



# ARMORMAX<sup>®</sup>

Engineered Earth Armoring System

## ARMORMAX<sup>®</sup> FOR PARRALLEL CHANNEL INSTALLATION AND MAINTENANCE GUIDELINES

Thank you for purchasing the ARMORMAX<sup>®</sup> Engineered Earth Armoring Solution by Propex Operating Company, LLC (Propex). This document provides installation and maintenance guidelines for ARMORMAX<sup>®</sup> used as channel armoring to increase channel resiliency towards forces created by high velocities and shear stresses. ARMORMAX<sup>®</sup> provides permanent erosion protection on the side slopes and/ or bed of a channel, and consists of two components:

- Pyramat<sup>®</sup> - High Performance Turf Reinforcement Mat (HPTRM)
- Engineered Earth Anchor (Anchor)

Temporary securing pins (pins) are used during installation to hold Pyramat in place while installing anchors. Pins also promote vegetation establishment keeping Pyramat in intimate contact with the soil.

ARMORMAX<sup>®</sup> is an engineered solution with a unique design for each specific project. While Propex has made every effort to ensure general validity, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability, and accuracy. The documentation provided herein is for general information only, and is intended to present installation guidance only. Project specific contract documents take precedence when pin and anchor placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armored, work restrictions may be in place such as limiting installation based on growing seasons, weather patterns, etc. Work should be performed under the provisions set forth for the specific project. Propex Engineering Services is available for support during installation to consult for solving constructability issues encountered in specific applications. Please feel free to call our technical support hotline at (423) 553-2450.

### BEFORE INSTALLATION BEGINS

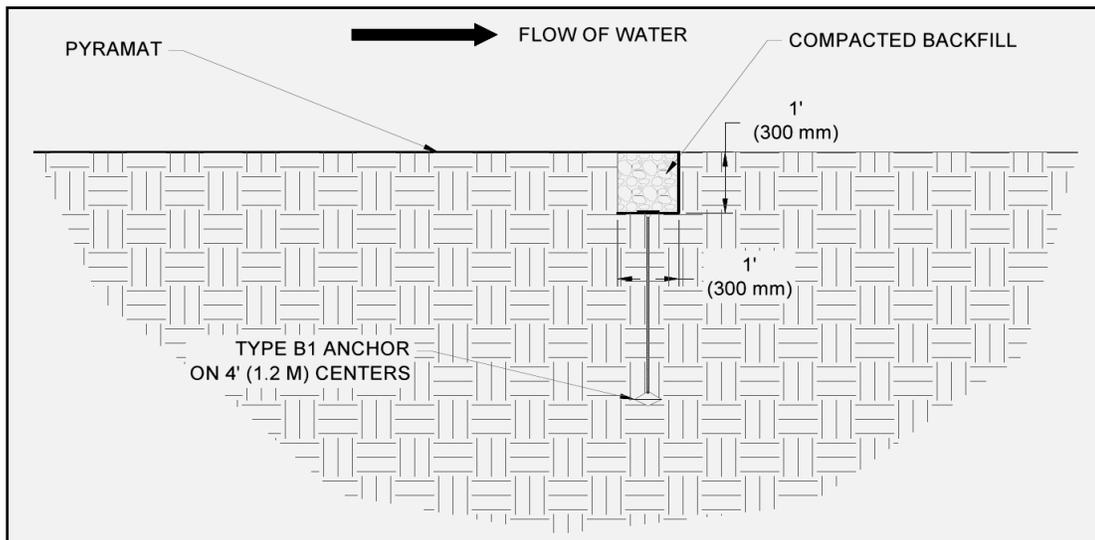
- *Coordinate with a Propex Representative:* A pre-construction meeting with the construction team and a representative from Propex is recommended prior to installation. This meeting should be scheduled by the contractor with at least a two week notice prior to construction.
- *Gather the Tools Needed:* Tools that you will need to install ARMORMAX<sup>®</sup> include a pair of industrial shears to cut Pyramat, tape measure, percussion hammer (sized appropriately for the anchors), ground rod driver compatible with the percussion hammer, drive steel compatible with the anchor, setting tool to set and load-lock the anchor, and wire cutters to cut the cable tendon of the anchor. If anchors will be load tested during construction, additional testing equipment may be necessary. Consult the “Anchor Load Test Manual” from Propex for further guidance. Available for purchase from Propex are drive steel, setting tools, and wire cutters.
- *Determine Vegetation Establishment Strategy:* The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation. Refer to *Establish Vegetation* for further guidance.

## INSTALLATION OF ARMORMAX® FOR CHANNELS

### PREPARE THE SITE

It is recommended during all stages of site preparation that disturbed soils remain unprotected for not more than a single day. Depending on project size this may require progressive site preparation during installation.

1. Grade and compact the area in the channel where ARMORMAX® will be installed. The channel surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that during Pyramat Laydown, Pyramat comes in direct, intimate contact with the channel surface.
2. Prepare the area to be armored with ARMORMAX® by loosening the topsoil to promote better vegetation establishment. This may be accomplished with a rotary tiller on slopes 3:1 or flatter. For slopes greater than 3:1, prepare topsoil in a safe manner.
3. Excavate an Initial Channel (IC) trench a minimum of 12 in x 12 in (300 mm x 300 mm) across the channel at the downstream end of the project (Figure 1). Deeper IC trench and/or hard armoring may be required for channels that have the potential for scour.



**Figure 1: Initial Channel (IC) Trench**

4. Excavate a Crest of Slope (COS) trench a minimum of 12 in x 12 in (300 mm x 300 mm) along both sides of the installation. Each COS trench must be a minimum of 3 ft (900mm) over the crest of the slope, preferably on a relatively flat surface (Figure 2).

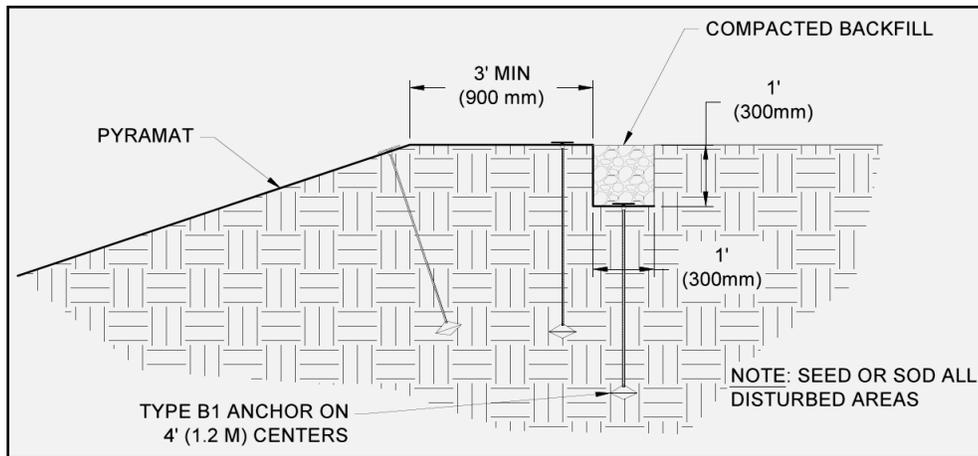


Figure 2: Crest of Slope (COS) Trench

- Excavate a Terminal Channel (TC) trench a minimum of 12 in x 12 in (300 mm x 300 mm) across the channel at the upstream end of the project (Figure 3). Deeper TC trench and/or hard armoring may be required for channels that have the potential for scour.

