Section 35 43 00 – Permanent Geosynthetic Turf Reinforcement Mat

GENERAL

1.01 SUMMARY

A. This section specifies the permanent Geosynthetic Turf Reinforcement Mat (TRM) Futerra™ 7020 with Flexterra® High Performance - Flexible Growth Medium™ (HP-FGM™) infill, to prevent long-term soil and vegetation loss resulting from excessive water flow (velocity and shear stress) in which unreinforced vegetation could not resist.Both the TRMand HP-FGM are made in the United States of America. The HP-FGM provides immediate and temporary protection against movement and/or loss of soil until vegetation can be established. The HP-FGM infill also provides an ideal environment for rapid seed germination and accelerated plant and root establishment within the matrix of the TRM.

B. Related Sections: Other Specification Sections, which directly relate to the work of this Section include, but are not limited to the following:
   1. *Section 01 57 13 - Temporary Erosion and Sedimentation Controls*
   2. *Section 02 24 23 – Chemical Sampling and Analysis of Soils*
   3. *Section 31 25 00 - Erosion and Sedimentation Controls*
   4. *Section 31 35 00 - Slope Protection*
   5. *Section 32 01 90.16 - Amending Soils*
   6. *Section 32 91 00 - Planting Preparation*
   7. *Section 32 92 00 - Turf and Grasses*
   8. *Section 35 30 00 - Shoreline Protection*

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rate.

B. Certifications: Manufacturer shall submit a letter of certification that the product meets or exceeds all technical and packaging requirements and is made in the U.S.A.

1.03 DELIVERY, STORAGEAND HANDLING

A. Deliver materials and products in UV and weather-resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations.

PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. PROFILE Products LLC
   750 Lake Cook Road – Suite 440
   Buffalo Grove, IL 60089
   International - +1-847-215-1144
   United States and Canada –800-366-1180 (Fax 847-215-0577)
   www.profileproducts.com

2.02 MATERIALS

A. Turf Reinforcement Mat shall be Futerra 7020, manufactured for the purpose of permanent channel lining and turf reinforcement. The TRM shall be made from 100% synthetic material and contain no biodegradable components or materials.

1. The TRM shall be a homogeneous, three-dimensional matrix consisting of continuous monofilament yarns which are thermally fused at the crossover points to provide a structure that will maintain its dimensional stability without laminated or stitched layers. No nettings or stitching shall be permitted. The TRM shall have a minimum 95% open space available for soil, HP-FGM and root interaction. The TRM shall not lose its structural integrity and shall not unravel or separate when TRM is cut in the field.

2. The TRM shall exhibit no buoyancy factor (i.e., the specific gravity of the fibers used should be greater than 1.0) so as to allow the TRM to maintain intimate contact with the soil (particularly between fasteners) under low flow or submersed conditions.

3. The TRM, when infilled with HP-FGM, shall meet the following property values:

	Test Method	**Units**	**Tested Value**	
Mechanical Properties			**Typical**	**MARV**
Mass Per Unit Area	ASTM D 6566	oz/yd^2 (g/m^2)	12.0 (407)	11.0 (373)
Thickness (Min)	ASTM D 6525	inches (mm)	0.75 (19)	0.6 (15.2)
Tensile Strength (MD)	ASTM D 6818	lb/ft (kN/m)	240 (3.5)	175 (2.6)
Resiliency (Min)	ASTM D6524	%	85	80
Light Penetration (Min)	ASTM D6567	%	1.0	
Ground Cover (Max)	ASTM D6567	%	99	
UV Stability (2000 hrs)	ASTM D4355	%	80	
Endurance				
Functional Longevity[1]	Observed	Months	> 36	
Performance				
C-Factor[2]/ % Effectiveness[2]	Large Scale[3]	n/a / %	< 0.01 / > 99	
Manning's n Range	ASTM D6460[4]	n/a	0.025 – 0.045	
Permissible Veg. Velocity	ASTM D6460[4]	ft/s (m/s)	20.0 (6.1)	
Permissible Veg. Shear	ASTM D6460[4]	lb/ft^2 (N/m^2)	17.0 (810)	
Permissible Unveg. Velocity	ASTM D6460[4]	ft/s (m/s)	16.0 (4.9)	
Permissible Unveg. Shear	ASTM D6460[4]	lb/ft^2 (N/m^2)	5.8 (280)	
Vegetation Establishment	ASTM D7322	%	800	
Physical	**Units**		**Typical Value**	
Dimensions [width x length]	ft (m)		8.0 x 112.5 (2.4 x 34.3)	
Roll Area	yd^2 (m^2)		100 (83.6)	
Estimated Roll Diameter	ft (m)		2.0 (0.6)	
Estimated Roll Weight	lb (kg)		75 (34)	
Color	n/a		Black	

