PARALLEL CHANNEL INSTALLATION AND MAINTENANCE GUIDELINES-PYRAMAT® 25

Thank you for purchasing the Pyramat® 25 Turf Reinforcement Mat (TRM) by Propex Operating Company, LLC (Propex). This document provides installation and maintenance guidelines for Pyramat® 25 used as channel armouring to increase channel resiliency towards forces created by high velocities and shear stresses. Pyramat® 25 provides permanent erosion protection on the side slopes and/or bed of a channel.

Temporary securing pins (pins) are used during installation to hold Pyramat® 25 in place. Pins also promote vegetation establishment keeping Pyramat® 25 in intimate contact with the soil.

Pyramat® 25 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 placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armoured, 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. Please feel free to call our local Global Synthetics representative, refer www.globalsynthetics.com.au for support during installation as required.

BEFORE INSTALLATION BEGINS

- Coordinate with a Global Synthetics Representative: A pre-construction meeting with the construction team and a representative from Global Synthetics is recommended prior to installation. This meeting should be scheduled by the contractor with sufficient notice prior to construction.

- Gather the Tools Needed: Tools that you will need to install Pyramat® 25 include a pair of industrial shears to cut Pyramat® 25, tape measure, and a mallet or hammer.

- 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 PYRAMAT® 25 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 Pyramat® 25 will be installed. The channel surface should be uniform and smooth, having deleterious matter such as rocks, clods, vegetation or other objects removed so that during Pyramat® 25 laydown, Pyramat® 25 comes in direct, intimate contact with the channel surface.

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MELBOURNE P: (03) 9791 1772 F: (03) 9791 1776
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2. Prepare the area to be armoured with Pyramat® 25 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 300 mm deep x 300 mm wide across the channel at the downstream end of the project (Figure 1). Deeper IC trench and/or hard armouring may be required for channels that have the potential for scour.