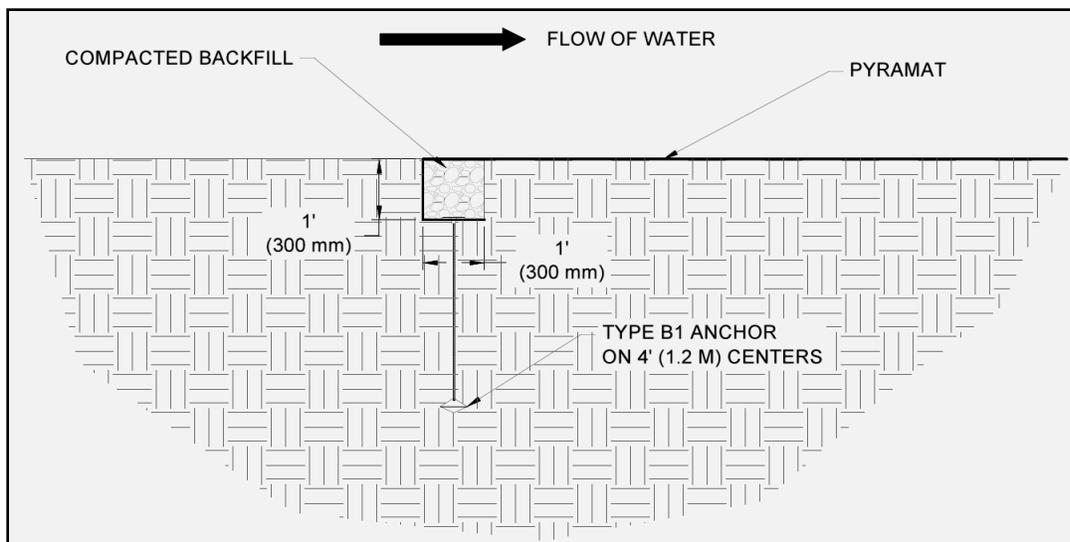


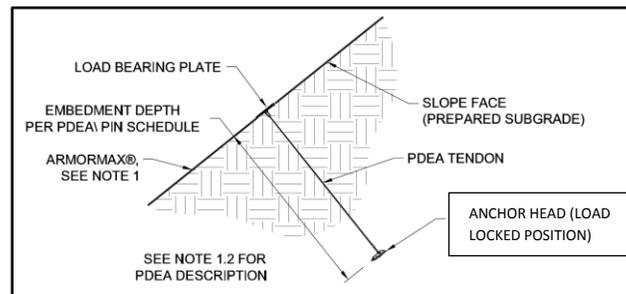
Figure 3: Terminal Channel (TC) Trench

- If seeding, refer to *Vegetation Establishment* for additional considerations during site preparation.

## INSTALL ANCHORS

The ARMORMAX® anchor typically consists of a die-cast, aluminum alloy bullet-nose anchor head, a carbon steel cable tendon, and a load bearing plate fabricated from die-cast zinc and containing an array of openings for optimal vegetation growth. For quality control purposes and warranty claims, anchors should be delivered to the jobsite fully assembled and ready for installation.

Anchors are to be installed in locations specified for the project, and are typically installed in conjunction with *Pyramat Laydown*. There are several options available from Propex for different types of anchors. For optimal performance with the greatest risk reduction, it is important to select the proper anchor and perform the installation in accordance with the pattern designed for required resiliency and long term durability of the channel.



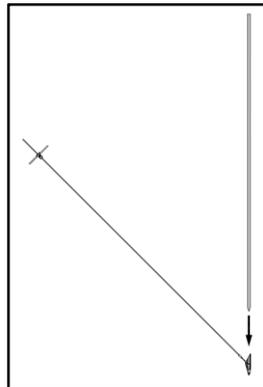
**Figure 4: Type B1 Anchor Detail**

Understanding the mechanics behind installing the anchor component of ARMORMAX® will result in a quality ARMORMAX® installation. The installation of a Type B1 Anchor (Figure 4) is described below. The tools that you will need are a percussion hammer, a ground rod driver, drive steel compatible with the anchor, a setting tool, and wire cutters.

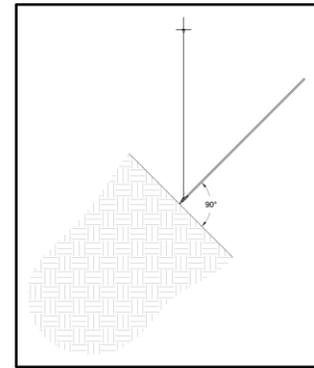


## TYPE B1 ANCHOR

1. Insert the tapered end of the drive steel into the hollow cavity of the anchor head. Position the anchor head/ drive steel tip above the ground at the drive location, being careful to lay the cable tendon and load bearing plate (plate) off to the side. (Figure 5 and Figure 6)
2. Using a percussion hammer, guide the drive steel into the ground perpendicular to the slope surface at a smooth pace. Continue driving until the desired embedment depth is reached. (Figure 7) Be careful not to allow the plate to slip downward along the cable tendon during step 2. Remove the plastic stop sleeve from under the plate after desired embedment depth is reached.

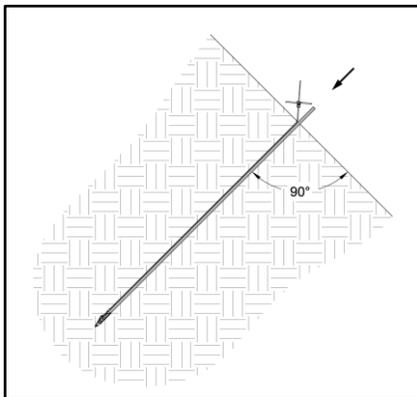


**Figure 5: Insert Drive Steel into Anchor**

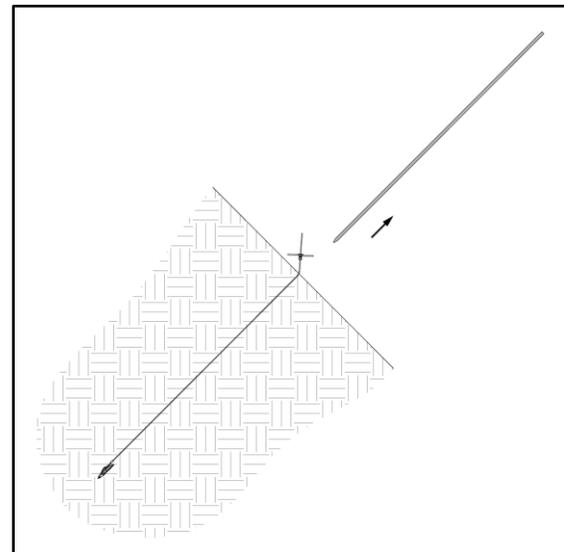


**Figure 6: Position Anchor Head / Drive Steel Tip**

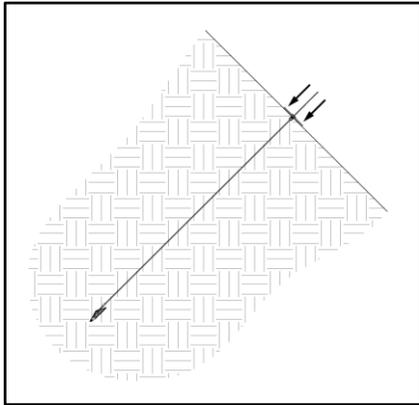
3. Remove the drive steel from the ground. (Figure 8) Depending on soil conditions, this may require the use of a setting tool or metal bar for leverage.
4. Slide the load bearing plate down the anchor tendon towards the channel surface using your hands (Figure 9).



