Properties of the Composite Series Modules and Accessories:

SmartSlope modules as locally manufactured by, or under license from SmartSlope, LLC shall be identified from the face by their smooth finish, unique **olive green** color (after surface applied stain) and a generally arched face coming to a peak at center of its width in accordance with the drawings. Lining the trough of each module shall be a 100% post-consumer **polymer liner** which is permanently bonded to the concrete. The liner will facilitate the use of proprietary structural accessories such as **SmartShields** for water applications, **SmartRadius** support for tight radii applications and **mechanical connection to reinforcement straps**. SmartSlope C185 modules are designed to be installed with a side-to-side spacing between modules of 14" to optimize load bearing capacity. The modules shall be designed to interlock when installed according to the specifications so as to form a flexible, stable and **plantable** structure. The modules allow for **variable setbacks** between 70° without spacers and 60° or 50° from horizontal by utilizing **SmartBatter** spacers as shown in the construction drawings and system specifications. Each SmartSlope module shall have a **solid bottom** fill-receiving trough, which is open and unbounded at the rear, allowing fill within the modules trough to be completely compacted and in contact with the retained mass. All SmartSlope accessories are made from a 100% post-consumer polymer. The modules shall be made of **wet-cast concrete** meeting the requirements of ASTM C 1372-01a for SRW units (or later versions) with the following exceptions: minimum 28 day compressive strength of **5000 psi**, entrained air appropriate to the region of use, maximum absorption of 5%, may contain up to 20% Portland cement replacement with post-industrial cementicious material, no more than +/- 1/16" variation from published dimensions in stacking height.

Visit our design center for complete details, pictures and video demonstrations at www.SmartSlope.com

Installing a Lift

Spreading the Tails

Full Pallet of 30 Modules

SmartSlope C185 modules shall be 20" wide x 15" deep with an 8" course (stacking) height, weighing approximately 80 lbs per unit before backfill and yield 1.85 sf installed coverage per unit. Larger and smaller size modules are to be introduced in the near future.

General Information:

SmartSlope walls follow many of the same procedures as traditional modular block walls, with just a few exceptions:

- The modules do not touch side–to-side, which means far fewer modules to be placed and leveled in the base. This also makes it impractical to level from block-to-block along the base units with a two foot level. It requires a 5' long level or a laser-level with stick mounted receiver.

- Since our modules are not solid blocks, they do not have a suitable location to be tapped for the purpose of leveling and may break if struck firmly in the wrong place. The base rock must be level prior to setting the blocks and a thin topping of finer aggregate helps.

- Any tapping required should be done the proper tool, such as a 4-6 lbs."Nupla" brand dead-blow mallet with replaceable soft tips.

- SmartSlope modules reinforce like an MSE panel wall by utilizing straps threaded through a slot in the bottom of each module. Care must be taken to ensure the straps lay flat and horizontal on compacted fill at the elevation of the connection. No stacking of multiple courses, no gaps under the connection and block, no downhill grade to the straps is allowed and no equipment behind the blocks that would introduce deflection into the straps. For tall walls, select granular is easier to work with than soil as mass backfill.

- The modules have a large fill receiving trough that must be filled with soil for plant growth. The operation is much the same as core filling traditional block but the soil must be stepped on to fully fill the trough and must be completed prior to placing mass backfill.

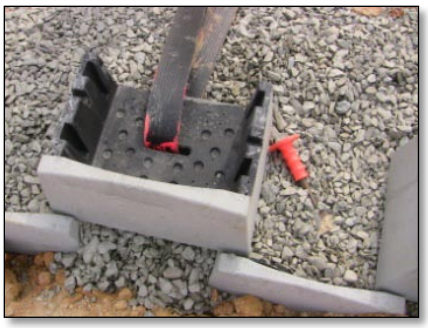
- During construction, block level front-to-back is important and should be maintained with an 8-12 inch level along the rail tops.

- During construction, side-to-side level is not as critical as long as the base is properly installed. Visually inspect each course and check level at each strap course with the five foot level so that it spans multiple modules.