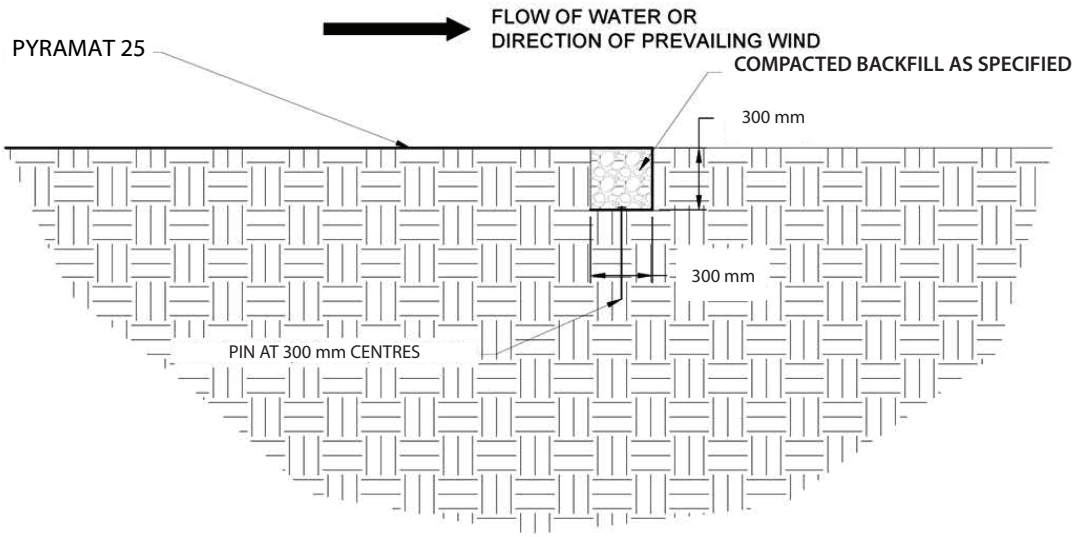

Figure 1: Initial Channel (IC) Trench

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

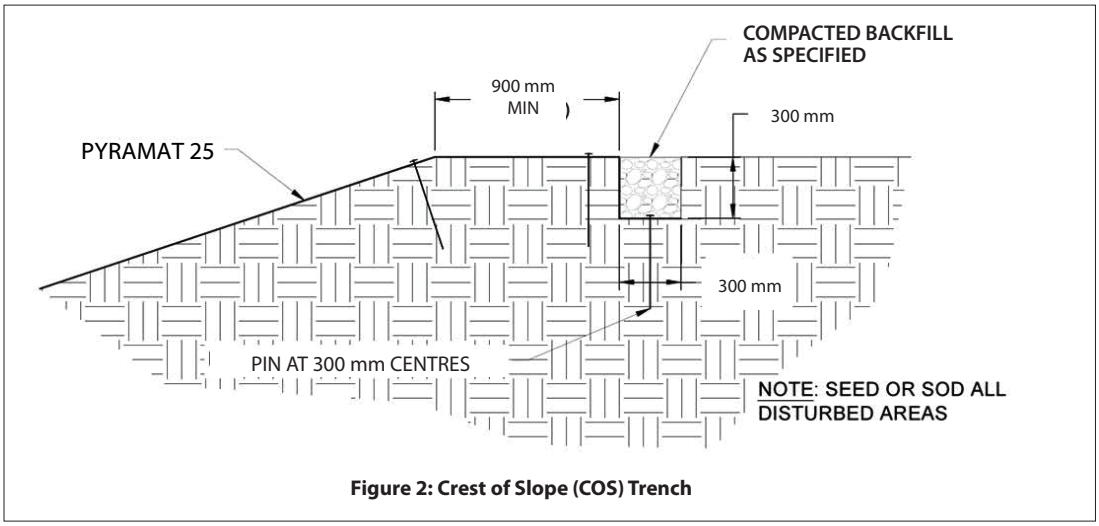

Figure 2: Crest of Slope (COS) Trench

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F: (07) 3865 4444

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F: (08) 9459 4311

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

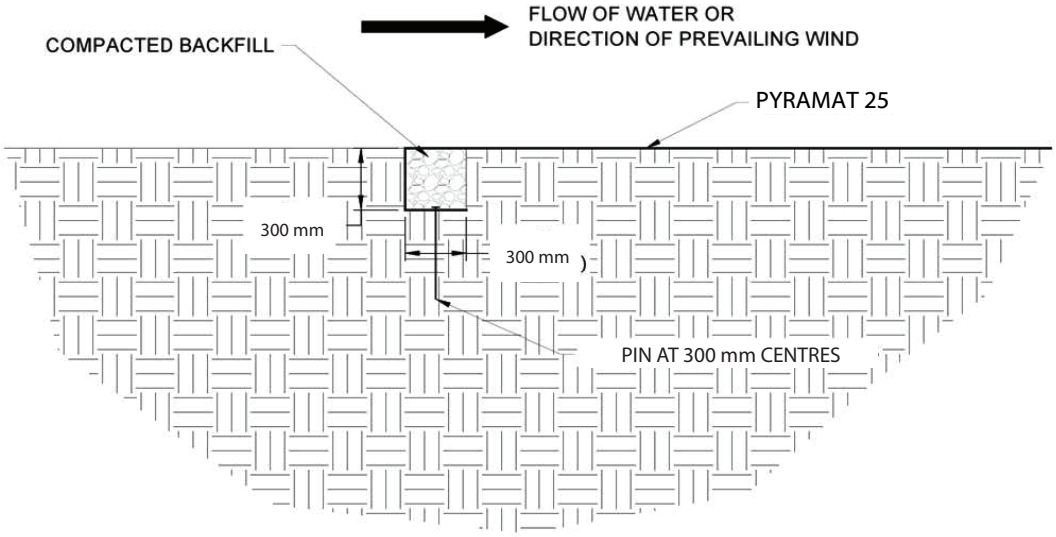

Figure 3: Terminal Channel (TC) Trench

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

PYRAMAT® 25 LAYDOWN

1. Begin the Pyramat® 25 laydown process in the centre 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 pinned. Panel edges should rest parallel to the channel centre line. For best results, panels of Pyramat® 25 should be continuous and free from seams. Panel edge and end overlapping should follow a pattern of placing each proceeding panel's edge over the top of the previous panel edge, shingling the panels in the direction of the water flow.

2. Place the Pyramat® 25 panels by laying the Pyramat® 25 rolls on the downstream side of the IC trench so that the roll end points towards the IC trench (Figure 4), with a 75 mm overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 75 mm overlap during Pyramat® 25 laydown. (Figure 14).

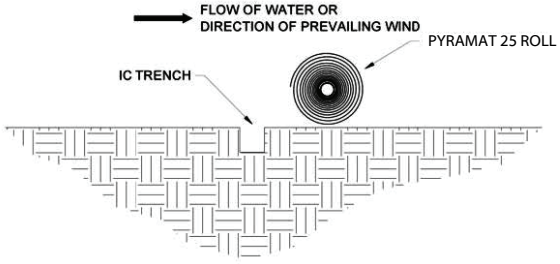

Figure 4: Initial Channel (IC) Trench Alignment

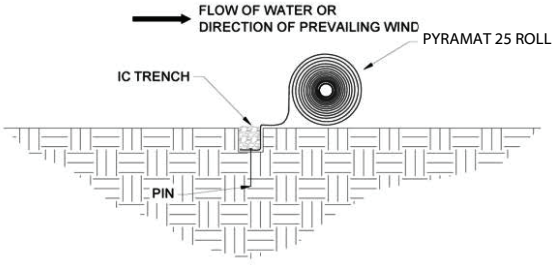

Figure 5: Initial Channel (IC) Trench Placement

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3. Place the Pyramat® 25 roll ends in the IC trench, ensuring full coverage along the bottom of the entire IC trench with the Pyramat® 25 (Figure 5).

4. Secure Pyramat® 25 with pins in the IC trench (Figure 5). Pins should be U pins with a minimum length of 150 mm and shall be made of mild steel with a 4 mm minimum diameter (Figure 6). Longer pins may be required for looser soils. Heaver metal stakes may be required in rocky soils. Suggested placement of pins for the IC trench is along the bottom of the trench with pins on 300 mm. Pins should also be installed on panel edge overlaps in the IC trench.