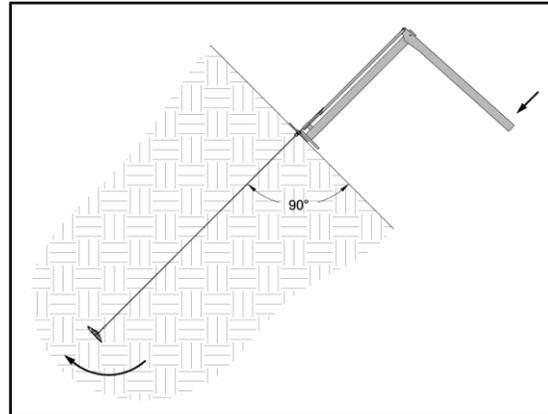
**Figure 7: Drive Steel to Drive the Type B1 Anchor into the Ground**



**Figure 8: Remove Drive Steel from Ground**

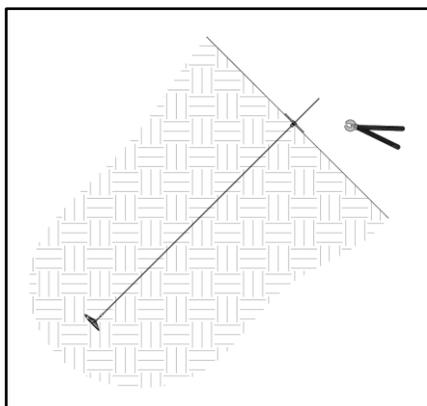


**Figure 9: Slide Plate**

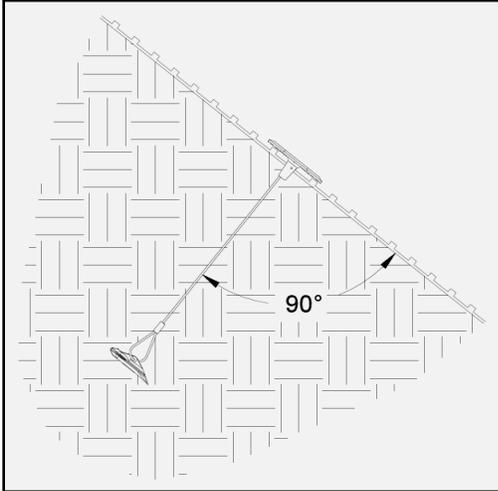


**Figure 10: Use Setting Tool to Set Anchor**

5. Once the plate is close to the channel surface, stand on the anchor plate and insert the setting tool into the loop at the top of the anchor tendon, keeping the anchor tendon perpendicular to the channel surface. (Figure 10) With gentle force, slowly start to pull upwards - away from the channel surface - causing the anchor tendon to start to move out of the ground (displace). During this step, the anchor head will turn in the ground - a process known as "anchor setting". The change in embedment depth to set a Type B1 Anchor is approximately 2 inches. When the anchor is set, there will be a noticeable change in the amount of force needed to displace the anchor any further. This is a good indication that the anchor head is now perpendicular to the anchor tendon and the anchor is ready to be load-locked.
6. To load-lock an anchor, continue to apply tension to the anchor tendon using the setting tool without changing the embedment depth any further. While the tendon is in tension, gently tap the anchor plate down with a rubber mallet, creating a slight depression on the channel surface. Visually, anchors across ARMORMAX® will look similar to buttons across a mattress top when anchors have been properly load-locked.
7. Conduct anchor load tests when required for quality assurance during installation. Refer to the document entitled "Anchor Load Test Manual" by Propex for further details.
8. Once anchors have been load-locked, cut off the excess looped anchor tendon flush to the plate at the channel surface using wire cutters. (Figure 11 and Figure 12)



**Figure 11: Trim Extra Cable Flush to Plate**

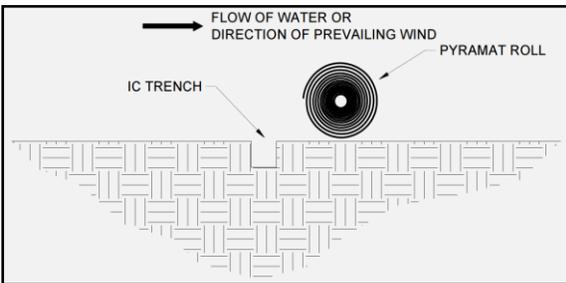


**Figure 12: Complete Type B1 Anchor Installation**

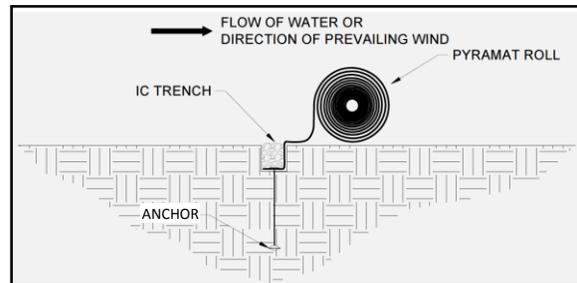


**PYRAMAT LAYDOWN**

1. Begin the Pyramat Laydown process in the center of the channel at the downstream end of the site. To ensure proper anchoring of the overlapped areas the proceeding roll width must be laid out before the current roll width can be fully anchored. Panel edges should rest parallel to the channel center line. For best results, panels of Pyramat should be continuous and free from seams. Panel edge and end overlapping should follow a pattern of placing each proceeding panel's edge overtop the previous panel edge, shingling the panels in the direction of the water flow.
2. Place the Pyramat panels by laying the Pyramat rolls on the downstream side of the IC trench so that the roll end points towards the IC trench (Figure 13), with a 3 inch (75 mm) overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 3 inch (75 mm) overlap during *Pyramat Laydown*. (Figure 22)

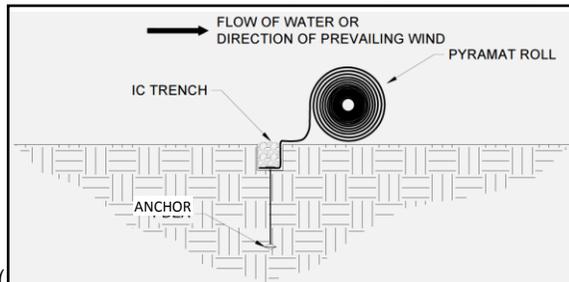


**Figure 13: Initial Channel (IC) Trench Alignment**



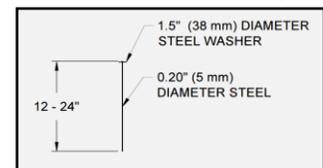
**Figure 14: Initial Channel (IC) Trench Placement**

3. Place the Pyramat roll ends in the IC trench, ensuring full coverage along the bottom of the entire IC trench



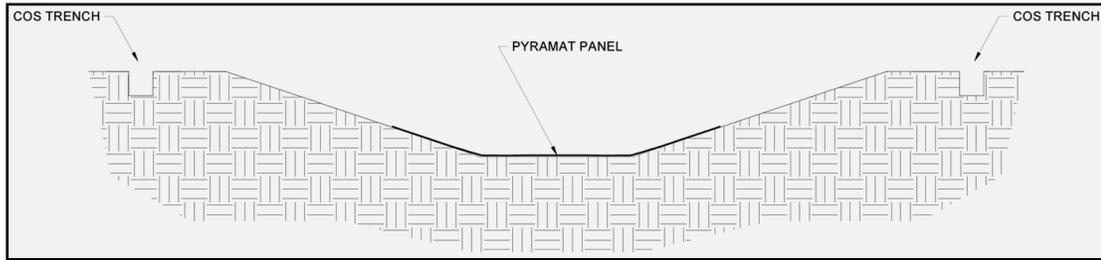
with the Pyramat ( ).

