

United States Department of Agriculture



Natural Resources Conservation Service  
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To: Energy Production Operator

Date: February 25, 2009

Subject: Re-vegetation Recommendations Following Energy Production Construction Activities

Attached are several documents from USDA-Natural Resources Conservation Service (NRCS) concerning re-vegetation recommendations following energy production construction work. The NRCS has developed conservation practice standards and specifications over the last 60 years to assist land managers with applying technically sound conservation practices, including re-vegetation. These practice specifications are located in the CO Field Office Technical Guide (FOTG), and are available online at:

<http://efotg.nrcs.usda.gov/treemenuFS.aspx>, in Section IV, and are where the information enclosed was obtained.

The conservation practices most relevant to re-vegetating areas following energy development are Critical Area Planting, Mulching, and Pest Management (weed control). Following the enclosed information as closely as possible should assist in the successful establishment of vegetation following construction activities.

We hope you find this information beneficial. Please contact us if you have specific questions or comments concerning your project.

Sincerely,

A handwritten signature in blue ink, appearing to read "Sterling Moss", is written over a light blue circular stamp.

Sterling Moss  
District Conservationist

Enclosures:

General Re-vegetation Guidelines  
CO Plant Materials Technical Note 59  
Table 5 – Seeding Rates

Critical Area Planting  
Mulching  
Table 6 – Plant Suitability

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# USDA-Natural Resources Conservation Service

## Re-Vegetation Guidelines for Energy Production Projects

**Seedbed Preparation:** NRCS recommends the grasses be planted into a firm, weed-free seedbed, because success depends upon good soil-to-seed contact. The seedbed should be firm but not overly compact prior to planting. A good rule of thumb for seedbed preparation is a boot heel print should press about ½” deep. Where possible, topsoil (top 6”-10”) should be stockpiled during excavation/construction and replaced during final grading. Excess rock should be gleaned from the surface if possible to create an adequate seedbed surface. Seed should be planted to a depth of ¼” to ¾” whether drilled or broadcasted. Use a drill to plant seed on slopes that are 33 percent (3:1) or flatter.

For broadcast applications, hand raking or dragging the area with a harrow following broadcasting should incorporate the seed to an adequate depth if the soil surface is not excessively hard or loose.

**Seeding and Seed Rates** – The seed can be drilled or broadcasted. Using a drill with packer wheels is recommended, or rolling the seeded area with a cultipacker after drilling or broadcasting to create good seed to soil contact.

Following are three seed mixes for different situations. Other species may be planted if desired or requested by a landowner, etc.. The species highlighted with an asterisk (\*) are strongly recommended to be a portion of a seed mix due to their good growth and establishment characteristics. Refer to CO TGN #59 Table 5 for recommended seeding rates per species. The rates shown in Table 5 are for a full seeding of each species, and therefore need to be adjusted down to reflect their percentage of the seed mix. If the seed is broadcasted, seeding rates are doubled.

Refer to CO TGN #59 Table 6 for a complete list of species and the conditions they are adapted to. The table indicates whether they are native or introduced and conditions they are adapted to.

Following are 3 sample seed mixes that could be used in La Plata County for different situations. Other species can be used, but the following mixes contain species well adapted to La Plata County.

### Non-Irrigated Native Grass Mix

<u>Species</u>	<u>% in mix</u>		<u>Seeding Rate PLS**</u>	<u>Drilled Rate, PLS</u>	<u>Broadcasted Rate, PLS</u>	
			<u>Pounds/acre</u>	<u>Pounds Per Acre</u>	<u>Pounds Per Acre</u>	
Indian Ricegrass	10	x	12	=	1.2	2.4
Thickspike Wheatgrass*	20	x	10	=	2.0	4.0
Slender Wheatgrass	10	x	11	=	1.1	2.2
Western Wheatgrass*	40	x	16	=	6.4	12.8
Sandberg Bluegrass	10	x	2	=	0.2	0.4
Blue Grama	<u>10</u>	x	3	=	<u>0.3</u>	<u>0.6</u>
	100%				11.2 lbs PLS	22.4 lbs PLS

### Non-Irrigated Introduced Species Mix

<u>Species</u>	<u>% in mix</u>		<u>Seeding Rate PLS Pounds/acre</u>		<u>Drilled Rate, PLS Pounds Per Acre</u>	<u>Broadcasted Rate, PLS Pounds Per Acre</u>
Crested Wheatgrass	30	x	10	=	3.0	6.0
Intermediate Wheatgrass*	30	x	15	=	4.5	9.0
Smooth Brome*	35	x	13	=	4.6	9.2
Annual Ryegrass	<u>5</u>	x	8	=	<u>0.4</u>	<u>0.8</u>
	100%				12.5 lbs PLS	25.0 lbs PLS

### Irrigated Mix

<u>Species</u>	<u>% in mix</u>		<u>Seeding Rate PLS Pounds/acre</u>		<u>Drilled Rate, PLS Pounds Per Acre</u>	<u>Broadcasted Rate, PLS Pounds Per Acre</u>
Meadow Brome*	20	x	17	=	3.4	6.8
Orchardgrass*	20	x	4	=	0.8	1.6
Timothy	20	x	2	=	0.4	0.8
Perennial Ryegrass	20	x	8	=	1.6	3.2
Tall Fescue	<u>20</u>	x	8	=	<u>1.6</u>	<u>3.2</u>
	100%				7.8 lbs PLS	15.6 lbs PLS