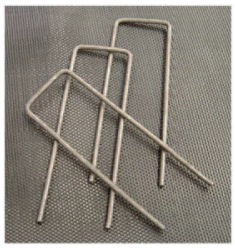

Figure 6: Securing Pin

5. Backfill and compact the IC trench in the location of the centre Pyramat® 25 panel only (Figure 5).

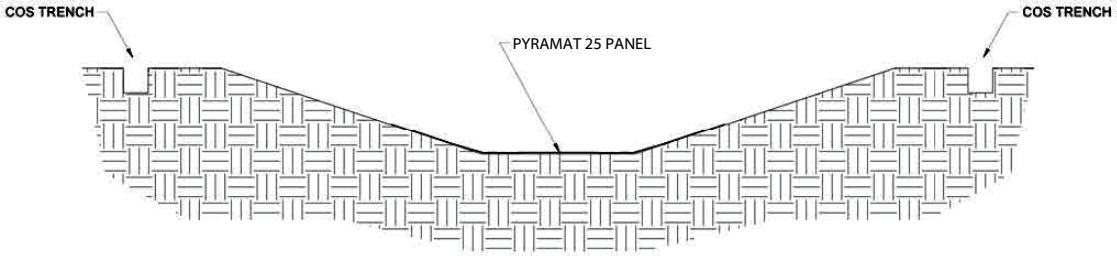

Figure 7: Centre Panel Placement

6. Starting with the centre Pyramat® 25 panel (Figure 7), roll the Pyramat® 25 rolls over the top of the compacted IC trench and upstream across the surface of the channel (Figure 8). Ensure that Pyramat® 25 has intimate contact with the ground and all irregular surfaces beneath the Pyramat® 25 are removed.

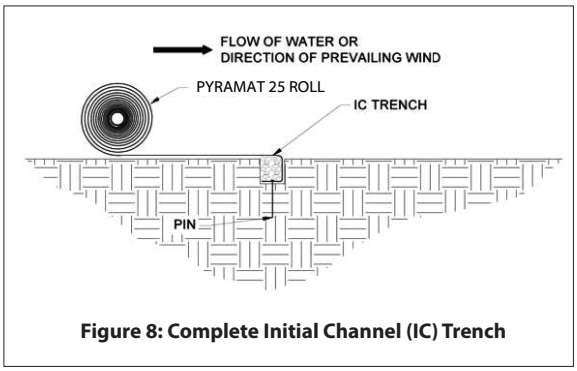

Figure 8: Complete Initial Channel (IC) Trench

7. For channel lengths greater than the length of the Pyramat® 25 Rolls available, place additional Pyramat® 25 panels by laying the Pyramat® 25 rolls on the upstream side of the TC trench so that the roll end points towards the TC trench (Figure 10), with a 75 mm overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 75 mm overlap during Pyramat® 25 laydown. (Figure 13)

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F: (02) 9725 4304

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8. Place the Pyramat® 25 roll edge in the TC trench, ensuring full coverage along the bottom of the entire TC trench with the Pyramat® 25 (Figure 9).

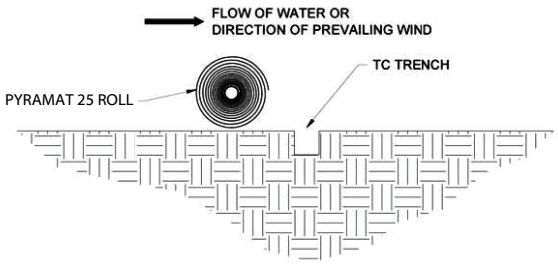

Figure 9: Terminal Channel (TC) Trench Alignment

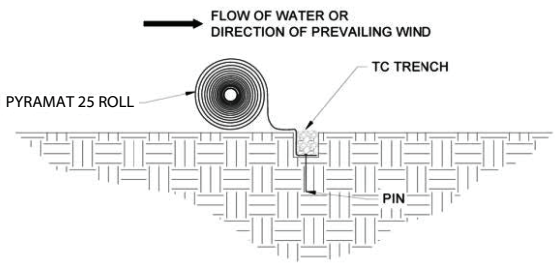

Figure 10: Terminal Channel (TC) Trench Placement

9. Secure Pyramat® 25 with pins in the TC trench (Figure 9). Suggested placement of pins for the TC trench is along the bottom of the trench at 300 mm centres. Pins 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® 25 panel only (Figure 10).

11. Starting with the centre Pyramat® 25 panel (Figure 7), roll the Pyramat® 25 rolls over the top of the compacted TC trench and downstream across the surface of the channel (Figure 11). Ensure that Pyramat® 25 has intimate contact with the ground and all irregular surfaces beneath the Pyramat® 25 are removed.

12. Overlap the upstream Pyramat® 25 panels a minimum of 150 mm over the top of the downstream Pyramat® 25 panels following the roll end anchoring requirements outlined below (Figure 14).

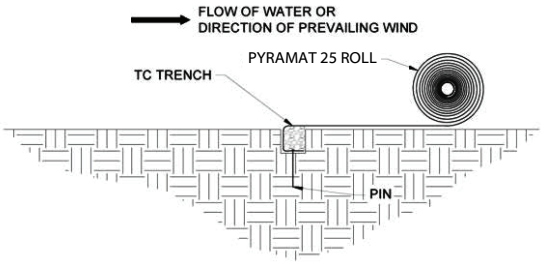

Figure 11: Terminal Channel (TC) Trench Complete

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13. Secure Pyramat® 25 panels in place using pins across the channel surface according to the project's engineered design. Pin placement should reflect a staggered checkerboard pattern across the channel surface for best results (Figure 12 and Figure 13).

