations thereof, for unique and aesthetic applications.

Confined vegetative soil performs exceptionally well in applications with low to moderate flows. Cellular confinement enhances the performance of vegetation through reinforcing root zones and directing flows over the top cells; thereby increasing the shear resistance of the fill and providing a finished site that is aesthetically superior when compared to conventional methods.

Aggregate performs well, allowing the use of different sizes for variances in flow velocities encountered from site to site. This provides and aesthetically pleasing and cost effective alternative to large rip rap or hard armoring by confining and improving the performance of smaller diameter, less costly aggregates.

Concrete filled cellular confinement systems are a cost effective alternative to traditionally installed concrete lined channels. The flexible nature of the the concrete filled cellular confinement system permits conformance with subgrade movement without the potential cracking and undermining associated with poured-in-place concrete slabs. Installation costs are dramatically reduced through elimination of costly forms and other construction techniques typically related to concrete channel lining.

In areas with limited easements, stacked cellular confinement wall slopes along channels allow the use of vegetative, granular or concrete fills in the outer cells in order to steepen slopes and to increase resistance to higher flow rates.

EROSION CONTROL APPLICATION OVERVIEW

SUITABLE CELL DEPTHS

In most erosion control applications, load bearing is not a major consideration. Therefore, the depth of the cell is generally determined by:

- Size and weight on infill
- Slope grade
- Outside environmental conditions
- Economics

ANCHORING

The number and type of anchors is determined by subgrade density, weight and type of infill, slope grade and environmental conditions. Anchors should be left in place after installation.

Systems with a low to moderate loading should be anchored using inJin hooks or wooden stakes.

Sites with severe conditions require further reinforcement. Anchoring the geocell with three or five tendons per section on slope grades up to 1:1 has been utilized with good success.

The anchoring system utilizing tendons and "J" hooks should be set deep enough to reach a solid subbase. If the slope subbase is soft or porous, the anchoring system must be set very deep in order to hold the installation in place. The holes for tendons, which are drilled lengthwise in the collapsed form, may be drilled in the field before installation or during the manufacturing process. The tendon material should have a tensile strength sufficient to support the total theoretical load, and should be constructed of cable, plastic coated cable, creep resistant woven polyester or polyester coated with PVC.

GEOTEXTILES

Whether to use a geotextile under the geocell is dependent on the subgrade. Generally, a geotextile should be used when the infill and subgrade are different, or if the subgrade is very soft or wet. The geotextile typically keeps the infill from migrating out from under the geocell.

GENERAL GUIDELINES

INFILL SELECTIONS

Topsoil and Vegetation: Steep slopes, berms, levees, chutes, aprons and spillways.

Sand and Granular: Suitable on gradual slopes.

Gravel (Max. Diameter 3in [760mm]): Channels, slopes, except for severe grades, moderate sheet flow.

Crushed Stone: Channels, slopes, except for severe grades, moderate sheet flow.

Concrete and Cement: Around bridges, severe slopes, high flow rate channels, spillways and chutes.

SYSTEM COMPONENTS

Geotextiles (Non-woven): Needed when subgrade is very soft or wet; when infill and subgrade are different.

Nets and Meshes: Used for surface bonding.

Staples and Clips: Acceptable anytime; needed when anchoring system is weak.

Anchors: Required in almost all applications; type and size dependent on project application.

Tendons (Anchor Systems): Severe slope or environmental conditions.

ENVIROGRID®

RETAINING WALLS

Retaining walls constructed with the EnviroGrid® cellular confinement system offer an attractive alternative to conventional systems such as poured concrete and timber piling.

As with load bearing applications, strength is obtained by confining and compacting a granular infill material such as sand, gravel or stone up to 2in (50mm) in diameter.

EnviroGrid® sections sized 8in (203mm) in depths x 8' (2.44m) in width are utilized for retaining walls. Normal lengths for walls are approximately 4ft (1.22m), increased or decreased in 8in (203mm) increments, depending on engineering recommendations. The minimum length available is 2.5ft (760mm). The applicable lengths will be determined by the designer based on factors including wall height and other engineering criteria, including infill material, surcharge and backfill pressures, overall weight of the wall and resistance to overturning, sliding and pullout.

Geogrids and/or geosynthetics may also be placed between layers at strategic intervals and tied back into the soil fill.

Compared to conventional earth retention systems, EnviroGrid® retaining walls offer several distinct advantages:

COST EFFECTIVE INSTALLATION

No heavy equipment is required, which is especially important in remote or limited access locations. Native granular infill material can be used. Palletized sections are inexpensive to ship, and individual sections are easily handled during construction.

VERSATILE

EnviroGrid® can be used for all types of earth retention, including retaining walls, gravity walls, free standing walls and anchored or composite structures. All of these systems are highly tolerant to subgrade differential settlement.

DURABLE

EnviroGrid® is manufactured from high density polyethylene (HDPE), a strong, stable material. Additional ultraviolet (UV) protection is provided for exposed fascia surfaces. EnviroGrid® is not affected by corrosion or extreme temperature changes, both of which adversely affect steel and concrete.

AESTHETICALLY SUPERIOR

Fascia cells can be filled with topsoil and vegetated to blend in with the surrounding landscape. Fascia strips are also available in green or tan coloring.

Whatever the earth retention requirement might be, EnviroGrid® is the answer!