\*\* PLS = Pure Live Seed

**Note on Seed Mixes** – The seed mixes are chosen for reliability and successful establishment. The amounts of each species in the mixes can be adjusted to reflect your plans objectives. The Native mix contains a larger proportion of Western Wheatgrass because it establishes relatively quickly and grows in a wide range of condition. The native mix will likely take slightly longer to establish but will reflect species found in the surrounding natural landscape and may persist longer in the future compared to the introduced species. The Introduced mix contains species that will establish in various growing conditions and typically will establish somewhat quicker than the native mix. Annual Ryegrass in the introduced grass mix will germinate quickly for fast cover, but will only persist for about 1 year. The irrigated mix contains species that typically occur locally on irrigated pastures and hay fields.

**Recommended Planting Dates** - The recommended planting dates for elevations below 7,500' are October 25 – April 30, or July 15 – September 15. For higher elevations recommended seeding dates are October 15 – April 30, or June 15 – July 15.

**Mulching** – Mulch on slopes steeper than 3:1, or where needed. Once the seed is planted, mulching the area with ½ to 1 ton per acre of certified weed free straw or grass hay can aid establishment. Apply straw at a rate to get 80-100% ground cover, enough to hold soil moisture, but not excessively thick which will slow soil temperatures from warming in the spring. Using grass hay has the added benefit of adding additional desirable seed from the grass in the hay. Hydro-mulching may also be used. Erosion control blankets may be used following manufacturer's specifications.

**Weed Control** – Annual weeds can be controlled initially via mowing. A broad spectrum herbicide can be used later in the summer once the grass is adequately established to prevent damage from the herbicide. It is usually recommended to wait until the grass is in the 3 to 4 leaf stage before applying any herbicide. Follow the manufacturer's label for more detailed instructions.

**Maintenance** – Two growing seasons will be needed to determine success or failure of the seeding. Full grass establishment takes time. Managing weed competition will enhance establishment. Newly planted grass needs time to develop a significant root system in order to compete against weeds. Defer livestock grazing for a least two growing seasons or until plants are well established.

The above recommendations are all taken from the Colorado NRCS Field Office Technical Guide.

# TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE    STATE OF COLORADO    NATURAL RESOURCES CONSERVATION SERVICE

**Plant Materials Technical Note No. 59 (revised)**

**September 19, 2002**

**To:** All Offices

**From:** James L. Sharkoff  
State Conservation Agronomist

## **Plant Suitability and Seeding Rates for Conservation Plantings in Colorado**

This revised Technical Note provides guidance for planners, producers and consultants to develop plant suitability and seeding rate recommendations for conservation plantings within Colorado.

The tables included with this Technical Note list general Climate Characteristics, Seeding Dates, Synonymy, Retardance Factors for Grassed Waterways and Seeding Rates and Species Suitability for selected conservation plantings by Major Land Resource Area (MLRA). A revised Colorado MLRA – Average Annual Precipitation map is also included.

Conservation planting recommendations developed in accordance with this Technical Note will meet species suitability and seeding rate criteria for the Colorado Natural Resources Conservation Service Conservation Practice Standards listed below.

Critical Area Planting (342)  
Cross Wind Trap Strips (589C)  
Filter Strips (393)  
Grassed Waterways (412)  
Pasture and Hayland Planting (512)

Range Seeding (550)  
Riparian Forest Buffer (391)  
Riparian Herbaceous Cover (390)  
Soil Salinity Management – Nonirrigated (571)  
Wastewater Treatment Strips (635).

### **General**

In order to use this technical note to develop conservation planting recommendations, first identify the MLRA delineation and precipitation potential for your site. Next, go to the Suitability Table and select species based on local site conditions and the Conservation Practice to be applied. Then identify the appropriate seeding rates and dates for the selected species.

Seed mix recommendations developed for Critical Area Planting and erosion control purposes shall be comprised of at least 50 percent adapted sod forming species.

### **Plant Suitability**

In many cases, the selection of adapted cultivars is just as important as the selection of adapted species for the proper functioning of vegetative conservation practices. Some species and cultivars grow over wide geographic areas while others have specific site requirements. Species and cultivars seeded outside their range of adaptation may exhibit poor establishment, decreased forage and seed yields and short-lived stands due to winterkill, drought or excessive soil moisture.

The use of named cultivars that have been evaluated under similar field conditions in similar MLRAs is generally recommended. Good performance can be expected when adapted species and cultivars are planted within prescribed soil, climate and site limitations.

### Seeding Rates

Actual seeding rates shall be within 90 to 125 percent of the rates given in this Technical Note.

Nonirrigated seeding rates should be used in areas that will only be irrigated during establishment or if the area will only receive supplemental irrigation.

This Technical Note does not provide specific seeding rate recommendations for row plantings for seed production. Generally, seeding rates for 30 to 40 inch row plantings are 1/4 to 1/3 of the drilled rates for solid stand plantings, or 20 to 40 seeds per linear foot of row.

Seeding rate recommendations provided in this Technical Note are given in pounds Pure Live Seed (PLS) per acre. To determine pounds PLS from a Seed Tag, multiply the Percent Purity X Percent Germination X Total Bulk Pounds. Seed Tag Analysis is required by State and Federal Seed Laws.