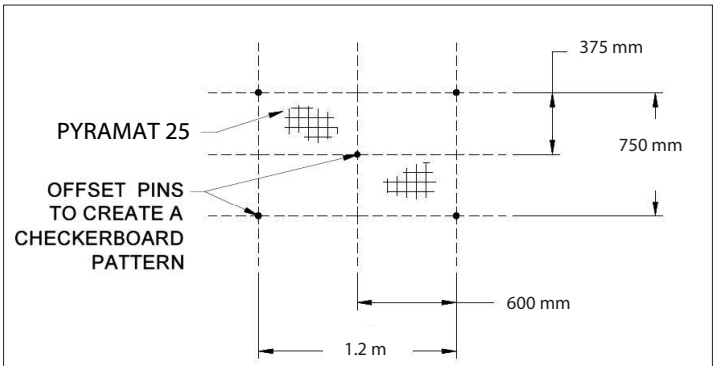

Figure 12: Example Pin Pattern

- Roll edges shall be overlapped a minimum of 75 mm with pins placed at 300 mm centres (Figure 13).

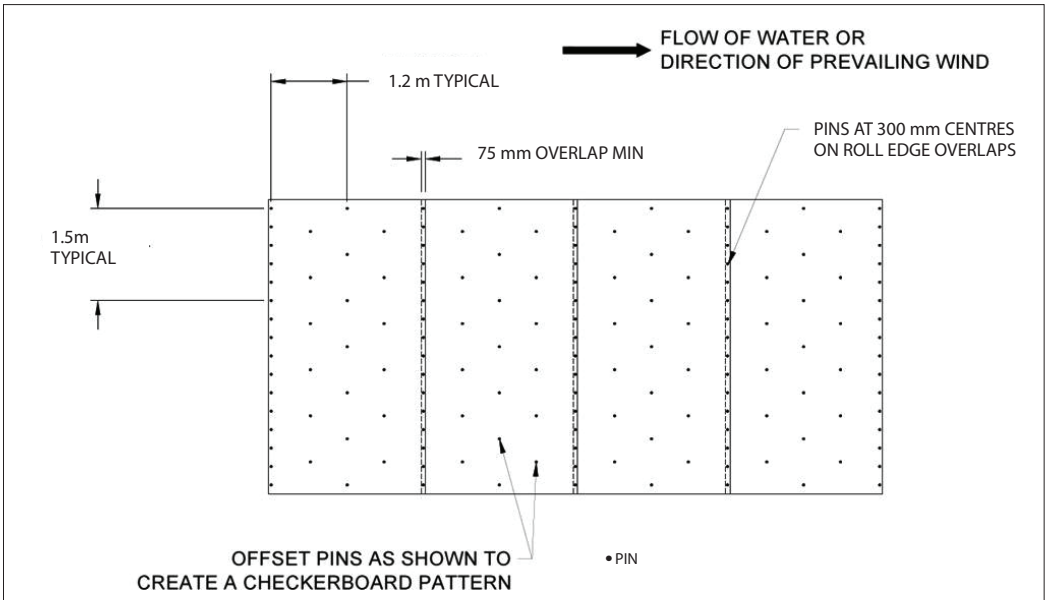

Figure 13: Example Edge Overlap Pattern

- Roll ends shall be overlapped a minimum of 150 mm with upstream panel on top. Secure roll end overlaps with two rows of pins staggered 150 mm apart at 300 mm centres (Figure 14).

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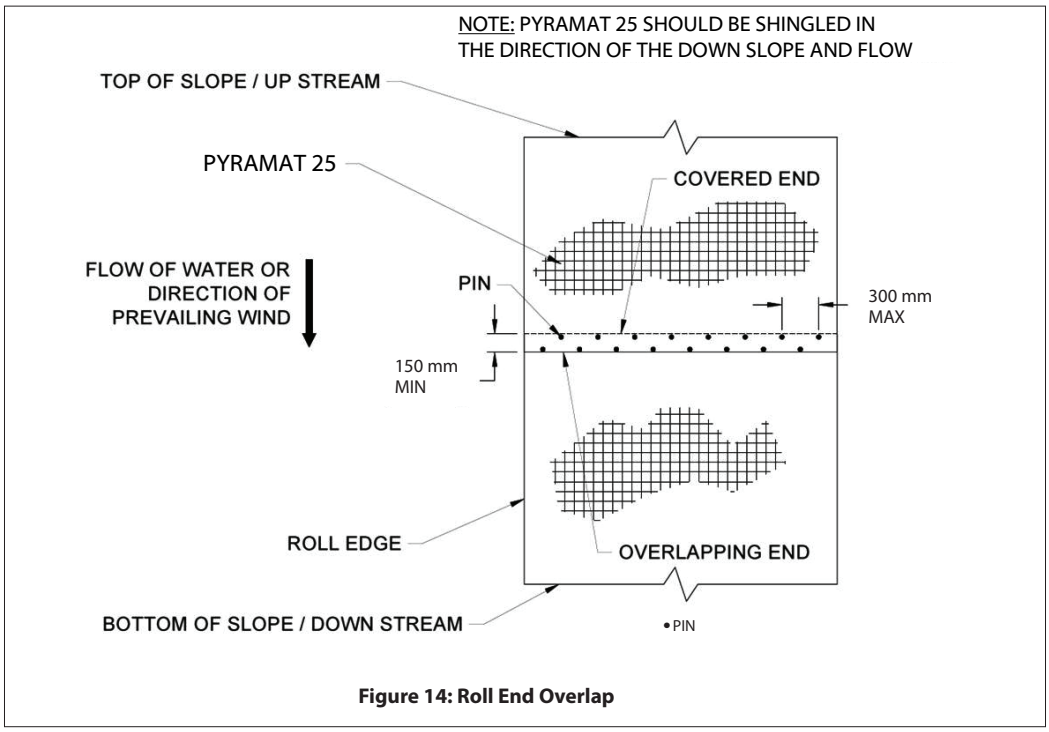