4. Secure Pyramat with pins and anchors in the IC trench (Figure 14). Pins should be made of steel with a 0.20 in (5 mm) minimum diameter, having a 1.5 in (38mm) diameter washer at the head, and a length between 12 and 24 in (300-600 mm) with sufficient ground penetration to resist pullout (Figure 15). Longer pins may be required for looser soils. Heaver metal stakes may be required in rocky soils. Suggested placement of pins and anchors for the IC trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between anchors on 4 ft (1.2 m) centers. Anchors should also be installed on panel edge overlaps in the IC trench.



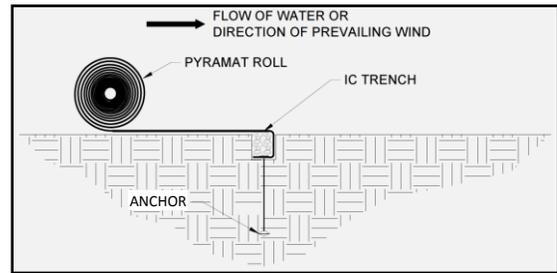
**Figure 15: Securing Pin**

5. Backfill and compact the IC trench in the location of the center Pyramat panel only (Figure 14).

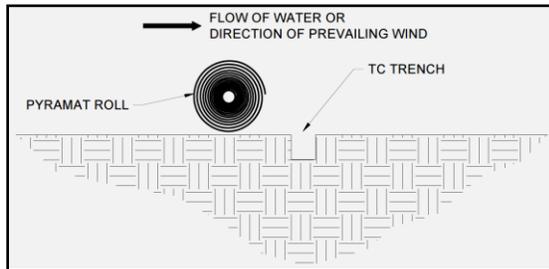


**Figure 16: Center Panel Placement**

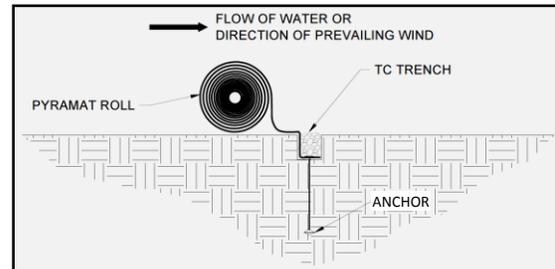
6. Starting with the center Pyramat panel (Figure 16), roll the Pyramat rolls over the top of the compacted IC trench and upstream across the surface of the channel (Figure 17). Ensure that Pyramat has intimate contact with the ground and all irregular surfaces beneath the Pyramat are removed.
7. For channel lengths greater than the length of the Pyramat rolls available, place additional Pyramat panels by laying the Pyramat rolls on the upstream side of the TC trench (Figure 19), with a 3 inch (75 mm) overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 3 in (75 mm) overlap during *Pyramat Laydown*. (Figure 22)



**Figure 17: Initial Channel (IC) Trench Complete**



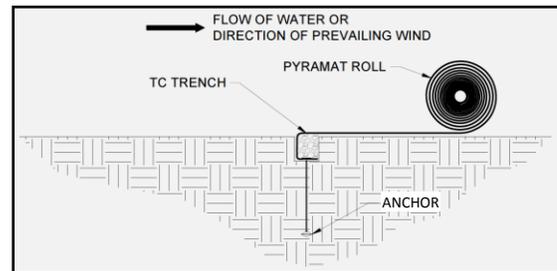
**Figure 18: Terminal Channel (TC) Trench Alignment**



**Figure 19: Terminal Channel (TC) Trench Placement**

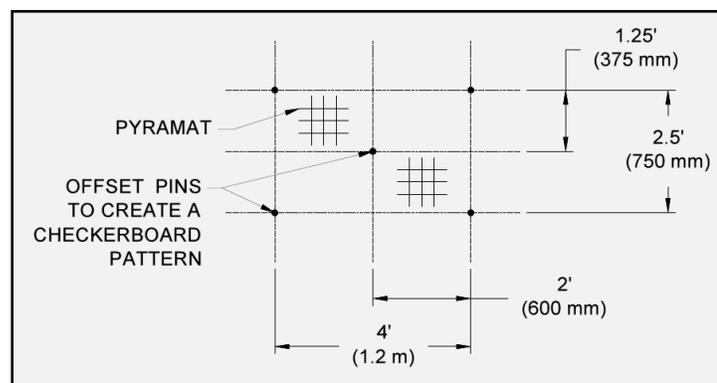
8. Place the Pyramat roll edge in the TC trench, ensuring full coverage along the bottom of the entire TC trench with the Pyramat (Figure 18).
9. Secure Pyramat with pins and anchors in the TC trench (Figure 18). Suggested placement of pins and anchors for the TC trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between anchors on 4 ft (1.2 m) centers. Anchors should also be installed on panel edge overlaps in the TC trench.
10. Backfill and compact the TC trench in the location of the first Pyramat panel only (Figure 19).
11. Starting with the center Pyramat panel (Figure 16), roll the Pyramat rolls over the top of the compacted TC trench and downstream across the surface of the channel (Figure 20). Ensure that Pyramat has intimate contact with the ground and all irregular surfaces beneath the Pyramat are removed.

12. Overlap the upstream Pyramat panels a minimum of 6 in (150 mm) overtop of the downstream Pyramat panels following the roll end anchoring requirements outlined below (Figure 24).



**Figure 20: Terminal Channel (TC) Trench Complete**

13. Secure Pyramat panels in place using pins and anchors across the channel surface according to the project's engineered design. Pin and anchor placement should reflect a staggered checkerboard pattern across the channel surface for best results (Figure 21 and Figure 22).
  - a. Roll edges shall be overlapped a minimum of 3 in (75 mm) with pins placed on 12 in (300 mm) centers in between ANCHORS on 5 ft (1.5 m) centers (Figure 22).
  - b. Roll ends shall be overlapped a minimum of 6 in (150 mm) with upstream panel on top. Secure roll end overlaps with two rows of pins staggered 6 in (150 mm) apart on 12 in (300 mm) centers and with one row of ANCHORS on 4 ft (1.2 m) centers (Figure 24)
  - c. For channel lengths greater than 45 ft (13.7 m), install simulated check slots. This method includes placing two rows of pins 12 in (300 mm) apart on 12 in (300 mm) centers and one row of anchors between the rows of pins on 4 ft (1.2 m) centers at 45 ft (13.7 m) maximum intervals or across the midpoint of the channel for channel lengths less than 60 ft (18.2 m) (Figure 23).
  - d. At the break in slope interface towards the channel bed, it is suggested that anchors be installed on 4 ft (1.2 m) centers (Figure 25).