Example – Calculating PLS Quantities for a Mixture from Seed Tag Analysis

<u>Species</u>	<u>Percent Purity in Mix</u>		<u>Percent Germination</u>		<u>Total Bulk Pounds</u>		<u>PLS</u>
Western wheatgrass	47.67	X	.90	X	816.5	=	350
Sideoats grama	14.25	X	.86	X	816.5	=	100
Green needlegrass	8.28	X	.74	X	816.5	=	50
Blue grama	7.66	X	.80	X	816.5	=	50

In order to compute seeding rates for mixtures, decrease the given Solid Stand Seeding Rate for individual species proportional to the percentage of the species in the mixture.

Example - Nonirrigated drilled seeding mixture for Range Seeding

<u>Species</u>	<u>Percent of Mix</u>		<u>Solid Stand Seeding Rate</u>		<u>Mixture Seeding Rate</u>
Sideoats grama	.50	X	4.5	=	2.25 lbs PLS per acre
Blue grama	.30	X	1.5	=	0.45 lbs PLS per acre
Western wheatgrass	.20	X	8.0	=	1.60 lbs PLS per acre

Example - Nonirrigated drilled seeding mixture for Critical Area Planting

<u>Species</u>	<u>Percent of Mix</u>		<u>Solid Stand Seeding Rate</u>		<u>Mixture Seeding Rate</u>
Western wheatgrass	.75	X	16	=	12.00 lbs PLS per acre
Streambank wheatgrass	.25	X	11	=	5.50 lbs PLS per acre

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Table 1. Climate	Climate and Elevation Characteristics for Major Land Resource Areas within Colorado
Table 2. Seeding Dates	Seeding Dates for Conservation Plantings by Major Land Resource Areas within Colorado
Table 3. Synonymy	Synonymy Cross Reference
Table 4. Retardance Factors	Retardance Factors for Grassed Waterways within Colorado
Table 5. Seeding Rates	Graminoid, Forb and Shrub Seeding Rates for Conservation Plantings within Colorado
Table 6. Suitability	Perennial Graminoid, Forb and Woody Plant Suitability for Conservation Plantings by Major Land Resource Areas within Colorado
Map	Colorado Precipitation and MLRAs (Major Land Resource Areas)

Table 5. Graminoid, Forb and Shrub Seeding Rates for Conservation Plantings within Colorado

Genus species (common name - Cultivar)	Notes		Seeds per pound (1,000s)	Seeds per square foot per pound planted per acre	Solid Stand Seeding Rates 1) pounds PLS (pure live seed) per acre					
					Irrigated		Nonirrigated		Critical, Riparian, Grassed Waterways	
					drill	broadcast	drill	broadcast	drill	broadcast
<i>Achnatherum hymenoides</i> (Indian ricegrass - Nezpar, Rimrock)	NCB	2) 4) 5)	235.0	5.4	8.0	16.0	4.0	8.0	8.0	16.0
<i>Achnatherum hymenoides</i> (Indian ricegrass - Paloma)	NCB	2) 4) 5)	140.0	3.2	12.0	24.0	6.0	12.0	12.0	24.0
<i>Agropyron cristatum</i> X <i>desertorum</i> (crested wheatgrass - Hycrest)	ICB	2)	302.0	6.9	6.0	12.0	3.0	6.0	6.0	12.0
<i>Agropyron cristatum</i> (crested wheatgrass - Ephraim)	ICB	2)	302.0	6.9	6.0	12.0	3.0	6.0	6.0	12.0
<i>Agropyron desertorum</i> (crested wheatgrass - Nordan)	ICB	2)	190.0	4.4	10.0	20.0	5.0	10.0	10.0	20.0
<i>Alopecurus arundinaceus</i> (creeping meadow foxtail - Garrison)	ICS		750.0	17.2	3.0	6.0	1.5	3.0	3.0	6.0
<i>Bouteloua curtipendula</i> (sideoats grama)	NWB	5)	191.0	4.4	9.0	18.0	4.5	9.0	9.0	18.0
<i>Bouteloua gracilis</i> (blue grama)	NWB	2)	711.0	16.3	3.0	6.0	1.5	3.0	3.0	6.0
<i>Bromus biebersteinii</i> (meadow brome - Regar)	ICB	2)	93.0	2.1	17.0	34.0	11.0	22.0	17.0	34.0
<i>Bromus inermis</i> (smooth brome)	ICS		140.0	3.2	13.0	26.0	6.5	13.0	13.0	26.0
<i>Bromus marginatus</i> (mountain brome - Bromar, Garnet)	NCB	2)	78.0	1.8	20.0	40.0	10.0	20.0	20.0	40.0
<i>Dactylis glomerata</i> (orchardgrass)	ICB	2) 4)	540.0	12.4	4.0	8.0	2.0	4.0	4.0	8.0
<i>Elymus lanceolatus lanceolatus</i> (thickspike wheatgrass)	NCS		154.0	3.5	10.0	20.0	5.0	10.0	10.0	20.0
<i>Elymus lanceolatus psammophilus</i> (streambank wheatgrass)	NCS		156.0	3.6	11.0	22.0	5.5	11.0	11.0	22.0
<i>Elymus trachycaulus</i> (slender wheatgrass)	NCB	2)	160.0	3.7	11.0	22.0	5.5	11.0	11.0	22.0
<i>Festuca arizonica</i> (arizona fescue)	NCB	2)	411.0	9.4	4.5	9.0	2.5	4.5	4.5	9.0
<i>Festuca ovina</i> (sheep fescue - Covar)	NCB	2)	680.0	15.6	3.0	6.0	1.5	3.0	3.0	6.0
<i>Hesperostipa comata</i> (needleandthread)	NCB	2)	160.0	3.7	11.0	22.0	5.5	11.0	11.0	22.0
<i>Leymus cinerius</i> (basin wildrye)	NCB	2) 4)	130.0	3.0	10.0	20.0	5.0	10.0	10.0	20.0