- SmartSlope walls are intended to be grown over with vegetation. Therefore the plants are the aesthetic face of the finished wall and not the modules. Minor imperfections to levelness are not seen due to the checkerboard pattern of spaces and blocks, even before planting.

- **Helpful accessories:**
  - **spool rack** to hold and dispense straps for cutting
  - **marking paint** for marking the midpoint in long straps
  - **utility knives or scissors** for cutting straps to length
  - **spacing fixture** to aid in quickly setting the base modules at the correct distance apart without having to measure each one
  - **tape measures**
  - **string lines**
  - **asphaltic shingles** for shimming
  - **vibratory plate compactor**
  - **flat faced shovels** to strike soil off the rail tops after soil filling
  - **laser transit and stick**
  - **hand levels** at **8"**, **2'** and **5' levels**
  - **3" wide chisel** to knock out the bottom of the connection slot

Spool Rack and Strapping



Marking Paint and 3" Chisel

Base Block Spacing Fixture

Utility Knife Cutting Straps

Best Practices:

Analyze site layout to anticipate potential for runoff water directed at proposed wall area.

Prepare to protect the wall from erosion on a daily basis during the construction phase.

Collaborate with responsible party for erosion protection of surface above finished wall and put measures in place immediately on completion

The following chart is for you to fill out as you plan your wall:

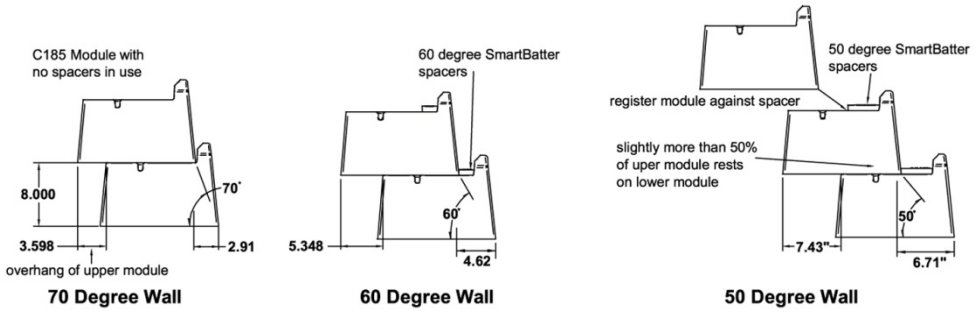
Cubic Yards of Plantable Unit Infill in above grade modules: (sf of wall face x 1' = cf of fill, divided by 27 cf/cy = cy of bulk infill) OR (two SmartMedia bags per exposed module)	
Cubic Yards of Mass Backfill	
Cubic Yards Base Rock	
Cubic Yards Drain Rock	
Total Modules required (project sf divided by 1.85)	
Total pallets of Modules @2600 lbs each (modules divided by 30 per pallet rounded up to nearest whole pallet)	
Total Plantable pockets if using plugs (total sf less below grade sf divided by 1.85)	
Plant species and total plant count @ 1 or more per pocket	
Lineal feet of SmartGrid (design embedment depth per connected module x 2 plus 1 foot)	
Rolls of SmartGrid (total lf of SmartGrid divided by 328 lf per roll)	
Lineal Feet of Drain Tubing	
Square Yards of Filter Fabric	
Required number and degree of SmartBatter spacers (2 per module only on applications less than 70 degrees)	
Required number of SmartRadius supports (one-two per module only in tight radius sections)	
Required number of SmartShields (2 per module only at elevations in contact with water)	
Setback angle of the wall or slope	