**Figure 21: Example Pin Pattern**

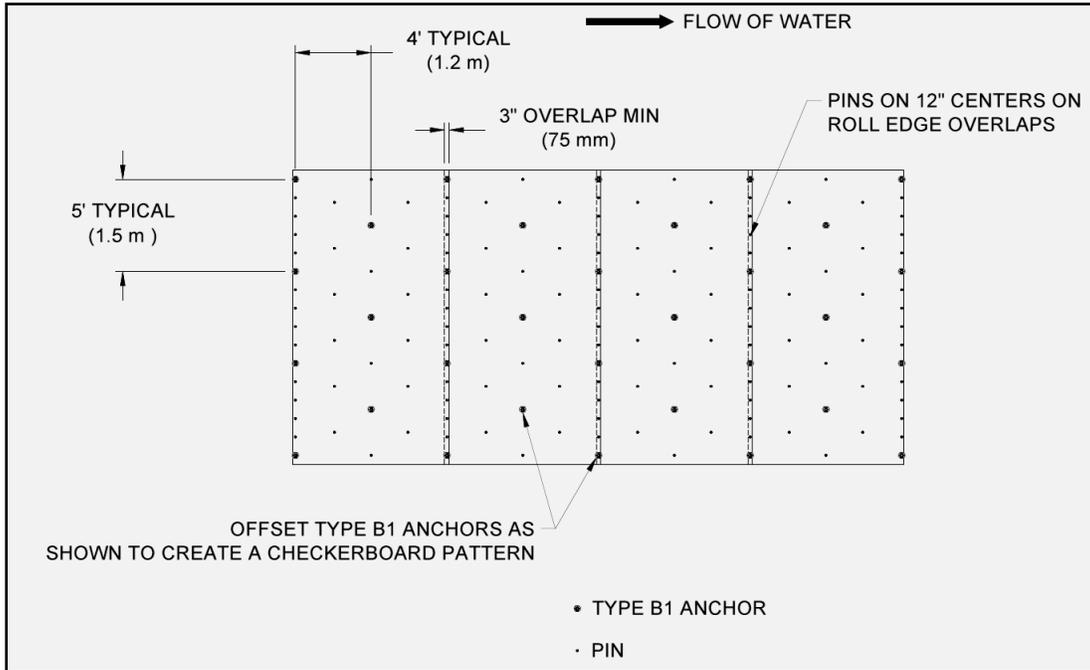


Figure 22: Example Anchor Pattern - 0.5 Anchors/Yd2

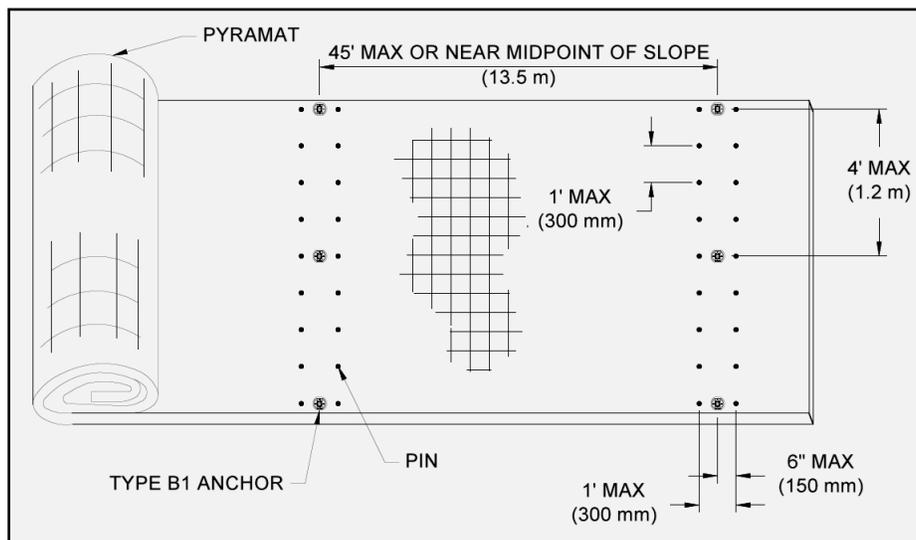


Figure 23: Simulated Check Slot

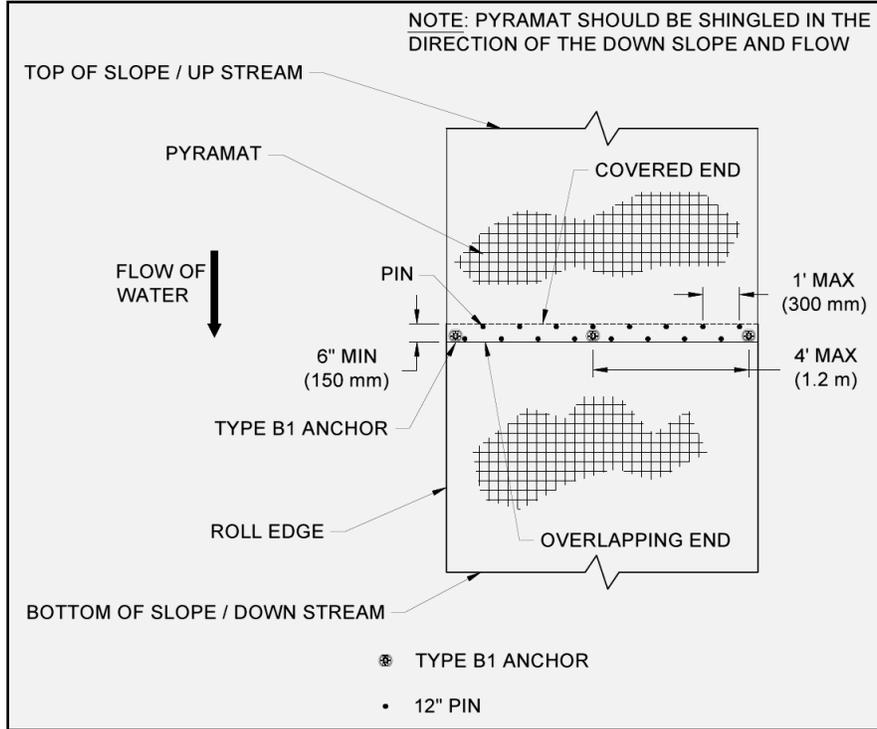


Figure 24: Roll End Overlap

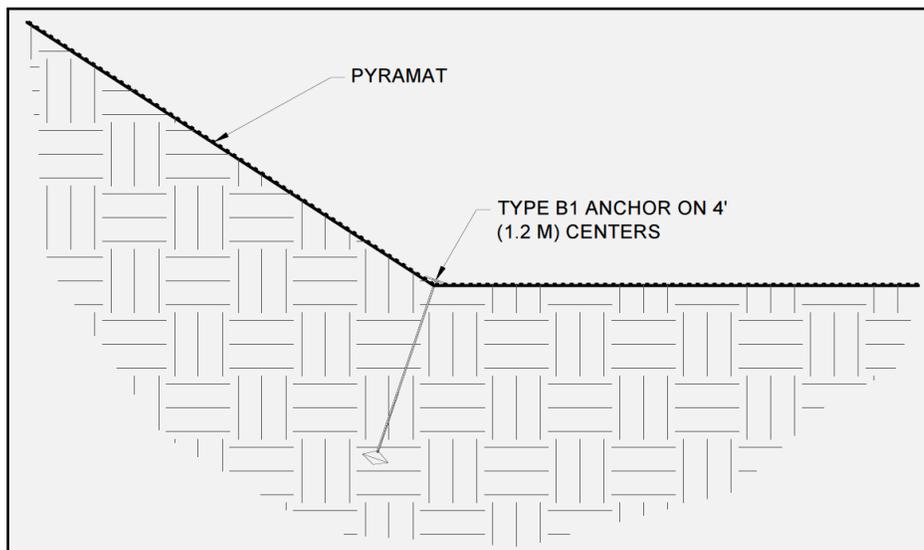
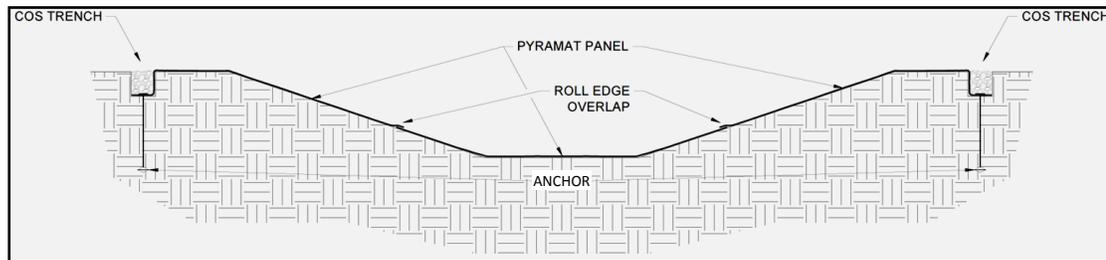