Figure 14: Roll End Overlap

- For channel lengths greater than 14 m, install simulated check slots. This method includes placing two rows of pins 300 mm apart at 300 mm centres at 14 m maximum intervals or across the midpoint of the slope for slope lengths less than 18 m (Figure 15).

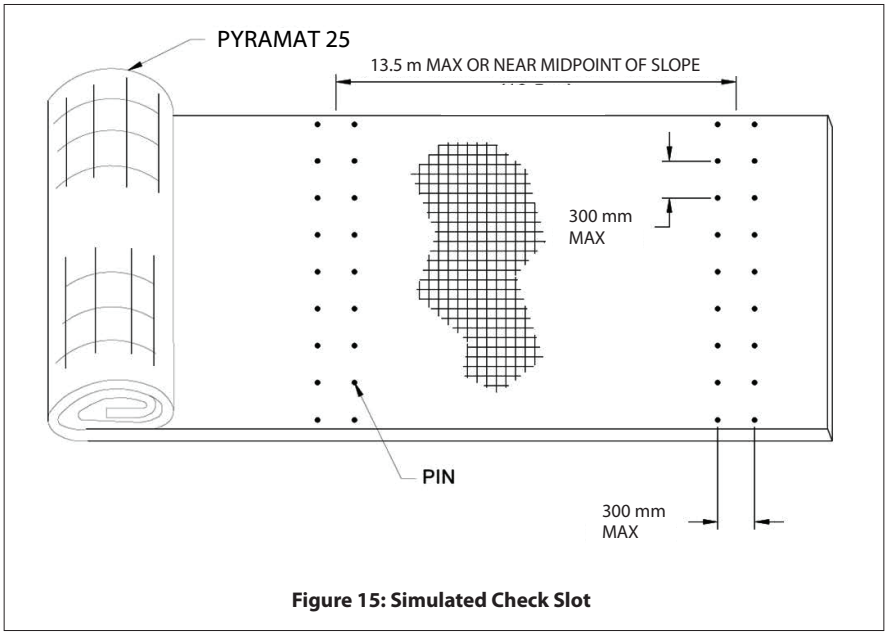

Figure 15: Simulated Check Slot

- At the break in slope interface towards the channel bed, it is suggested that Pins be installed on 300 mm centres (Figure 16).

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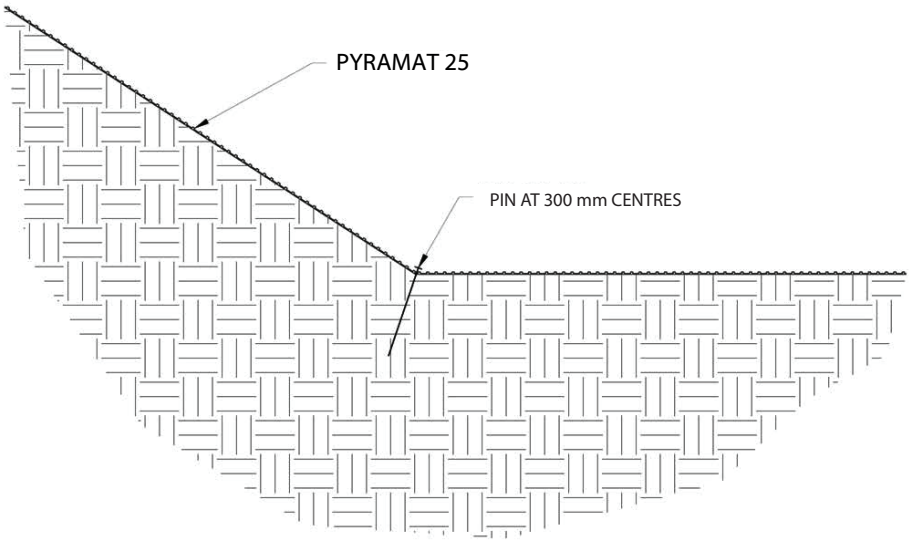

Figure 16: Break in Slope Interface

14. Continue to work along the width of the channel by repeating steps 11 through 13 overlapping each adjacent Pyramat® 25 panel edge by 75 mm (Figure 17). The Pyramat® 25 panels placed on the crest of the side slopes should terminate their edges in the COS trench with pins on 300 mm centres.

15. Place the final Pyramat® 25 panel edges in the COS trench, ensuring full coverage along the bottom of the entire COS trench with the Pyramat® 25 (Figure 17).