Layout and Staking Prior to Construction

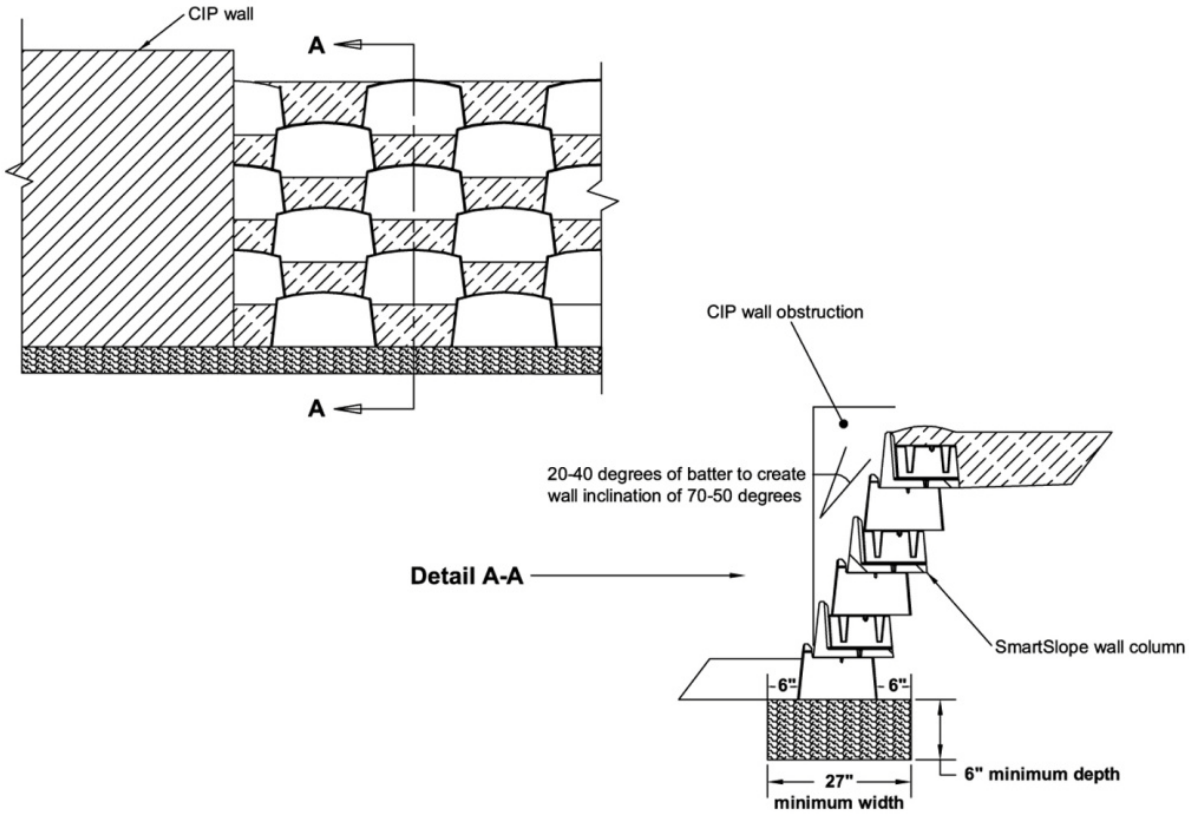
Stake centers, offset locations and stake markings shall be the preference of the wall contractor. The SmartSlope system has 20-40 degrees of batter and as such must be carefully considered when laying out walls with step-ups and step-downs in the footing. **A wall at 70 degrees will change face position by moving back 2.91" for every step** either up or down, at 60 degrees the change is 4.62" and at 50 degrees it is 6.71". When laying out a SmartSlope project the contractor must identify where the modules become above grade, obstructions that may influence positioning options and then calculate the offset from string line caused by steps and buried courses. One of two methods may be selected to control the drift caused by stepping of a highly battered system. When viewed from above they both look as a lightning bolt is depicted.

Method A - Hold modules out in front of the desired line to the step-up, so that stepping up brings the modules back into alignment.

Method B - Hold modules on line until step-up moves alignment back off line, then angle them back to line by next step-up.



The effect of batter on top-of-wall positioning must be considered early in the project to determine the space required for the finished structure and its proximity to other planned structures or obstructions. In the case of abutments, the number of courses must be counted to determine how a cut block can be installed against the abutment on the top course, as well as the effect of batter on the junction.