Figure 25: Break in Slope Interface



14. Continue to work along the width of the channel by repeating steps 11 through 13 overlapping each adjacent Pyramat panel edge by 3 inches (75 mm) (Figure 26). The Pyramat panels placed on the crest of the side slopes should terminate their edges in the COS trench with pins on 12 in (300 mm) centers in between anchors on 5 ft (1.5 m) centers.
15. Place the final Pyramat panel edges in the COS trench, ensuring full coverage along the bottom of the entire COS trench with the Pyramat (Figure 26).



**Figure 26: Crest of Slope (COS) Placement**

16. Secure Pyramat with pins and anchors in the COS trench. Suggested placement of pins and anchors for the COS trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between anchors on 5 ft (1.5 m) centers (Figure 26).
17. Backfill and compact the COS trench (Figure 26).
18. At a minimum, Pyramat panels should be pinned entirely across the channel surface, pins and anchors should be installed in the trenches, and the trenches should be backfilled and compacted at the end of each day to minimize rework in the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example isometric view (Figure 27) of a channel armored with ARMORMAX<sup>®</sup> can be seen below for overall reference. Consult Propex Engineering Services at (423) 553-2450 with any questions that you may have.

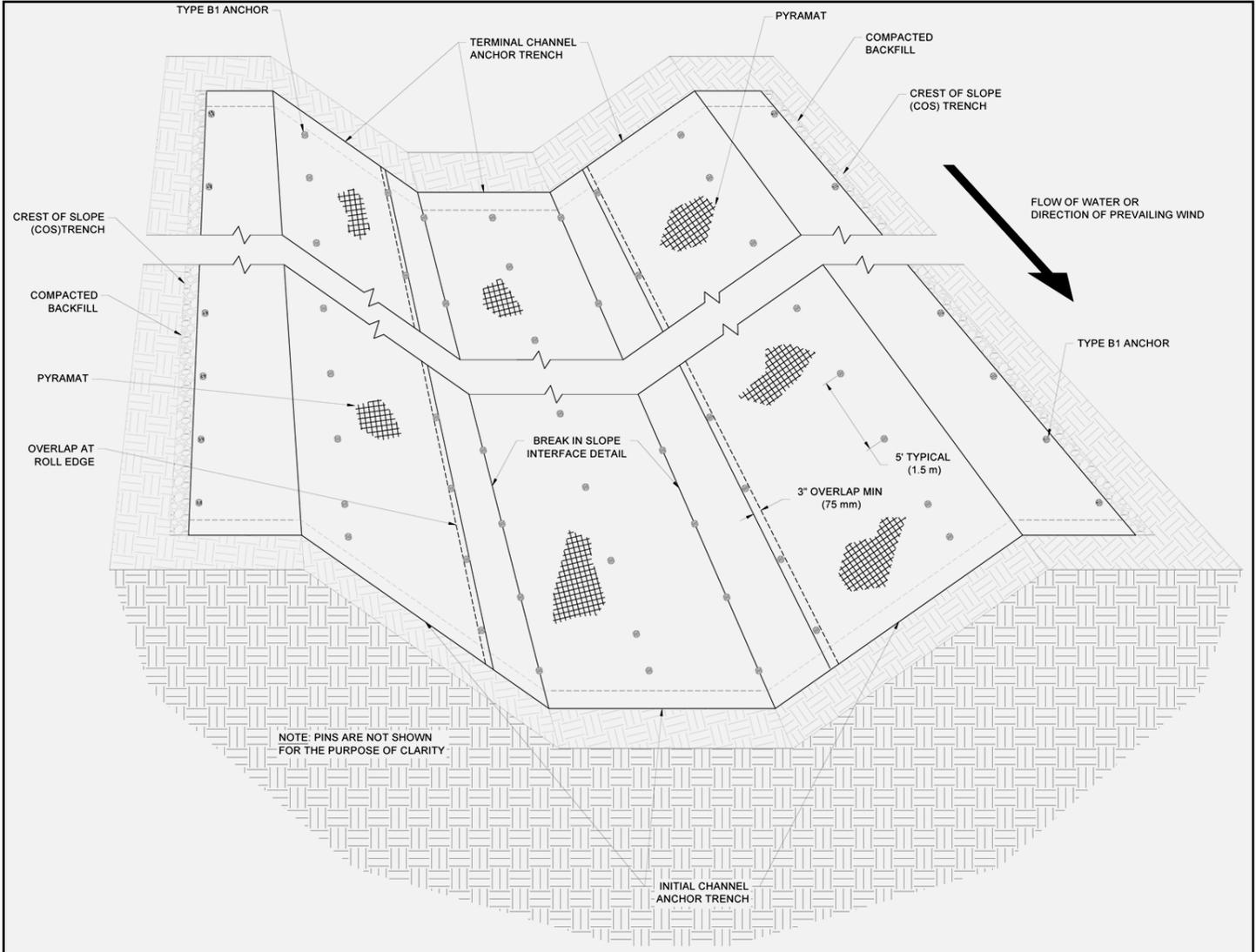


Figure 27: Completed Channel Isometric View



## ESTABLISH VEGETATION

Vegetation can be established with ARMORMAX<sup>®</sup> by broadcast seeding, hydraulic seed application (hydroseeding), or sodding. Seed application rate, seed type, sod type, and irrigation rate should be selected based on local or site specific knowledge and time of year. For best results, consider having a site specific soil test performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation.

### WITH SEED

1. Determine the seed location. Seed can be placed entirely on top of soil filled ARMORMAX<sup>®</sup>, or alternatively 50% below ARMORMAX<sup>®</sup> prior to pinning and anchoring, with the remainder placed on top of soil filled ARMORMAX<sup>®</sup>. If a rain event occurs prior to vegetation establishment, having 50% of the seed below ARMORMAX<sup>®</sup> ensures that some seed remains in place. Seed placed entirely on top of soil filled ARMORMAX<sup>®</sup> will allow for faster vegetation establishment.
2. If seeding below ARMORMAX<sup>®</sup>, ensure 50% of the seed is placed prior to the installation of ARMORMAX<sup>®</sup>.
3. Once ARMORMAX<sup>®</sup> is in place, distribute soil on top by filling the pyramid like projections of Pyramat. The proper amount can be visually measured by making the top ridges of the pyramid projections barely visible, or is approximately 1 inch thick when measured. Soil filling can be accomplished manually or by using a small piece of equipment. Do not place excessive soil above ARMORMAX<sup>®</sup>. See *Consider Project Specific Needs* for guidance on driving equipment across ARMORMAX<sup>®</sup>.
4. After seed has been placed, for added protection, install a Landlok<sup>®</sup> Erosion Control Blanket (ECB) above the soil-filled ARMORMAX<sup>®</sup>.
5. Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of 2 inches. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding. When watering seeded areas, use a fine spray to prevent erosion of seeds or soil. Do not over irrigate. Proper irrigation guidance is provided under the Maintenance portion of this document.

