

SECTION 213

MULCHING

DESCRIPTION

213.01 This work consists of mulching the seeded areas, furnishing and placing wood chip mulch in the planting beds and plant saucers, furnishing and applying hydromulch with tackifier on roadway ditches and slopes, furnishing and placing tackifier on mulch or soil on roadway ditches or slopes, and furnishing and installing metal landscape border for the separation of planting beds, in accordance with the Contract or as directed. Mulching may be accomplished by the crimping method using straw or hay, by the hydraulic method using wood cellulose fiber mulch, or by other approved methods with approved materials. When a specific mulching method is required, it will be designated in the Contract.

This work includes furnishing and applying spray-on mulch blanket or bonded fiber matrix on top of rock cuts and slopes after seeding or as temporary stabilization as shown on the plans or as directed by the Engineer.

MATERIALS

213.02 Materials shall conform to the following requirements.

(a) *Mulching*. Materials for mulching shall consist of Certified Weed Free field or marsh hay or straw of oats, barley, wheat, rye or triticale certified under the Colorado Department of Agriculture Weed Free Forage Certification Program and inspected as regulated by the Weed Free Forage Act, Title 35, Article 27.5, CRS. Each certified weed free mulch bale shall be identified by one of the following:

- (1) One of the ties binding the bale shall consist of blue and orange twine, or
- (2) The bale shall have a regional Forage Certification Program tag indicating the Regional Forage Certification Program Number.

Mulch shall be inspected for and Regionally Certified as weed free based on the Regionally Designated Noxious Weed and Undesirable Plant List for Colorado, Wyoming, Montana, Nebraska, Utah, Idaho, Kansas and South Dakota.

The Contractor shall not unload certified weed free mulch bales or remove their identifying twine, wire, or tags until the Engineer has inspected and accepted them.

The Contractor shall provide a transit certificate that has been filled out and signed by the grower and by the Department of Agriculture inspector.

The Contractor may obtain a current list of Colorado Weed Free Forage Crop Producers who have completed certification by contacting the Colorado Department of Agriculture, Division of Plant Industry.

Straw or hay in a stage of decomposition (discolored, brittle, rotten, or moldy) or old, dry mulch which breaks in the crimping process will not be accepted.

The type and application rate of mulch material shall be as designated in the Contract.

(b) *Wood Cellulose Fiber Mulch*. Wood cellulose fiber mulch shall consist of virgin wood fibers manufactured expressly from clean whole wood chips. The chips shall be processed in such a manner as to contain no growth or germination inhibiting factors. Fiber shall not be produced from recycled materials such as sawdust, paper, cardboard, or residue from pulp and paper plants. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the mulch material shall form a blotter like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold seed in contact with the soil. The Contractor shall obtain certifications from suppliers that laboratory and field testing of their product has been accomplished, and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

The wood cellulose fiber mulch shall conform to the following specifications:

Property	Requirement
Percent moisture content	10.0% ± 3.0%
Percent Organic Matter* (Wood Cellulose Fiber)	99.3% ± 0.2%
Percent Ash Content*	0.7% ± 0.2%
pH	4.9 ± 0.5
Water Holding Capacity*	1200-1600 grams**
*Oven Dried Basis **Per 100 grams of fiber	

The wood cellulose fiber mulch shall be packaged in units containing current labels, with the manufacturer's name, the net weight, and certification that the material meets the foregoing requirements for wood cellulose fiber mulch.

- (c) *Mulch Tackifier*. Material for mulch tackifier shall consist of a free-flowing, noncorrosive powder produced either from the natural plant gum of *Plantago Insularis* (Desert Indianwheat) or pre-gelatinized 100 percent natural corn starch polymer. The powders shall possess the following properties:

Plantago Insularis (Desert Indianwheat):

Property	Requirement	Test Method
pH 1% solution	6.5 - 8.0	
Mucilage content	75% min.	ASTM D7047

Pre-gelatinized 100 percent natural corn starch polymer:

Property	Requirement
Organic Nitrogen as protein	5.5-7%
Ash content	0-2%
Fiber	4-5%
pH 1% solution	6.5 – 8.0
Size	100% thru 850 microns (20 mesh)
Settleable solids	<2%

All fibers shall be colored green or yellow with a biodegradable dye.

The material used for mulch tackifier shall not contain any mineral filler, recycled cellulose fiber, clays, or other substances which may inhibit germination or growth of plants. Water shall conform to subsection 209.02.

- (d) *Wood Chip Mulch*. Wood chip mulch shall consist of fresh, moist pole peelings material having approximate dimensions; Width: 1/4 to 1/2 inch; Length: 3 to 4 inches

The Contractor shall submit a sample to the Engineer for approval at least 30 days prior to placing on the project.

- (e) *Metal Landscape Border*. The metal landscape border shall consist of a strip of metal such as steel conforming to ASTM A1011 or approved equal.