Leveling Pad

Foundation soil shall be excavated as required for the leveling pad and the reinforced fill zone to the depths and locations shown on the plan sheet or as directed by the site engineer. The exposed foundation soil shall be observed by the on-site soils engineer prior to construction to verify that the exposed material is suitable for the net design bearing pressure and that the base of the excavation is free of loose soil, uncompacted fill, water, or frozen material. Undercut any unsuitable soil. Undercut areas shall be filled with crushed rock and compacted to at least 95% of the material's standard Proctor maximum dry density. **If using clean rock similar to an AASHTO #57 stone, ease in leveling and speed of placement will be enhanced by topping the clean stone with 2 inches of chips or other suitable fine material.** Construct the crushed rock leveling pad to the lines and grades shown on the plans.

Convex Radius with Supports

Ready for Next Course

Wall Building

Install the first course of modules on the leveling pad. Modules must be level front-to-back and side-to-side on properly compacted footer. The facing column's tendency is to settle backward against the backfill. **Care must be taken to keep the modules level front-to-back as construction continues, so a properly designed and compacted footer is imperative.**

On straight runs, modules shall be placed 14" apart in accordance with the diagrams to yield a 34" center-on-center spacing. On **convex radii** sections, the modules spacing will decrease with each successive lift, so starting at 14" spacing between modules is appropriate. On **concave radii** sections, the modules spacing will increase with each successive lift, so initial spacing at the footer should be less than 14" to allow for the increasing radius as the wall climbs. When spacing increases beyond 14", modules will not rest on two rails below so the entire radius needs to be adjusted with the addition of a module that tightens the spacing enough to ensure every module rests on two rails below. When spacing tightens to less than 2-3", the radius needs to be adjusted by removing a module and re-spacing the course so that the spacing is similar to that in the base course. The appropriate spacing is determined by the contractor on site based upon tightness of radius and height of wall and how frequently the contractor wishes to adjust module spacing when spacing grows beyond 14" or shrinks to less that 3". Radius walls may require smaller or larger spacing between the units to maintain the running bond. When off-bond (upper module not evenly straddling lower module), then addition of the SmartRadius supports may be installed in order to ensure peak performance of the system.

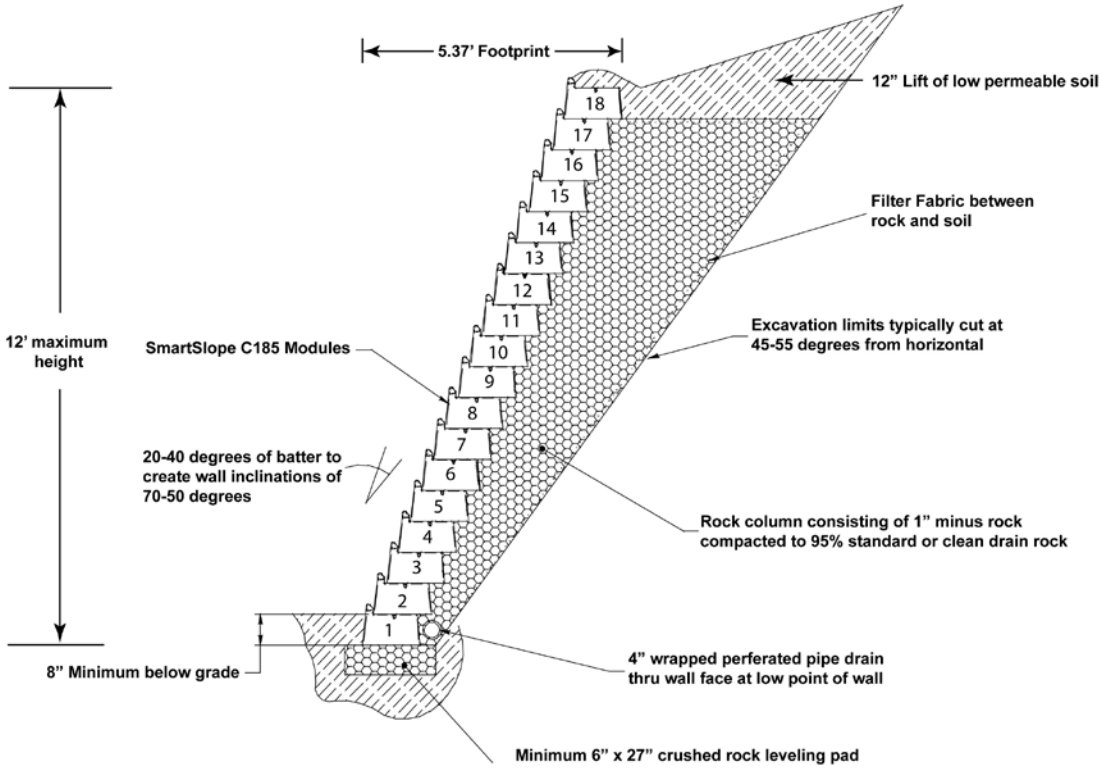
Fill units, and spaces between units, with plantable unit infill to a level even with the tops of the side rails. If contained in Filtrexx GardenSoxx, place one bag into each module and one between each module **(effectively two in each trough)**. If bulk infill, the material must be stepped on to give some compaction to ensure the trough is properly filled. Fill and compact the reinforcement zone immediately behind the modules in a manner that achieves proper compaction, but also maintains the horizontal positioning of the strap reinforcement. **The compaction process cannot impose downward deflection of the straps or significant tension in the straps.**