### WITH SOD

1. Sod will be always placed on top of ARMORMAX<sup>®</sup>.
2. Sod staples should be used to secure the sod against ARMORMAX<sup>®</sup>. During the placement of the sod, ensure that ARMORMAX<sup>®</sup> is 100% covered by tightly adjoining rolls or squares of sod along edges. Any voids in between sod pieces should be filled with clean loose soil.
3. Irrigate as necessary. Proper irrigation guidance is provided under the Maintenance portion of this document.
4. Monitor to identify areas where browned/dead sod emerges. These areas may need to be addressed to ensure proper sod establishment.



## CONSIDER PROJECT SPECIFIC NEEDS

1. For applications that require special transitions (i.e. connections to riprap, concrete, T-walls, etc.), refer to the project specific drawings or consult with Propex Engineering Services at (423)553-2450.
2. A deeper trench and/or hard armoring may be required when channels have severe scour potential at IC and TC trenches.
3. For installing Pyramat panels around curved sections of a channel, trim panels at an angle so that no more than two layers of Pyramat overlap at any point in time. Additional pins and anchors may be needed to secure panel edges towards the break in slope interface depending upon the radius of the curved channel. Install pins or anchors as necessary to securely fasten Pyramat to the ground.
4. Allowable Vehicle Traffic:
  - A. If using equipment on ARMORMAX®, it should be of the rubber-tired type and should avoid sharp turns. Tracked equipment is not permitted to drive over the ARMORMAX® without vegetation at any time.
  - B. Avoid any traffic over ARMORMAX® if loose or wet soil conditions exist.
5. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed or sod such areas.
6. Do not mulch areas where ARMORMAX® is to be placed.



## SHORT-TERM AND LONG-TERM MAINTENANCE OF ARMORMAX<sup>®</sup>

The purpose of this section is to provide some general guidelines for performing short-term and long-term maintenance of ARMORMAX<sup>®</sup> with respect to maintaining vegetation reinforced with ARMORMAX<sup>®</sup>, and patching of ARMORMAX<sup>®</sup> (in the event it needs to be removed or replaced). These procedures are to be considered minimum guidelines for proper maintenance, and further maintenance techniques may be appropriate considering local practices and procedures.

### ARMORMAX<sup>®</sup> PROTECTED CHANNEL

For ARMORMAX<sup>®</sup> to be most effective, it is important to ensure that it is properly maintained both during construction and after construction. Identifying trouble areas is easy with ARMORMAX<sup>®</sup>, and it can make identifying potential threats much simpler and manageable. Look for areas with sparse, dying, or no vegetation as these are obvious signs that ARMORMAX<sup>®</sup> is losing intimate contact with the channel surface. If loss of ground surface occurs, ARMORMAX<sup>®</sup> will need to be removed and reinstalled as described in *Patching and Repairs* Section after the eroded area is backfilled with compacted soil that is similar to material of the slope. After ARMORMAX<sup>®</sup> is reinstalled, re-establish vegetation on the newly installed ARMORMAX<sup>®</sup> and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimize exposure to unwanted maintenance and repair, ARMORMAX<sup>®</sup> armored channels should be free of unauthorized vehicular traffic. Routine maintenance and slope inspections should be performed with rubber tired vehicles. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over ARMORMAX<sup>®</sup> in times of emergency after vegetation establishment is complete. Failure to control unauthorized traffic can result in ARMORMAX<sup>®</sup> being damaged resulting in erosion below ARMORMAX<sup>®</sup> during storm events. In addition, routine mowing maintenance should be used to keep the protected area free of unwanted brush, saplings, and trees. Selective herbicides that target only the unwanted plants can be used as long as the vegetation established with ARMORMAX<sup>®</sup> is not impaired. Failure to control the sapling and tree growth can result in the trees being uprooted during a flood.

### MAINTAINING VEGETATION

Good vegetative cover will ensure maximum performance of ARMORMAX<sup>®</sup>. Vegetative cover care starts before a project is complete and is ongoing until all ARMORMAX<sup>®</sup> is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilize, water, and mow the grasses as needed until a project is complete in the short-term, with the owner of the channel fulfilling the maintenance of the channel in a similar fashion for the long-term. For the entire lifecycle of ARMORMAX<sup>®</sup>, every effort must be made to prevent unauthorized encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning during inappropriate seasons.

1. After the installation of vegetation is complete, immediately water and soak the entire area using a fine spray to prevent erosion and loss of seeds. A suggested amount of water is identified below. Prior to installation if using sod, the sod pads in storage should be kept moist at all times and not stored for more than 24 hours from site arrival to installation. Warmer weather will necessitate more frequent applications than listed below.
  - A. For each reach/segment of installed vegetation, watering shall be conducted immediately after each installation or the day's work.
  - B. For initial vegetation establishment, water vegetation in a manner consistent with best practices for vegetation type and location.



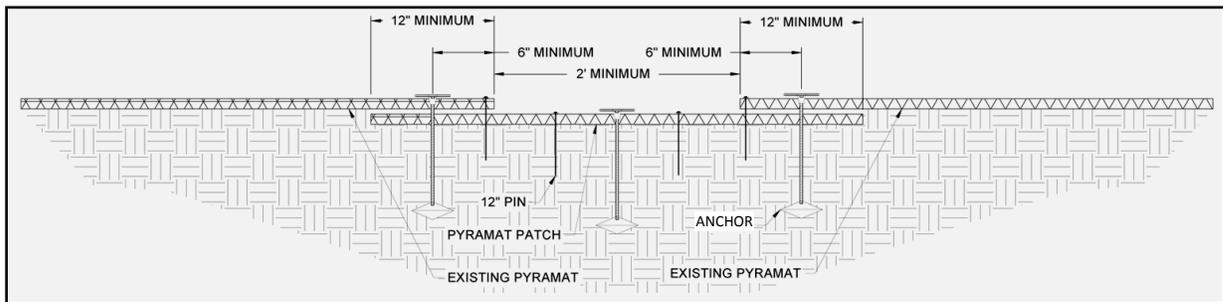
- C. Establish a watering schedule and follow until vegetation is well established and will thrive in the absence of manual watering.
  - D. Avoid excessive application of water, so that surface runoff does not occur. Runoff should be prohibited. However, additional watering may be required for repaired or damaged areas.
4. Fertilizer should be applied as needed to address any nutrient deficiencies revealed in soil testing.
5. Implement best practices for mowing over ARMORMAX<sup>®</sup>. While ARMORMAX<sup>®</sup> is designed to withstand non-hydraulic stresses such as mowing, there are procedures to minimize exposure to unwanted damage.
    - A. Immediately after installation, signage and post shall be installed stating that "Vehicles and Pedestrians are Prohibited from Access" on the slopes and the newly installed vegetation. Signage shall be posted every 1,500 lineal feet.
    - B. Vegetated areas should be mowed to a height no less than 6 inches and no greater than 12 inches from natural ground after a period of 60 days of growth. The excessive grass clippings created from mowing shall be evenly spread on the slope section outside of the armored area. Periodic and final grass mowing should be performed until final inspection and acceptance of slope work. Monitor the vegetated areas throughout winter months and generate reports as needed, noting any issues that should be addressed.
    - C. To prevent damage to the newly established vegetation, the mowing tractor should be fitted with 3-rib agriculture tires. Note that tractors with 8-foot flail mowers provide best results. Tractors with 15-foot brush hogs should avoid sharp turns up the slope to prevent damage to vegetation.
    - D. Mowing should not take place for a minimum of 48 hours after a rainfall event of 2 inches or more to minimize the potential for rutting and/or damage to the slope surface. Maintenance mowing of the slope should be done on a consistent basis to prevent vegetation growing to more than 3 feet in height. This will minimize thatch thickness and potential damage to ARMORMAX<sup>®</sup>. If turn-around pads are present, operate mowing equipment utilizing the turn-around pads to the fullest extent. The mowing blade height over ARMORMAX<sup>®</sup> should be a minimum of 8 inches. However, should vegetation grow to more than 3 feet in height, the mowing blade height for the condition should be a minimum of 12 in.
  6. Some special circumstances may exist. When mowing the crown of a slope with a crown or crest equal to or exceeding 20%, it should be mowed with an articulating arm mower to minimize the potential for the mower blades to catch ARMORMAX<sup>®</sup> at the channel surface. The articulating arm mower should be level on the surface with the articulating arm extending over the crown. **Pay close attention to areas where the slope changes.** The mower blades should be set at a minimum height of 8 inches. If ARMORMAX<sup>®</sup> is damaged by the mowing blades at any time, mowing should stop immediately and further direction should be obtained to continue activity. Repair the damaged area as described in the *Patching and Repairs* section below.
  7. ARMORMAX<sup>®</sup> protected channels are not as susceptible to animal burrowing due the tenacity of the ARMORMAX<sup>®</sup>; however, inspections to detect the presence of burrowing animal activity are generally most effective immediately after the slope has been mowed. Animal burrows that are identified should be thoroughly excavated and inspected, backfilled with compacted soil that is similar to material of the slope, and vegetation re-established. This will avoid the possibility of water piping through unfilled portions of the burrows. Should ARMORMAX<sup>®</sup> be damaged, it is to be repaired as described *Patching and Repairs* section below.