Table 5. Graminoid, Forb and Shrub Seeding Rates for Conservation Plantings within Colorado										
Genus species (common name - Cultivar)	Notes		Seeds per pound (1,000s)	Seeds per square foot per pound planted per acre	Solid Stand Seeding Rates 1) pounds PLS (pure live seed) per acre					
					Irrigated		Nonirrigated		Critical, Riparian, Grassed Waterways	
					drill	broadcast	drill	broadcast	drill	broadcast
<i>Lolium arundinaceum</i> (tall fescue - Alta)	ICB	2)	205.0	4.7	8.0	16.0	4.0	8.0	8.0	16.0
<i>Lolium perenne</i> (perennial ryegrass)	ICB	2)	247.0	5.7	8.0	16.0	4.0	8.0	8.0	16.0
<i>Medicago sativa</i> (alfalfa)	IL	2)	220.0	5.1	8.0	16.0	4.0	8.0	8.0	16.0
<i>Pascopyrum smithii</i> (western wheatgrass)	NCS		110.0	2.5	16.0	32.0	8.0	16.0	16.0	32.0
<i>Phleum pratense</i> (timothy)	ICB	2)	1,230.0	28.2	2.0	4.0	1.0	2.0	2.0	4.0
<i>Poa fendleriana</i> (muttongrass)	NCB	2)	2,000.0	45.9	1.0	2.0	0.5	1.0	1.0	2.0
<i>Poa secunda</i> (Canby/Sandberg bluegrass)	NCB		925.0	21.2	2.0	4.0	1.0	2.0	2.0	4.0
<i>Thinopyrum intermedium</i> (intermediate wheatgrass)	ICS		88.0	2.0	15.0	30.0	10.0	20.0	15.0	30.0
<i>Thinopyrum intermedium</i> (pubescent wheatgrass)	ICS		100.0	2.3	14.0	28.0	9.0	18.0	14.0	28.0

**Notes:** I= introduced; N= native; C= cool season; W= warm season; B= bunchgrass; S= sodformer; F= forb; L= legume; Sh = shrub; V= vine; 1) Seeding rates for extremely small (greater than 825,000 seeds/pound) or extremely large (less than 100,000 seeds/pound) have been adjusted based on past establishment data; 2) Mix with adapted sodformers; 3) Inoculate seed with appropriate rhizobium before planting; 4) Stratification recommended; 5) Scarification recommended; 6) Plant unstratified/unscarified seed in late fall; 7) Plant separately or in rows alternating with grasses to decrease competition.

**References:** USDA NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA; Thornburg, Ashley A. 1982. Plant materials for use on surface-mined lands in arid and semiarid regions. USDA SCS-TP-157. 88 pp.; Wasser, C.H. 1982. Ecology and culture of selected species useful in revegetating disturbed lands in the west. USDI FWS. FWS/OBS-82/56. 347 pp.; Hassell, W. and W. R. Beavers. 1996. Seeding rate statistics for native and introduced species. USDI NPS, USDA NRCS. Lakewood, CO. 25 pp.; Colorado Agronomy Technical Note No. 61. Seeding rates. 1981. USDA NRCS. Lakewood, CO.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**CRITICAL AREA PLANTING**

(Acres)

**CODE 342**

**DEFINITION**

Establishing permanent vegetation on sites that have or are expected to have high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices.

**PURPOSE**

- Stabilize areas with existing or expected high rates of soil erosion by water.
- Stabilize areas with existing or expected high rates of soil erosion by wind.
- Rehabilitate and revegetate degraded sites that cannot be stabilized through normal farming practices.
- Stabilize coastal areas, such as sand dunes and riparian areas.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to highly disturbed areas such as active or abandoned mined lands, urban conservation sites, road construction areas, conservation practice construction sites, areas needing stabilization before or after natural disasters such as floods, hurricanes, tornados and wildfires and other areas degraded by human activities or natural events.

**CRITERIA**

**General Criteria Applicable To All Purposes**

Conduct a site investigation to identify any physical, chemical or biological conditions that could affect the successful establishment of vegetation.

Species selected for seeding or planting shall be suited to current site conditions and intended uses.

Do not establish plants on the state noxious weeds list in critical area plantings.

Selected species will have the capacity to achieve adequate density and vigor within an appropriate period to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Specify species, rates of seeding or planting, minimum quality of planting stock such as pure live seed (PLS) or stem caliper, method of seedbed preparation, and method of establishment, before application. Use only viable, high quality seed or planting stock.

Complete seeding or planting at a time and in a manner that best ensures establishment and growth of the selected species. Specify what constitutes successful establishment, e.g. minimum percent ground/canopy cover, percent survival, stand density, before application.