(f) *Spray-on Mulch Blanket*. Spray on mulch blanket shall be one of the following, unless otherwise shown on the plans:

- (1) Spray-on Mulch Blanket (Type 1) shall be a hydraulically applied matrix containing organic fibers, water soluble cross-linked tackifier, and reinforcing biodegradable fibers. The reinforcing fibers shall completely break down (be compostable) and shall not release metals or toxins. Mulch Blanket (Type 1) shall conform to the following:

Properties	Requirement	Test Method
Organic Fibers	71% Min.	ASTM D2974
Cross linked Tackifiers	10% ± 2% Min.	
Reinforcing Fibers	2.5% Min.	
Biodegradability	100%	ASTM D5338
Ground Cover at Application Rate	90% Min.	ASTM D6567
Functional Longevity	12 Months Min.	
Cure Time	< 8 hours	
Application		
Application Rate	3,000 lb./acre	

The organic fiber shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. The organic fibers and reinforcing interlocking fibers cannot be produced from sawdust, cardboard, paper, or paper by-products.

- (2) Spray-on Mulch Blanket (Type 2) shall be a hydraulically applied matrix pre-packaged in 50-pound bags containing both a soil and fiber stabilizing compound and thermally processed wood fiber.

The sterilized weed-free wood fiber mulch shall be manufactured through a thermo-mechanical defibrating process containing a specific range of fiber lengths averaging 0.25 inches or longer.

Mulch Blanket (Type 2) shall meet the following requirements:

Property	Requirement	Test Method
Fiber Retention On 28-Mesh Screen	≥ 40%	Tyler Ro-Tap Method
Moisture Content	12% ± 2%	Total Air Dry Weight Basis
Organic Matter	99.2% ± 0.2%	Oven Dry Weight Basis
Ash Content	0.8% ± 0.2%	Oven Dry Weight Basis
pH At 3% Consistency In Water	4.5-7.0 ± 0.5%	
Sterilized Weed-Free	Yes	
Non-Toxic To Plant Or Animal Life	Yes	
Application		
Application rate	3,000 lb./acre	

The soil and fiber stabilizing compound shall be composed of linear anionic copolymers of acrylamide pre-packed within the bag having a minimum content of 1.0 percent. The compound shall conform to the following:

Property	Requirement
Molecular Weight	≥ 12x10 ⁶
Charge Density	> 25%
Non-Toxic To Plant Or Animal Life	Yes

- (g) *Bonded Fiber Matrices (BFM)*. BFM shall consist of hydraulically-applied matrix with a minimum of 70 percent non-toxic thermally processed or refined long strand organic fibers and water soluble tackifier to provide erosion control and shall be designed to be functional for a minimum of 9 months. BFMs form an erosion-resistant blanket that promotes vegetation and prevents soil erosion. The BFM shall be 100 percent biodegradable. The binder in the BFM shall also be biodegradable. BFMs shall conform to the following requirements:

Property	Requirement	Test Method
Ground Cover (%)	95	ASTM D6567
Bio-degradability (%)	100	ASTM D5338
functional Longevity (months)	9 month minimum	
Cure Time (hours)	24-48	
Cross-linked Tackifier	10% minimum	
Application		
Application Rate (lbs./Acre)	3000	

The fibers shall not contain lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach. Fiber shall not be produced from sawdust, cardboard, paper, or paper by-products.

CONSTRUCTION REQUIREMENTS

213.03

- (a) *Hay or Straw Mulching.* After seeding has been completed or when required for erosion control, hay or straw shall be uniformly applied, with no bare soil showing, at the rate designated in the Contract or as directed. It shall be crimped in with a crimper or other approved equipment. The Engineer may order hand-crimping on areas where mechanical methods cannot be used.

The seeded area shall be mulched and crimped within four hours after seeding. Areas not mulched and crimped within four hours after seeding or prior to precipitation or damaging winds on site shall be reseeded with the specified seed mix at the Contractor's expense, prior to mulching and crimping.

When tackifier is required in the Contract it shall be applied in the following order: (1) mulching, (2) mulch tackifier.

- (b) *Hydraulic Mulching.* Wood cellulose fiber mulch and mulch tackifier shall be added to water to form a homogeneous slurry.

The operator shall spray apply the slurry mixture uniformly over the designated seeded area.

Hydraulic mulching shall not be done in the presence of free surface water.

Mixing procedure for the hydraulic mulch and tackifier mixture shall be as follows:

- (1) Fill tank with water approximately 1/4 full.
- (2) Continue filling while agitating with engine at full rpm.
- (3) Pour tackifier, at a moderate rate, directly into area of greatest turbulence.
- (4) With the recommended amount of tackifier in solution, add wood cellulose fiber mulch. Do not add fertilizer.

Apply the hydromulch and tackifier mixture at the following rate:

Wood Cellulose Fiber Mulch	Tackifier
2,000 lbs./Acre	100 lbs./Acre

(c) *Mulch Tackifier*. Mixing procedure for mulch tackifier shall be as follows:

- (1) Fill tank with desired amount of water and run engine at full R.P.M.
- (2) Add wood cellulose fiber. Agitate until a homogenous, non-lumpy slurry is formed. Do not add fertilizer
- (3) Slowly sift powdered tackifier into slurry and continue to agitate for at least five minutes.