1. Functional longevity is an estimate of product functionality and is dependent upon moisture, light, microbial and other environmental conditions.
2. Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface. % Effectiveness = One minus Cover Factor multiplied by 100%.
3. Large scale testing conducted at Utah Water Research facility using rainfall simulator on 2.5H:1V slope, sandy-loam soil, at a rate of 5" per hour for a duration of 60 minutes.
4. Flume testing performed at Colorado State University – data and details available upon request.

B. All components of the HP-FGM shall be pre-packaged by the Manufacturer to assure both material performance and compliance with the following values. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and biostimulant materials should be added to this product.

1. Thermally Processed* (within a pressurized vessel) Wood Fiber – 80%
   *Heated to a temperature greater than 380 degrees Fahrenheit (193 degrees Celsius) for 5 minutes at a pressure greater than 50 psi (345 kPa)
2. Wetting agents (including high-viscosity colloidal polysaccharides, cross-linked biopolymers, and water absorbents) – 10%
3. Crimped Biodegradable Interlocking Fibers – 5%
4. Micro-Pore Granules – 5%

EXECUTION

3.01 SOIL TESTING

A. Soil Samples shall be taken and sent to a third-party, independent lab for analysis and in compliance with Section 02 24 23– Chemical Sampling and Analysis of Soils, if applicable.

B. The tests shall include analysis and interpretation of results.

C. The soil testing methods used shall be compliant with recognized agronomic testing standards, as outlined in Section 02 24 23, for revegetation of disturbed sites.

D. Soil Analysis shall include results for:

1. Soil pH
2. Soluble Salts
3. Excess Carbonate
4. Organic Matter
5. Nutrient readings for:
   i. Nitrogen, Phosphorus, Potassium
   ii. Magnesium, Calcium, Sodium, Manganese, Sulfur, Zinc, Copper, Iron, Boron
6. Cation Exchange Capacity
7. Percent Base Saturation Sodium

E. ProGanics® BSM, BioPrime™, JumpStart™, Aqua-pHix™ and NeutraLime™ Dry or other amendments shall be specified according to Section 32 01 90.16 –Amending Soils and applied with the hydroseeding slurry at Manufacturer recommended rates based on soil test results.

3.02 VEGETATION SPECIES SELECTION

A. Once soils have been analyzed for agronomic potential and amendment recommendations, selection of suitable plant species for achieving sustainable growth and effective erosion control shall be determined by a qualified seed supplier, consulting professional and/or regulatory agency. Species selection and establishment shall be compliant with Section 32 92 00 – Turf and Grasses, if applicable.

B. Site and project specific information considered for species selection shall include:

1. Project Location and Planning
   i. Climate
   ii. Elevation

iii. Aspect
iv. Slope/Gradient
v. Permanent or Temporary Planting
vi. Installation Date(s)

2. Soil Conditions
   i. Soil Texture
   ii. Soil pH
   iii. Toxicities/Deficiencies noted in the previous section.
3. Site Maintenance Requirements
   i. Mowing
   ii. Irrigation
   iii. Animal grazing preference
4. Preferred Vegetation
   i. Drought Tolerant
   ii. Native Vegetation
   iii. Shrub Species
   iv. Turf Grasses
   v. Cool Season
   vi. Warm Season
   vii. Blend of Cool and Warm Season
   viii. Legume Species
   ix. Cover Crops

3.03 PREPARATION

A. The installation site shall be prepared byclearing, grubbing and excavation or fillingthe area to the design grade.

B. The surface to receive the TRM shall beprepared to relatively smooth conditionsfree of obstructions, rocks, dirt clods,roots, stumps, depressions, debris and softor low density pockets of substrate. Erosion features such as rills, gullies, etc. must be graded out of the surface before TRM deployment. The substrate shall be capable of supporting avegetative cover as determined by soil testing.

C. Compaction as specified by the geotechnical engineer will be required before deploying product to make sure the TRM makesimmediate contact with the soil.

D. Cut trenches for initial anchor trenches,termination trench and longitudinal anchortrenches (12 in (30 cm) wide and 12 in (30 cm) indepth) as shown on the drawings.