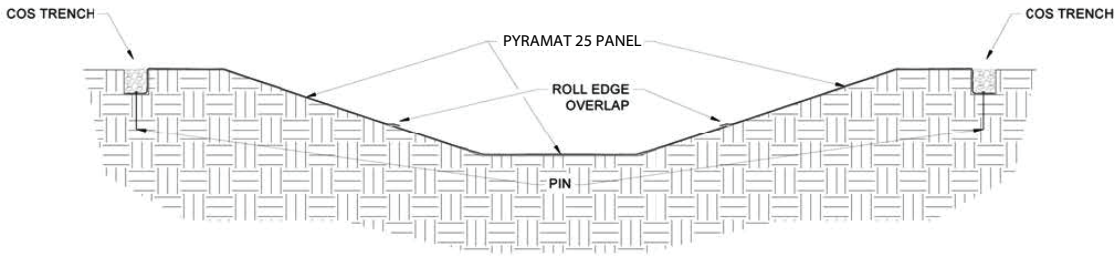

Figure 17: Crest of Slope (COS) Placement

16. Secure Pyramat® 25 with pins in the COS trench. Suggested placement of pins for the COS trench is along the bottom of the trench on 300 mm centres (Figure 17).

17. Backfill and compact the COS (Figure 17).

18. At a minimum, Pyramat® 25 panels should be pinned entirely across the channel surface, pins should be installed in the trenches, and the trenches should be backfilled and compacted at the end of each day to minimise rework in

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the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example isometric view (Figure 18) of a channel armoured with Pyramat® 25 can be seen below for overall reference. Consult Global Synthetics at www.globalsynthetics.com.au with any questions that you may have.

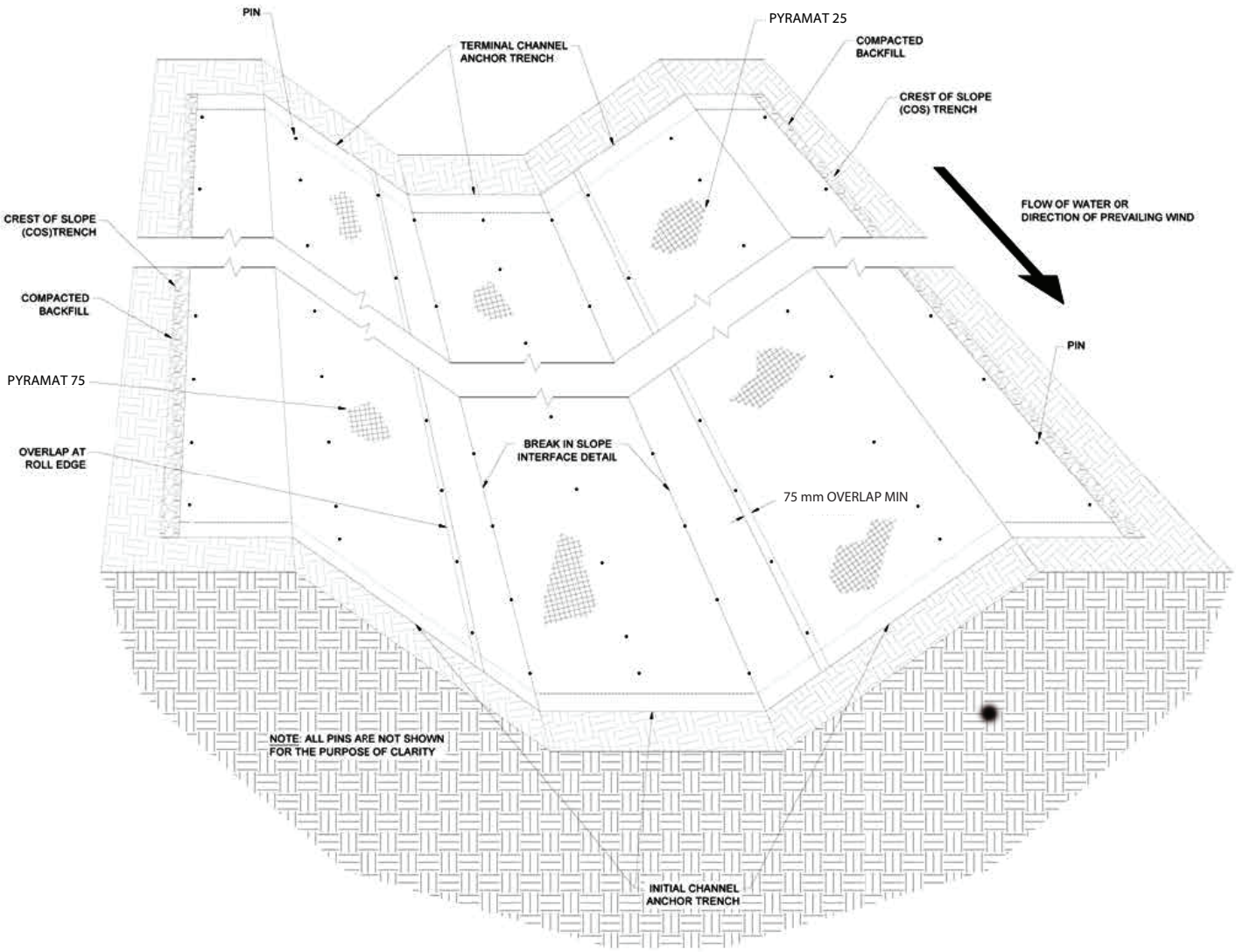

Figure 18: Completed Channel Isometric View

ESTABLISH VEGETATION

Vegetation can be established with Pyramat® 25 by broadcast seeding, hydraulic seed application (hydroseeding), or turf/ 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 fertiliser, need to be incorporated into the soil to promote healthy vegetation.