Mulch tackifier shall be sprayed over hay or straw using a nozzle that will disperse the spray into a mist that will uniformly cover the mulch.

Application Rate: Apply this as an overspray at the following rate or as approved by the Engineer.

Powder	Wood Cellulose Fiber	Water
200 lbs./Acre	300 lbs./Acre	2,000 gal./Acre

(d) *General*. Mulch shall be tacked simultaneously or immediately upon completion of mulching and crimping to avoid nonuniform coverage. Areas not properly mulched, or areas damaged due to the Contractor's negligence, shall be repaired and remulched as described above, at the Contractor's expense.

Mulch removed by circumstances beyond the Contractor's control shall be repaired and remulched as ordered. Payment for this ordered corrective work shall be at the contract prices.

The Engineer may order test sections be established for adjusting the mulching equipment to assure conformance with the specified application rate. The Engineer may order equipment readjustment at any time.

(e) *Wood Chip Mulch*. A 4-inch layer, unless otherwise shown in the plans, of wood chip mulch shall be uniformly applied to all planting beds as shown on the plans or as directed. Wood chip mulch shall be placed in all tree and shrub saucers in seeded areas. Wood chip mulch shall be capable of matting together to resist scattering by the wind.

(f) *Metal Landscape Border*. Metal landscape border shall be installed along the lines and at the grades shown on the plans by an approved method that will not damage the border. Ends of metal landscape border shall overlap the next adjacent section a minimum of 6 inches. Metal landscape border shall be anchored with wire tie-downs at intervals of approximately 2 feet. Wire tie-downs shall be 9-gage wire at least 14 inches long. Metal landscape border shall be inserted into the ground by driving against the wire tiedowns; ground may be moistened to ease entrance into the ground. Driving on edge of metal landscape border will not be permitted except when the edge is properly shielded. Metal landscape border may be bent for sharp angles, and overlapped at closure of perimeter.

(g) *Spray-On Mulch Blanket*. Spray-on mulch blanket installation shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes and bio nutrients will be permitted. The spray-on mulch blanket shall be mixed and applied as follows:

The hydromulching vessel shall be filled with water to at least $\frac{1}{3}$ capacity (high enough to cover agitators) prior to adding any material. Continue to fill vessel with water and slowly add the fibers while agitators are in motion. Run agitators at $\frac{3}{4}$ speed. Continue to mix tank a minimum of 10 minutes prior to application.

Apply spray-on mulch blanket in a uniform application using a minimum 22-degree arc type nozzle. Apply hydro slurry in two directions (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers).

Co-polymer shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and should not be used on saturated soils that have groundwater seeps.

(h) *Bonded Fiber Matrices (BFM)*. Bonded fiber matrices shall strictly comply with the Manufacturer's mixing recommendations and installation instructions. No chemical additives with the exception of fertilizer, soil pH modifiers, extended-term dyes, and bio stimulant materials shall be permitted. BFMs shall be applied in a uniform application using a minimum 22-degree arc type nozzle. BFMs shall be applied in two directions (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers).

Biodegradable BFMs shall not be applied immediately before, during, or immediately after rainfall if the soil is saturated.

BFMs shall not be used use in channels, swales, or other areas where concentrated flows are anticipated and shall not be used on saturated soils that have groundwater seeps.

Foot traffic, mechanical traffic or grazing shall not be permitted on treated areas until vegetated. Treated areas damaged due to circumstances beyond the Contractor's control shall be repaired or re-applied as ordered. Payment for corrective work, when ordered, shall be at contract unit prices.

METHOD OF MEASUREMENT

213.04 The quantity of hay and straw mulch, wood chip mulch, wood fiber and, spray-on mulch blanket, bonded fiber matrix, and tackifier will not be measured but shall be the quantity designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. Measurement for acres will be by slope distances.

The quantity of mulch tackifier to be measured will be the actual number of pounds of dry tackifier powder used.

Metal landscape border will be measured by the linear foot of completed and accepted metal border. Measured length of metal landscape border will not include required overlap splices.

Spray-on mulch blanket and bonded fiber matrix will be measured by the acre or by the actual pounds of product applied, as shown on the plans. The area will be calculated on the basis of actual or computed slope measurements. The Contractor shall verify, prior to application, weight of spray on mulch blanket and bonded fiber matrix bags for certification of materials and application rate.

BASIS OF PAYMENT

213.05 The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item Pay Unit

Mulching ()		Acre
Mulching (Hydraulic)		Acre
Mulching (Weed Free Hay)		Acre
Mulching (Weed Free Straw)		Acre
Mulching (Wood Chip)		Cubic Foot
Mulch Tackifier		Pound
Metal Landscape Border	Inch	Linear Foot
Spray-on Mulch Blanket		Acre
Spray-on Mulch Blanket		Pound
Bonded Fiber Matrix		Acre
Bonded fiber Matrix		Pound

Water, wood fiber, mixing and application for mulch tackifier will not be measured and paid for separately but shall be included in the work.

Adjusting or readjusting mulching equipment will not be paid for separately but shall be included in the work.

Payment for spray-on mulch blanket and bonded fiber matrix will be full compensation for all work and materials necessary to complete the item.