Use Colorado Plant Materials Tech Note 59, Table 2, to schedule planting dates for the selected species, while optimizing soil moisture for germination and/or establishment.

Apply soil amendments (e.g. lime, fertilizer, compost) according to a nutrient management plan, at rates necessary to insure stand establishment.

Protect plantings from pests (e.g. weeds, insects, diseases, livestock, wildlife) as necessary to ensure stand establishment.

All soil amendment, nutrient and pest management applications shall follow the requirements in the Colorado Field Office Technical Guide.

Use current approved wind and or water erosion prediction technology to determine the amount of plant biomass and cover needed to decrease wind and water erosion to the planned soil loss objective.

**Additional Criteria to Rehabilitate And Revegetate Degraded Sites That Cannot Be Stabilized Through Normal Farming Practices**

If gullies or deep rills are present, treat if feasible, to allow equipment operation and ensure proper site and seedbed preparation.

Apply soil amendments to ameliorate or eliminate physical or chemical conditions, according to a soil test and an approved nutrient management plan.

**Additional Criteria to Stabilize Coastal Areas Such As Sand Dunes and Riparian Areas**

Plants selected for sand dunes and coastal sites must be able to survive burial by blowing sand, sand blasting, salt spray, salt water flooding, drought, heat and low nutrient supply.

Local plant lists including appropriate species shall be developed and utilized.

Sand trapping devices such as sand fences or brush matting shall be included in the revegetation stabilization plans where applicable.

**CONSIDERATIONS**

Consider selection of adapted native species or mixes that have multiple values, to increase site diversity.

Avoid selecting species that may harbor pests that can decrease site function.

Plans should comply with the Migratory Bird Treaty Act.

Planning and installation of other conservation practices such as Diversions, Land Smoothing, Obstruction Removal, Surface and Subsurface Drains or Underground Outlets may be necessary to prepare a critical area for planting.

**PLANS AND SPECIFICATIONS**

Prepare plans and specifications for each field or management unit according to the criteria and operation and maintenance sections of this standard. Specifications shall describe the requirements for applying this practice to meet the intended purpose.

Record practice specifications using approved specification sheets, job sheets or other acceptable documentation.

Address the following elements in the plan, as applicable, to meet the intended purpose.

**Site Preparation**

Remove materials such as rocks and trash that will interfere with planting.

Control runoff water from the site or adjacent areas to prevent serious erosion and damage to the planting.

**Topsoil**

If soils in the critical area have insufficient depth or physical characteristics unsuitable for development of vegetative cover, spread topsoil or soil material having the capability of supporting the planned vegetation over the deficient areas. Apply the material uniformly and in sufficient depth to support the type and quality of vegetative cover for the site. Sources of soil materials must be approved before installation.

**Fertilizer Application**

Base fertilizer and or amendment applications on soil test recommendations and the Colorado Nutrient Management, 590 Conservation Practice Standard. If phosphorus is required, apply and incorporate before seeding. Delay nitrogen applications until stand is established.

Fertilizer applications made without a soil test recommendation may cause excess weed growth that will inhibit stand establishment.

**Seedbed Preparation**

The seedbed shall be well settled and firm, but friable enough that seed can be placed at the seeding depths specified in "Depth of Seeding".

Soils that have been over-compacted by traffic or equipment, especially when wet, should be tilled to break up root restricting layers, then harrowed, rolled or packed to prepare the required firm seedbed.

The seedbed shall be reasonably free of weeds. Control competitive stands of weeds that are present before seeding by shallow tillage or by application of herbicides labeled for this purpose.

If noxious weeds are present, plan and apply the Pest Management, 595 Conservation Practice Standard.

**Methods of seeding**

Use a drill to plant seed on slopes that are 33 percent (3:1) or flatter. The drill must have the capability of handling the kind and application rate of seed.

For broadcast applications, incorporate seed to a depth not to exceed  $\frac{3}{4}$  inch by raking, harrowing or other proven method.

Plant Indian ricegrass seed to a depth of up to 2 inches on sandy loam and loamy sand soils.

**Time of Seeding**

Time the planting of grasses, legumes and other seeded species according to Colorado Plant Materials Technical Note No. 59, Plant Suitability and Seeding Rates for Conservation Plantings in Colorado, Table 2. Allow up to 10 days flexibility in seeding dates in order to adapt to local soil moisture conditions.

Fall plant species such as Rocky Mountain Penstemon, hairy vetch, milkvetch and Indian ricegrass to help break seed dormancy.

**Selection of Species**

Species recommendations shall be consistent with Colorado Plant Materials Technical Note No. 59, Plant Suitability and Seeding Rates for Conservation Plantings in Colorado, Table 6. Site-specific knowledge of the Major Land Resource Area, topography, soils, precipitation potential, elevation and future use and management is required to develop site-specific Critical Area Planting recommendations.

**Seed Source**

Use adapted improved varieties and cultivars in the following order of preference, when available.

Certified named varieties  
Named varieties  
Common seed

Certified named varieties are required for all NRCS cost shared programs. Request an exemption from the NRCS State Resource Conservationist if certified seed is not available.

If both Certified named varieties and Named varieties are not available, common seed, originating from the same general locality as the planting site, may be used upon approval.

**Seed Analysis**

All seed that is cost-shared, whether purchased or grown for personal use, will meet the following minimum standards.