Once successive courses are being placed, the foreman should review the level and appearance of the wall every 2nd or 3rd course depending on the repeating pattern of the straps, and make any required adjustments in alignment to satisfy the eye, before continuing. Given the open face pattern of this system, slight variations in "level" from module-to-module along a course are not critical as long as the course overall maintains level. Thus, leveling along a course can be performed effectively by eye sighting; individual leveling from module to module is not recommended as it may slow down the installation process unnecessarily. However, **leveling every lift from front to back is very important**. If the modules progressively lean rearward, overall elevation of the wall and footprint of the wall will be impacted. Every lift should be checked for leveling front to back and shimmed if necessary. Adjustments may include tapping modules of the uppermost course, in or out, to maintain alignment and/or shimming up any low side-rails that may cause an aesthetic problem.

Checking Level Front to Back

Screed off the rail tops to ensure the next course will set evenly on the side rails and install the next course in a running bond stack. Pull units forward into contact with either the rear-face of the lower module, or the desired SmartBatter spacer, to establish a 70, 60 or 50 degree wall batter. **On any given lift, always fill the entire course of modules with plantable unit infill, before placing mass backfill**.

Backfill behind the modules to the cut embankment or ends of the strap reinforcement and continue construction in sequence. Each course of modules must be stacked and completely backfilled before the next course is placed**. No stacking of multiple courses before filling shall be allowed**.



Note: Because SmartSlope Wall Systems require batter between 20 and 40 degrees from vertical, installations impose a minimum footprint of 2.91" per course plus 15" for the length of the top module. A 12' tall wall at 70 degrees will have a footprint of 5.37' as measured from the face of course #1 to the rear of course #18.

BACKFILLING and COMPACTION

Wall backfill material shall be placed in maximum 8" compacted lifts to achieve at least 95% of the material's maximum dry density as determined by the standard Proctor method. Backfill shall be placed, spread and compacted in such a manner that minimizes wrinkles and movement of the reinforcement. Field density testing shall be conducted by a qualified soils technician to verify that at least the minimum degree of compaction is being obtained.

Vibratory Plate on Granular Zone

Walls with no additional reinforcement straps are less complex in terms of backfill and compaction. The modules themselves must be completely filled with plantable unit infill and the backfill zone to the rear must be well compacted to the cut embankment and drained, to ensure that the facing column does not settle backward. The use of large equipment directly behind these walls is unlikely and compaction should be achieved by utilizing **walk-behind rollers**, various sizes of **vibratory plate compactors** and /or **hand tampers**.