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WITH SEED

1. Determine the seed location. Seed can be placed entirely on top of soil filled Pyramat® 25, or alternatively 50% below Pyramat® 25 prior to pinning, with the remainder placed on top of soil filled Pyramat® 25. If a rain event occurs prior to vegetation establishment, having 50% of the seed below Pyramat® 25 ensures that some seed remains in place. Seed placed entirely on top of soil filled Pyramat® 25 will allow for faster vegetation establishment.

2. If seeding below Pyramat® 25, ensure 50% of the seed is placed prior to the installation of Pyramat® 25.

3. Once Pyramat® 25 is in place, distribute soil on top by filling the Pyramat® 25. The proper amount can be visually measured by making the top ridges of the pyramid projections barely visible, or is approximately 25 mm thick when measured. Soil filling can be accomplished manually or by using a small piece of equipment. Do not place excessive soil above Pyramat® 25. See Consider Project Specific Needs for guidance on driving equipment across Pyramat® 25.

4. Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of approximately 50 mm. 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 OR TURF

1. Turf or Sod will be always placed on top of Pyramat® 25 of immediate vegetative growth.

2. Pins should be used to secure the sod/ turf against Pyramat® 25. During the placement of the sod/ turf, ensure that Pyramat® 25 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/ turf emerges. These areas may need to be addressed to ensure proper grass establishment.

CONSIDER PROJECT SPECIFIC NEEDS

1. A deeper trench and/or hard armouring may be required when channels have severe scour potential at IC and TC trenches.

2. For installing Pyramat® 25 panels around curved sections of a channel, trim panels at an angle so that no more than two layers of Pyramat® 25 overlap at any point in time. Additional pins may be needed to secure panel edges towards the break in slope interface depending upon the radius of the curved channel. Install pins as necessary to securely fasten Pyramat® 25 to the ground.

3. Vehicular traffic should not be allowed on Pyramat® 25 at any time.

4. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed or turf such areas.

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SHORT-TERM AND LONG-TERM MAINTENANCE OF PYRAMAT® 25

The purpose of this section is to provide some general guidelines for performing short-term and long-term maintenance of Pyramat® 25 with respect to maintaining vegetation reinforced with Pyramat® 25, and patching of Pyramat® 25 (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.

PYRAMAT® 25 PROTECTED CHANNEL

For Pyramat® 25 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 Pyramat® 25, 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 Pyramat® 25 is losing intimate contact with the channel surface. If loss of ground surface occurs, Pyramat® 25 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 Pyramat® 25 is reinstalled, re-establish vegetation on the newly installed Pyramat® 25 and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimise exposure to unwanted maintenance and repair, Pyramat® 25 armoured channels should be free of vehicular traffic. Routine maintenance and channel inspections should be performed by foot traffic only. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over Pyramat® 25 in times of emergency after vegetation establishment is complete. Failure to control unauthorised traffic can result in Pyramat® 25 being damaged resulting in erosion below Pyramat® 25 during storm events.

MAINTAINING VEGETATION

Good vegetative cover will ensure maximum performance of Pyramat® 25. Vegetative cover care starts before a project is complete and is ongoing until all Pyramat® 25 is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilise, 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 life cycle of Pyramat® 25, every effort must be made to prevent unauthorised encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning during inappropriate seasons.

PATCHING AND REPAIRS

Pyramat® 25 may require localised repair at times. For emergency repairs, an adequate supply of Pyramat® 25 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 50 mm or more. When patrolling look for areas of sparse vegetation, exposed edges of Pyramat® 25, and areas where direct contact between Pyramat® 25 and the channel surface is compromised. Pyramat® 25 should be rated as Acceptable, Minimally Acceptable, or Unacceptable during inspection.

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A. Acceptable (A) - The rated area is in satisfactory, acceptable condition, and will function as designed and intended during the rain event. Pyramat® 25 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. Pyramat® 25 has 75% vegetation cover with un-vegetated patches as large as one square metre. Edges of Pyramat® 25 are exposed with noticeable damage. Minimal erosion has occurred underneath Pyramat® 25.

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. Pyramat® 25 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 one square metre, and there is evidence that erosion is occurring beneath Pyramat® 25.

2. Repair any raised or exposed edges of Pyramat® 25 by driving existing and additional pins along the edges as necessary to securely fasten to the ground. Inspect areas where the vegetation is not growing on top of Pyramat® 25 Many times this is an indicator that Pyramat® 25 has lost contact with the ground beneath. Check for voids beneath Pyramat® 25 and fill any holes, gullies, etc. with compacted fill material if possible. Replace Pyramat® 25 as described below.
3. To repair Pyramat® 25, cut out and remove damaged areas in a square configuration a minimum size of 600 mm by 600 mm. Remove all vegetation and debris atop of Pyramat® 25. Loosen the top 25 to 50 mm 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® 25 patch a minimum of 300 mm greater than the damaged area for all four sides of the patch. Overlap the patch area in all directions a minimum of 300 mm. The patch overlaps shall be tucked under the existing damaged Pyramat® 25 material (Figure 19 and Figure 20).