- Seed labeling, quality and testing will be in accordance with the Colorado Seed Law, which requires testing according to the "Rules for Seed Testing" of the Association of Seed Analysts (AOSA), and Rules and Regulations under the Federal Seed Act.
- Purity and germination tests for all lots of seed shall be less than one year old.

**Rates of Seeding**

Specify seeding rates according to Colorado Plant Materials Technical Note No. 59, Plant Suitability and Seeding Rates for Conservation Plantings in Colorado, Table 5. A completed CO-ECS-5, Grass Seeding Planned and Applied, is required to document planning and application of this practice.

**Mulching**

Mulch Critical Area Plantings where rapid establishment of seeded species is essential or where one or more of the following factors are likely to cause failure of the planting, as determined by the planner.

- Low or erratic precipitation
- Droughty or slowly permeable soils
- High soil temperatures
- Erosive soils
- Drying winds

Refer to the Colorado Mulching, 484 Conservation Practice Standard for planning criteria and specification requirements.

Cover crops or crop residues produced on site may satisfy mulching requirements if present in sufficient quantities to decrease erosion and conserve soil moisture. Refer to the Colorado Cover Crop, 340 Conservation Practice Standard for planning criteria and specification requirements.

**Planting Trees, Shrubs and Vines**

Plant woody species in late winter or early spring before bud burst.

Keep roots moist at all times before planting.

Spread roots out to as close to a normal position as possible during planting.

Dig holes deep and wide enough to accommodate seedlings without bending roots.

Plant stock at the same depth it was planted in the nursery, or slightly deeper. Do not plant stock shallower than planted in the nursery.

Pack soil firmly around the roots of seedlings to make it difficult to pull the seedling from the ground. Eliminate all air pockets in the soil around the roots.

Apply water to seedlings immediately after planting.

Refer to the Colorado Tree/Shrub Establishment, 612 Conservation Practice Standard for planning criteria and specification requirements.

#### **Supplemental Water for Plant Establishment**

In low rainfall areas where water is available and rapid establishment is needed, irrigate newly seeded areas during the first growing season when rainfall is not adequate for plant development. Apply water at approximately one-week intervals at a rate of 0.75 to 1.0 inches per application.

Apply water to woody transplants at the time of planting, followed by an application of at least one gallon per week applied to the soil at the base of the plant for the first growing season.

#### **Protection of Plantings**

Protect planted sites from trampling, grazing, rodents and browsing animals until plants are well established. In heavy use areas, protect critical area plantings with fencing or barriers.

#### **OPERATION AND MAINTENANCE**

Manage use of the area as long as necessary to stabilize the site and achieve the intended purpose.

Control or exclude pests that will interfere with the timely establishment of vegetation.

Conduct inspections, reseeding or replanting, fertilization and pest control to insure that this practice functions as intended throughout its expected life. Observe establishment progress at regular intervals until the practice has met the criteria for successful establishment and implementation.

Where establishment of vegetation creates potential habitat for grass-nesting birds, consider the impacts of vegetative disturbance upon these birds and their nests and include them in the operation and maintenance plans. Do not conduct maintenance activities that result in disturbance of vegetation during the primary nesting season for grass-nesting birds, where occupied habitat for these species exists.

#### **REFERENCES**

Colorado Field Office Technical Guide, Sec. IV. Cover Crop 340, Conservation Practice Standard. 2006. USDA, NRCS. Lakewood, CO. <http://efotg.nrcs.usda.gov/references/public/CO/CO340.pdf>

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Colorado Field Office Technical Guide, Sec. I. Plant Materials Technical Note No. 59. 2002. Plant Suitability and Seeding Rates for Conservation Plantings in Colorado. USDA, NRCS. Lakewood, CO. [http://efotg.nrcs.usda.gov/references/public/CO/COPMTN\\_59.pdf](http://efotg.nrcs.usda.gov/references/public/CO/COPMTN_59.pdf)

Colorado Field Office Technical Guide, Sec. IV. Tree/Shrub Establishment 612, Conservation Practice Standard. 2003. USDA, NRCS. Lakewood, CO. <http://efotg.nrcs.usda.gov/references/public/CO/CO612standard.pdf>.

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**MULCHING**

(Acre)

**CODE 484**

**DEFINITION**

Applying plant residues or other suitable materials produced off site, to the land surface.

**PURPOSE**

- Conserve soil moisture
- Moderate soil temperature
- Provide erosion control
- Suppress weed growth
- Facilitate the establishment of vegetative cover
- Improve soil condition
- Reduce airborne particulates

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to all lands where mulches are needed. This practice may be used alone or in combination with other practices.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The selection of mulching materials will depend primarily on site conditions and the material's availability. Mulch materials shall consist of natural and/or artificial materials that are environmentally safe such as plant residue, wood bark or chips, gravel, plastic, fabric, rice hulls, or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended purpose for the required amount of time.

Prepare the soil surface to achieve the intended purpose prior to mulching.

Evenly apply and if necessary, anchor the mulch material to the soil. Use tackifiers, emulsions, pinning, netting, crimping and or other acceptable methods of anchoring as needed, to hold the mulch in place for specified periods.

As a minimum, apply manufactured mulches according to the manufacturer's specifications.

Mulching operations shall comply with federal, state and/or local laws and regulations during the installation, operation and maintenance of this practice.