Correct Lower Strap and Backfill

Slightly more difficult are **reinforced walls and slopes under 12' tall** or walls and slopes with strap embedment lengths less than 10'. The mass backfill zone for these may be either select granular or suitable soil. In either case the straps must be laid horizontal to the connection at the module as stated elsewhere in this guide. Granular backfill makes it much easier to comply, therefore reducing the chance for vertical loads and downward deflection of the straps. Soils backfill is more difficult and extra care must be taken to ensure the straps lay flat and horizontal on well compacted backfill. The area from the rear of the module back 3-4 feet must be compacted with a vibratory plate compactor and **no jumping jack type equipment may be utilized in this zone**. If soil directly behind the modules, then small lifts must be compacted. If clean rock directly behind the modules, then larger individual lifts of fill may be installed.

Correct Filling

Ready for Upper Strap

Walls and slopes over 12' tall, with strap lengths greater than 10' and having high value structures above and below them are the most critical for the backfill and compaction operation. **Approved soil may be utilized but select granular will be the best choice for mass backfill material.** To ensure that no downward deflection occurs at the rear of the modules, it is recommended that a clean granular rock column be placed and compacted in the 12" directly rearward of the modules. The gap at the rear of the modules trough, under the uppermost strap, must also be filled in with this granular material in order to prevent deflection and undue stress on the rear of each connected module. The best way to accomplish this is to **flip one or both legs of the strap up and over the face of the module** so that it is out of the way as material is pushed up against the rear of the modules trough. Backfilling and compacting is to be accomplished in zones. Fill the modules first, then fill the granular zone just rear of the modules, then move in backfill to the ends of the straps at the rear of the reinforced zone. Compaction should take the same sequence, by first stepping-in of plantable unit infill, plate compaction of the granular zone, rolling and mechanically compacting mass backfill rearward to the tails of the straps, in order to drive all slack rearward.