3.04INSTALLATION

A. Care shall be taken during installation toavoid damage occurring to the TRM as aresult of the installation process. Should theTRM be damaged during installation, a TRM patch shall be placed over the damaged areaextending 1.0 ft (0.3 m) beyond the perimeterof the damage.

B. Install anchoring devices at a frequency of2.5 pins/staples per square yard (3 pins/staples per square meter). Additionalanchoring devices may be required dependingon site conditions or alignment of the slope or channel. Always staple (12 in (30 cm) centers) theseams between individual TRM rolls.

C. When overlapping successive TRM rolls,the rolls shall be overlapped upstream overdownstream and/or upslope over downslope.

D. For channels, begin at the downstream endin the center of the channel. Inspect trenchesfor position accuracy and depth and re-digto required dimensions. If trenches have not yet been constructed, dig

initial anchortrenches, check slot trenches and longitudinal anchor trenches as illustrated in installationguidelines or as directed on the plans. Unrollapproximately 10 ft(3 m) of the TRM, positioning the rollface down (as it unrolls) over the initial anchortrench, extending several inches beyond thetrench with the roll sitting on the downstream side of the anchor trench. Positioning roll inthis manner permits backfilling and compactionof soil into the trench while allowing installerto proceed with proper deployment of TRM byunrolling upstream, over the anchor trench.

E. Position second TRM with a minimum 4-in(10 cm) overlap of the previous TRM and secure it intothe anchor trench. After entire width area isinstalled with the TRM, then backfill andcompact the anchor trench.

F. Continue deploying TRM upstream to the nextcheck slot. Overlay a minimum of 18 in(45 cm) the ends of rolls with the next roll(s) beingdeployed, or position in bottom of check slot,anchor and backfill and compact checkslots. Continue the processes until you reachthe upstream starting point of the TRM.

G. For slopes, construct top anchor trench1-3 ft (0.3-0.9 m) beyond crest of slope, or as illustratedin drawings or shown in manufacturersrecommended installation guidelines. PositionTRM roll at crest of slope with sufficient materialto line the entire anchor trench plus enoughmaterial left over to cover the trench. Positionadjacent rolls to facilitate 6 in.(0.15m) overlaps. AnchorTRM in trench with appropriate pins/staplesat 1 ft (0.3 m) centers. Once several rolls are anchoredin trench, begin to backfill and compact trenchto original elevation. The preferred method ofdeploying roll down slope is to stand in frontof the roll and pin it as it rolls out down theslope, minimizing foot traffic on TRM, whichwill eliminate depressions under the mat.Always allow the mat to drape over the soil,never pulling it taut, to minimize tenting. Placeadditional pins into any apparent depressions tomaintain contact with the soil.

H. Hydraulically fill the TRM with 0.7 in (18 mm) ofHP-FGM, applied with hose at close range. Optimumapplication rate is 3,500 lb/ac (3,920 kg/ha) or to the depthof where the tips of TRM are still exposed.

I. Strictly comply with HP-FGM manufacturer'sinstallation instructions and recommendations.For optimum HP-FGM pumping and applicationperformance, use approved mechanically agitated,hydraulic seeding/mulching machines, hose ofsufficient length to reach the TRM, use of a 50degree tip/nozzle is highly recommended. ApplyHP-FGM from hose positioned over shoulder withnozzle approximately at chest level (4-5 ftor 1.2-1.5 m) toachieve optimum TRM infill.

J. For optimum hydraulic performance andvegetative establishment, be careful not tooverfill the TRM. The tips of the TRM shall beslightly exposed.

K. Apply supplemental water over the area asdirected by site personnel during germinationand initial three months of vegetation growth.

3.05 CLEANING AND PROTECTION

A. After application, thoroughly flush the tank, pumps and hoses to remove all material. Wash all material from the exterior of the machine and remove any slurry spills. Once dry, material will be more difficult to remove.

B. Clean spills promptly. Advise owner of methods for protection of treated areas. Do not allowtreated areas to be trafficked or subjectedto grazing.

3.06 INSPECTION AND MAINTENANCE

A. All inspections and maintenance recommendations shall be conducted by qualified professionals consistent with the owner, engineer/specifier and regulatory entity(s) expectations.

B. Initial inspections shall insure installations are in accordance with the project plans and specifications with material quantities and activities fully documented. Refer to Section 32 92 00 – Turf and Grasses for any additional details.

C. Subsequent inspections shall be conducted at pre-determined time intervals and corrective maintenance activities directed after each significant precipitation or other potentially damaging weather or site event.

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