Mulch material shall be relatively free of disease, pesticides, chemicals, noxious weed seeds, and other pests and pathogens.

**Additional Criteria to Conserve Soil Moisture**

Mulch materials applied to the soil surface shall provide at least 60 percent surface cover to decrease potential evaporation.

**Additional Criteria to Moderate Soil Temperature**

Selected and apply mulch materials to obtain 100 percent coverage over the area treated. The material shall be of a significant thickness to persist for the period required for temperature modification.

**Additional Criteria to Provide Erosion Control**

When mulching with cereal grain straw or grass hay, apply at a rate that achieves a minimum 70 percent ground cover. Determine the appropriate mulch application rate to reach the soil erosion objective using current erosion prediction technology.

When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply a minimum 2-inch thickness.

When mulching with gravel or other inorganic materials, apply a minimum 2-inch thickness of pieces 0.75 to 2 inches in diameter.

#### **Additional Criteria to Suppress Weed Growth**

Determine the depth of mulch needed by the size of the plants to be mulched. Keep mulch materials clear of the stems of plants where disease is likely to occur. Mulches applied around growing plants or prior to weed seedling development shall have 100 percent ground cover. Thickness of the mulch shall be adequate to prevent emergence of targeted weeds. Plastic mulches may be used.

#### **Additional Criteria to Facilitate the Establishment of Vegetative Cover**

Apply mulch at a rate that achieves a minimum of 70 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination and emergence.

#### **Irrigated sites**

Mulching is not generally recommended for perennial grass seedings on sites that have an irrigation system and adequate irrigation water supplies to ensure rapid, uniform germination and stand establishment. If mulching is planned for an irrigated perennial grass seeding, do not apply mulch materials such as bromegrass hay or small grain straw that includes viable seed, which can germinate and suppress establishment of perennial grasses.

#### **Additional Criteria to Improve Soil Condition**

Apply mulch materials with a carbon to nitrogen ratio (C:N) less than 30 to 1 so that soil nitrogen is not immobilized by soil biota. Do not apply mulch with C:N less than 20:1 to an area of designed flow in watercourses.

Use the Soil Conditioning Index to assess soil quality impacts and to determine the type and rate of the mulching material.

#### **Additional Criteria to Reduce Airborne Particulates**

Determine the mulch application rate using current wind erosion prediction technology to reach the soil erosion (movement of particulates offsite) objective.

## **CONSIDERATIONS**

Mulch materials may affect microbial activity in the surface soil, increase infiltration, and decrease runoff, erosion and evaporation.

Mulching may decrease the temperature of the surface runoff.

Mulch material used to conserve soil moisture should be applied prior to moisture loss.

Mulch materials with a high water holding capacity and/or high impermeability to water droplets may adversely affect the water availability for plants.

Fine textured mulches (e.g. rice hulls) which allow less oxygen penetration than coarser materials should be no thicker than 1 or 2 inches.

Organic materials with C:N ratios of less than 20:1 will release nitrate-nitrogen which can cause water quality impairments off-site.

Mulching may provide habitat for beneficial insects and provide pest suppression.

Clear and infrared transmissible (IRT) plastics have the greatest warming potential. They are transparent to incoming radiation and trap the longer wavelengths radiating from the soil. Black mulches are limited to warming soils by conduction only and are less effective.

Clear mulches allow profuse weed growth and may negate the benefits of soil warming. Black mulches provide effective weed control. Wavelength selective (IRT) plastic provides the soil warming characteristics of clear mulch with the weed control ability of black mulch.

Low permeability mulches (e.g. Plastic) may increase concentrated flow and erosion on un-mulched areas.

Consider potential toxic allelopathic effects that mulch materials may have on other organisms. Animal and plant pest species may be incompatible with the site.

Consider the potential for increased pathogenic activity within the applied mulch material.

Keep mulch 3 to 6 inches away from plant stems and crowns to prevent disease and pest problems. If needed, apply additional weed control measures around the plant base area.

Deep mulch provides nesting habitat for ground-burrowing rodents that can chew extensively on tree trunks and/or tree roots. Light mulch applied after the first cold weather may prevent rodents from nesting.

Some mulch material may adversely affect aquatic environments through changes in water chemistry or as waterborne debris. Consider placing mulch in locations that minimizes these risks.

### PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the Criteria and Operation and Maintenance sections of this standard. Specifications shall describe the requirements for applying this practice to meet the intended purpose.

Record practice specifications on specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

Documentation shall include the following as a minimum.

- Purpose of the Mulch
- Type of mulch material used
- The percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, or method of anchoring, and
- Operation and maintenance.

### OPERATION AND MAINTENANCE

Periodically inspect mulched areas and reinstall or repair as needed, to accomplish the intended purpose.

Removal or incorporation of mulch materials shall be consistent with the intended purpose and site conditions.

Operation of equipment near and on the site shall not compromise the intended purpose of the mulch.

Prevent or repair any fire damage to the mulch material.

Properly collect and dispose of artificial mulch material after intended use.

Monitor and control undesirable weeds in mulched areas.

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Table 6. Perennial Graminoid, Forb and woody Plant suitability for Conservation Plantings by Major Land Resource Areas within Colorado.