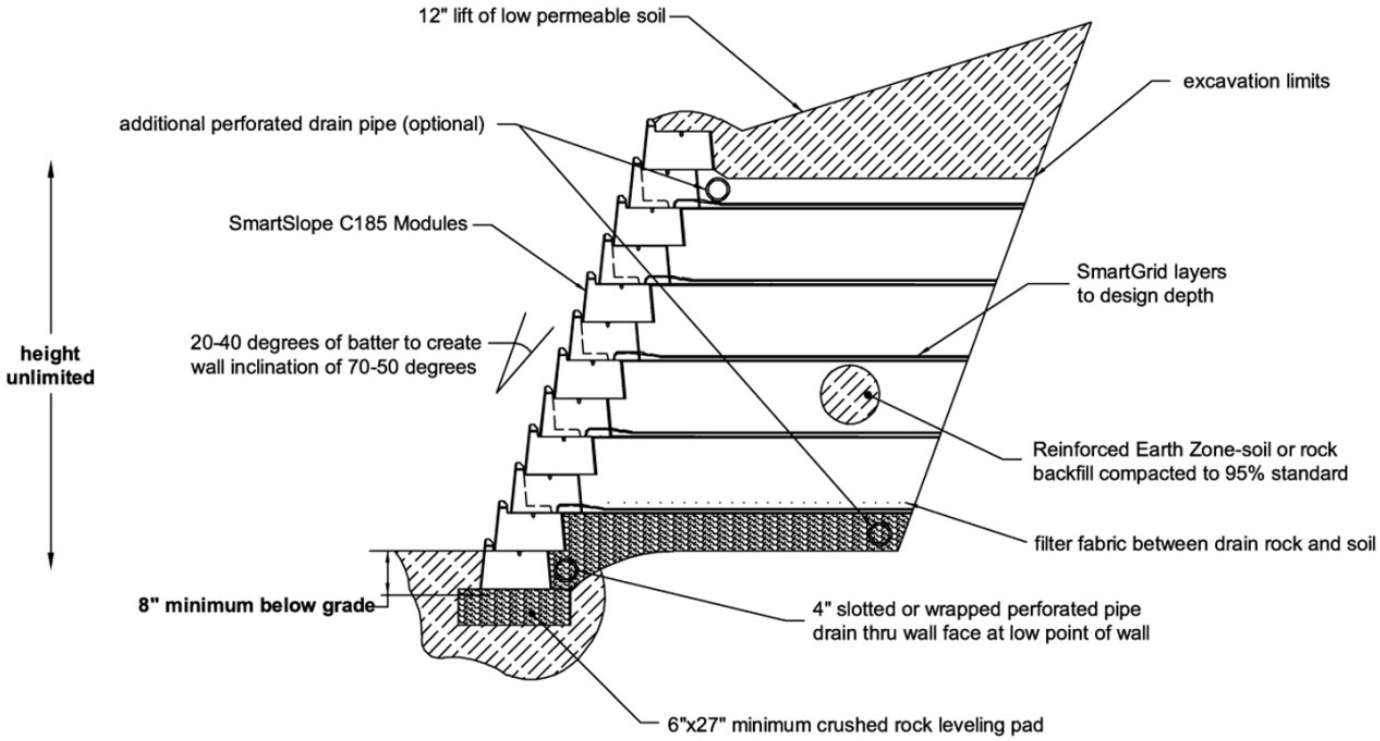
Upper Strap over the Top

The finished grade above any SmartSlope structure should include a drain swale and must be sloped in such a manner to drain all water away from the wall. (Go to the SmartSlope website @ Technical Diagrams for even more views and details.)

REINFORCED SECTIONS

SmartSlope walls and slopes are designed to be reinforced with a unique, woven and coated polymer strip reinforcement called SmartGrid. SmartGrid comes on small diameter, densely packed rolls that can easily be carried by a single laborer. The SmartGrid shall be cut with a simple razor knife to design length X 2 plus 1 foot for the wrap around of the modules bottom. Once the modules of a reinforced course have been placed on the wall column, each module can be lifted slightly at the rear so the tag end of the SmartGrid may be inserted from the top (inside the trough) through the connection aperture in the bottom of each module. The SmartGrid may now be pulled back to design depth evenly into the backfill zone for each module of the course at the elevations shown on the plans. The terminal ends of the strap should be at the same distance from the module and spread apart no more than the center-to-center width of the modules, which is 34". SmartGrid placed outside a plus or minus 4" zone of the placement design elevation will not be accepted**. Wrinkles in the SmartGrid shall be removed prior to placing backfill but straps should not be tight.** Initial mass backfill should be placed on the straps, directly at the rear of the modules in order to hold them in place. Remaining backfill shall be placed and /or pushed in a rearward direction, starting from the modules moving toward the rear of the fill zone. **Construction equipment, other than rubber tired or tracked shall not be operated directly on the SmartGrid material.**

Easy to Handle Strapping



PLANTING THE FINISHED WALL

SmartSlope walls and slopes are designed from their inception to be planted and grown over. The system is intended to be the most reliable means available for creating strong, economical structures that quickly disappear into the natural landscape. All of our design efforts have gone into making a system that will disappear once complete and yield an end-product that blends into the surrounding landscape while not separating it. Once complete, the face of the finished system should be brushed off to dislodge any over-filling of the pockets which would quickly slough off on its own. Planting must start from the top course and continue down the face of the wall until every pocket is filled with at least one plant. The planting pocket is designed large and the fill volume is high, so each pocket can accommodate multiple plugs or larger potted species if the designer has called for it. Live plants should be centered in the "sun receiving" area of the pocket (not up under the upper module) and any seeding should be focused on the same area. Hydro-seeding that is directed at the module faces may increase the quantity required, while hand broadcasting seed directly into the pocket will be the most seed efficient. Plants must be watered in and fertilized in accordance with the project plans. Maintenance will be required for the first year in order to ensure a proper grow-in and low to no maintenance thereafter. **Always consult with the owner and/or their representatives early in the project to determine all responsible parties with regard to plants, quantity, design, maintenance and feeding.** Visit the SmartSlope website for information on irrigation and construction details @ Technical Details and Cut Sheets .

High Capacity Trough

Hardy Natives from Quart Containers