## PATCHING AND REPAIRS

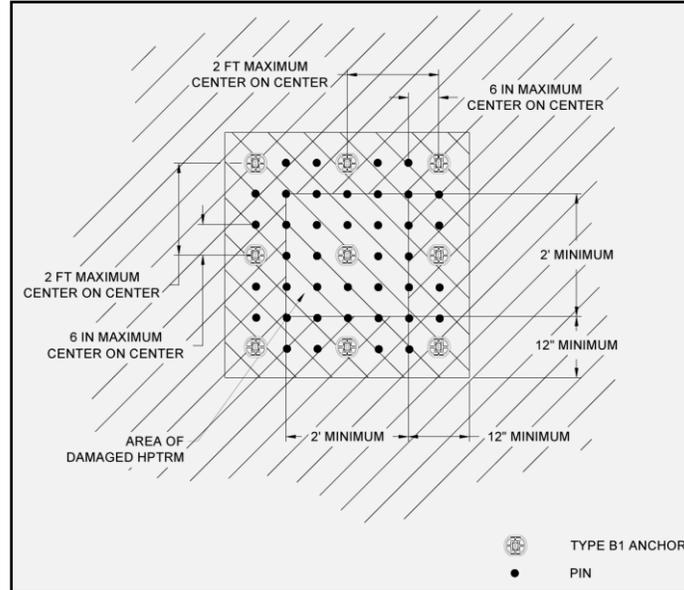
ARMORMAX<sup>®</sup> may require localized repair at times. For emergency repairs, an adequate supply of ARMORMAX<sup>®</sup> should be maintained in inventory with the necessary tools to install. This will allow for a timely, initial repair of the system.

1. In order to identify areas in need of repair, the site should be patrolled immediately after mowing and after rain events of 2 inches or more. When patrolling look for areas of sparse vegetation, exposed edges of ARMORMAX<sup>®</sup>, and areas where direct contact between ARMORMAX<sup>®</sup> and the channel surface is compromised. ARMORMAX<sup>®</sup> should be rated as *Acceptable*, *Minimally Acceptable*, or *Unacceptable* during inspection.
  - A. *Acceptable (A)* - The rated area is in satisfactory, acceptable condition, and will function as designed and intended during the rain event. ARMORMAX<sup>®</sup> has no exposed edges, is installed tightly by maintaining direct contact to the channel surface with no rilling beneath, and has over 90% vegetation cover. There is no noticeable damage present.
  - B. *Minimally Acceptable (M)* - The rated area has a minor deficiency that needs to be corrected. The minor deficiency will not seriously impair the functioning of the area during the next rain event; however, the overall reliability of the project will be lowered because of the minor deficiency. ARMORMAX<sup>®</sup> has 75% vegetation cover with un-vegetated patches as large as one square yard. Edges of ARMORMAX<sup>®</sup> are exposed with noticeable damage. Minimal erosion has occurred underneath ARMORMAX<sup>®</sup>.
  - C. *Unacceptable (U)* - The rated area is unsatisfactory. The deficiency is so serious that the area will not adequately function in the next rain event. ARMORMAX<sup>®</sup> has been physically torn, ripped, or lifted from the channel surface. Less than 75% vegetation cover is present with un-vegetated patches being greater than 1 square yard, and there is evidence that erosion is occurring beneath ARMORMAX<sup>®</sup>.
2. Repair any raised or exposed edges of ARMORMAX<sup>®</sup> by driving existing and additional pins or anchors along the edges as necessary to securely fasten to the ground. Inspect areas where the vegetation is not growing on top of ARMORMAX<sup>®</sup>. Many times this is an indicator that Pyramat has lost contact with the ground beneath. Check for voids beneath ARMORMAX<sup>®</sup> and fill any holes, gullies, etc. with compacted fill material if possible. Replace ARMORMAX<sup>®</sup> as described below.



**Figure 28: ARMORMAX<sup>®</sup> Patch Cross Section**

3. To repair ARMORMAX<sup>®</sup>, cut out and remove damaged areas in a square configuration a minimum size of 2 ft by 2 ft. Remove all vegetation and debris atop of ARMORMAX<sup>®</sup>. Loosen the top 1 to 2 in of soil in the patch area then seed. The subgrade of area to be patched shall be prepared to be smooth and uniform and transition smoothly into the in-situ area. Cut a square Pyramat patch a minimum of 12 in greater than the damaged area for all four sides of the patch. Overlap the patch area in all directions a minimum of 12 in. The patch overlaps shall be tucked under the existing damaged Pyramat material (Figure 28 and Figure 29).



**Figure 29: ARMORMAX® Patch Plan View**

4. Install Type B1 anchors on 2 ft (600 mm) (max) centers, and pins on 6 in (150 mm) (max) centers. For larger areas of damage, anchors should be installed to match existing anchor pattern. Once ARMORMAX® is in place, vegetate per project specifications.

## SUMMARY

Maintenance should consist of watering and weeding, repair of all erosion, and any re-seeding as necessary to establish a uniform stand of vegetation during construction and beyond. A minimum of 70% of the armored area should be covered with no bare or dead spots greater than 10 ft<sup>2</sup> (1 m<sup>2</sup>). Establishing vegetation should not be mowed prior to 70% vegetative density and a minimum grass growth of 4 in (100 mm). Throughout the duration of the project, the contractor should be responsible for mowing to facilitate growth and should not let the vegetation in the armored areas exceed 18 in (450 mm). In addition, the Contractor should water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project. After the project is complete, it is the responsibility of the Owner to maintain and upkeep all ARMORMAX® installed areas for long term performance and best results as described herein for superior channel armoring.