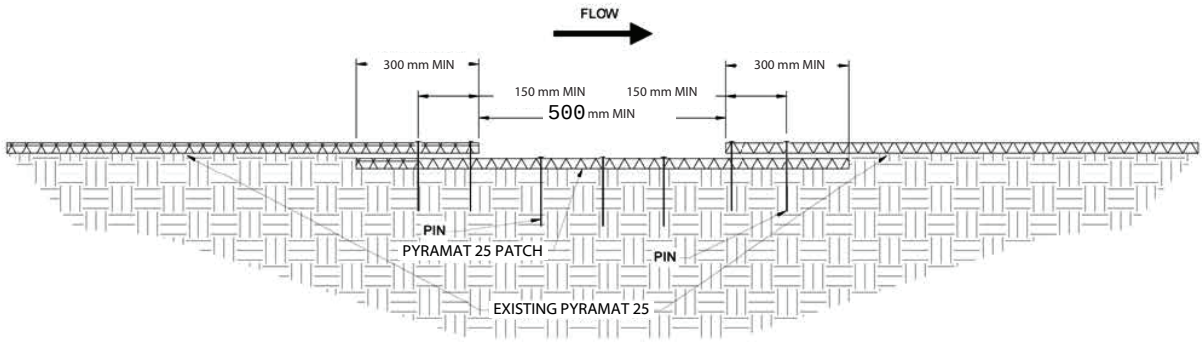

Figure 19: Pyramat® 25 Patch Cross Section

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BRISBANE P: (07) 3865 7000 F: (07) 3865 4444
PERTH P: (08) 9459 4300 F: (08) 9459 4311
MELBOURNE P: (03) 9791 1772 F: (03) 9791 1776
ADELAIDE P: (08) 8384 8894 F: (08) 8384 3886
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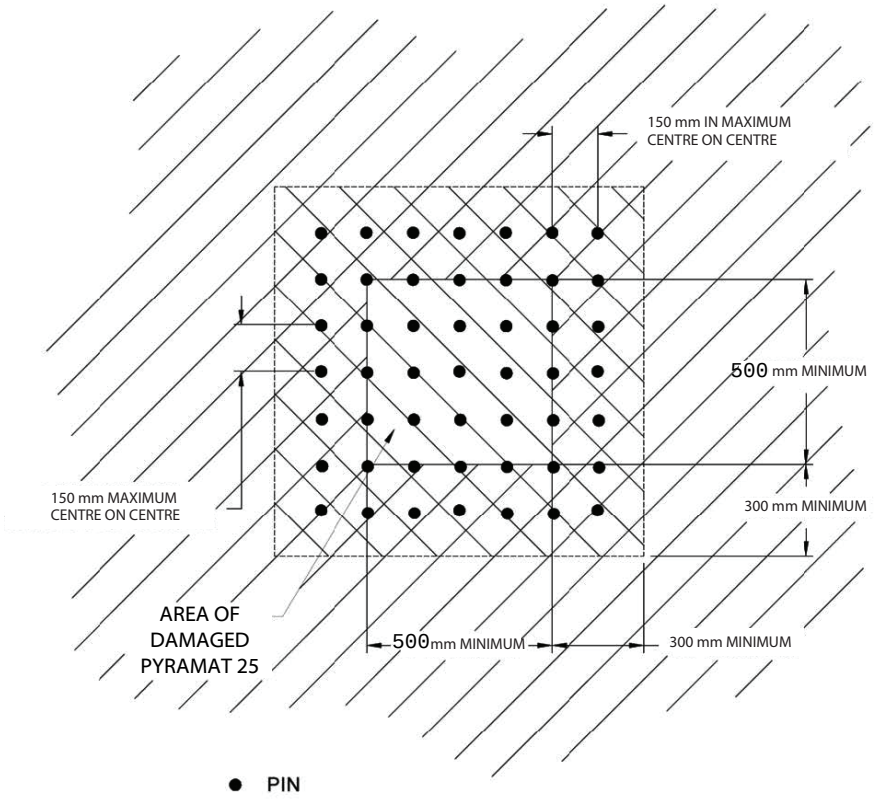

Figure 20: Pyramat® 25 Patch Plan View

4. Install pins at 150 mm (max) centres. For larger areas of damage, anchors should be installed to match existing anchor pattern. Once Pyramat® 25 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 armoured area should be covered with no bare or dead spots greater than one square metre. Throughout the duration of the project, the contractor should be responsible for mowing to facilitate growth and should not let the vegetation in the armoured area exceed 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 Pyramat® 25 installed areas for long term performance and best results as described herein for superior slope armouring.

July 17

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SYDNEY P: (02) 9725 4321 F: (02) 9725 4304
BRISBANE P: (07) 3865 7000 F: (07) 3865 4444
PERTH P: (08) 9459 4300 F: (08) 9459 4311
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