Table 6. Perennial Graminoid, Forb and woody Plant suitability for Conservation Plantings by Major Land Resource Areas within Colorado.										Soils and Landscape Position 1)				Suitability Ratings 3)										Conservation Plantings														
										Uplands		Lowlands 2)		Soil Textures	Moist	Dry	Moist	Dry	Seedling Vigor	Rate of Spread	Anaerobic Tolerance	CaCO3 Tolerance	Drought Tolerance	Fire Tolerance	Salinity Tolerance	Shade Tolerance	Fertility requirement	Water use	Critical Areas	Cross Wind Trap Strips	Filter Strips	Grassed Waterways	Pasture and Hayland	Range	Riparian Areas	Soil Salinity Management – Nonirrigated	Wastewater Treatment Strips	
										Slopes > 15%	Slopes < 15%	Saline Alkaline	Non-Saline Alkaline																									
Genus species (common name – Cultivar)	Notes	Mature Height	Min. Precip inches	Max. Precip inches	Min. Elev	Max. Elev	Soil pH Range	Major Land Resource Area		S	L	C	S	L	C	Moist	Dry	Moist	Dry	Seedling Vigor	Rate of Spread	Anaerobic Tolerance	CaCO3 Tolerance	Drought Tolerance	Fire Tolerance	Salinity Tolerance	Shade Tolerance	Fertility requirement	Water use	Critical Areas	Cross Wind Trap Strips	Filter Strips	Grassed Waterways	Pasture and Hayland	Range	Riparian Areas	Soil Salinity Management – Nonirrigated	Wastewater Treatment Strips
								D36	E48 B																													
<i>Lolium perenne</i> (perennial ryegrass)	ICB 8) 1) 0)	18 in	16	65	4,000	8,000	5.0-8.0	X					X	X	X	X	X	X	X	5	3	3	3	2	2	3	1	H	H				X			X		
<i>Medicago sativa</i> (alfalfa)	IL 8) 1) 0)	24 in	16	65	4,800	8,500	6.0-8.5	X	X				X	X				X	X	4	2	1	5	4	5	3	1	H	H	X			X			X		
<i>Pascopyrum smithii</i> (western wheatgrass - Arriba, Barton)	NCS 4) 5) 1) 0)	20 in	14	20	3,600	10,000	4.5-9.0	X	X	X	X	X	X	X	X	X	X	X	X	3	4	3	5	5	5	3	1	M	M	X	X	X	X	X	X			
<i>Pascopyrum smithii</i> (western wheatgrass - Rosana)	NCS 4) 5) 1) 0)	24 in	14	20	3,600	10,000	4.5-9.0	X	X	X	X	X	X	X	X	X	X	X	X	3	4	3	5	5	5	3	1	M	M	X	X	X	X	X	X			
<i>Phleum pratense</i> (timothy - Itasco)	ICB 5) 8) 1) 0)	30 in	18	65	4,500	11,500	5.0-7.8	X	X				X	X			X			3	2	3	5	2	3	2	3	M	M				X		X			
<i>Poa fendleriana</i> (muttongrass)	NCB 8)	24 in	10	18	4,000	13,900	6.0-8.0	X	X			X	X	X			X		X	2	2	1	5	5	2	1	1	L	L				X	X				
<i>Poa secunda</i> (Canby/Sandberg bluegrass)	NCB 8)	12 in	12	22	4,500	13,000	6.0-8.0	X	X			X	X	X	X	X	X	X	X	2	2	3	5	5	2	3	3	M	M		X		X	X	X			
<i>Thinopyrum intermedium</i> (intermediate wheatgrass - Amur)	ICS 1) 0)	30 in	15	28	3,500	9,000	5.6-8.5	X	X	X	X	X	X	X			X		X	5	3	3	5	3	5	2	1	M	M	X	X	X	X					
<i>Thinopyrum intermedium</i> (intermediate wheatgrass - Tegmar, Oahe)	ICS 1) 0)	30 in	15	28	3,500	9,000	5.6-8.5	X	X	X	X	X	X	X			X		X	5	3	3	5	3	5	2	1	M	M	X	X	X	X					
<i>Thinopyrum intermedium</i> (pubescent wheatgrass - Luna, Manska)	ICS 1) 0)	24 in	14	30	3,500	9,000	5.6-8.4	X	X	X	X	X	X	X			X		X	5	3	3	5	4	5	2	1	M	L	X	X	X	X					

Notes: I = introduced; N = native; C = cool season; W = warm season; B = bunchgrass; S = sod former; F = forb; L = legume; T = tree; Sh = shrub; NWI = National Wetlands Indicator (OBL = Obligate Wetland, FACW = Facultative Wetland, FAC = Facultative, FACU = Facultative Upland, UPL = Obligate Upland); FFP = Freeze Free Period; 1) Soils and Landscape Positions are general (S = sandy soils, L = loamy soils, C = clayey soils); 2) Low lying areas which receive additional water from higher ground; 3) Suitability ratings (1 = poor, 2 = fair, 3 = moderate, 4 = good, 5 = excellent; L = low, M = medium, H = high); 4) Suited for moist, saline lowland sites; 5) Suited for moist lowland sites; 6) Suited for wetland sites; 7) Will tolerate prolonged periods (3 to 4 days) of inundation; 8) Mix with sod-formers; 9) A bunchgrass which turns sod-former under continuous grazing; 10) Suited for irrigated sites.

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