SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Certification of Products

B. Acceptance and Warranty

C. Seed Types and Mixes

D. Equipment

E. Application of Seed

1.02 DESCRIPTION OF WORK

Includes the requirements for seedbed preparation; furnishing, applying, and covering the seed; and compaction of the seedbed.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Submit certification of products to the Engineer prior to seed placement:

1. Seed: Submit a laboratory analysis for all seeds, specifying the purity and germination. Provide a lot number on all submittals and labeling. Ensure lot number is the same on all records pertaining to a particular seed. Provide 48 hours notice prior to mixing the seed and give the Engineer an opportunity to witness the seed mixing. Submit a mechanically printed seed tag from a seed conditioner or grower approved by the Iowa Crop Improvement Association or other state's equivalent association/agency.

2. Fertilizer: Submit certification of the fertilizer analysis with scale weight and statement of guaranteed analysis. Submit from a certified fertilizer dealer, a mechanically printed commercial fertilizer label, or bill of lading. Comply with the inspection and acceptance requirements of Iowa DOT Materials I.M. 469.03.

3. Wood Cellulose Fiber Mulch: Submit certification of the degradable wood cellulose fiber mulch ingredients with applicable use and rate, and the water retention capacity by manufacturer or supplier.

4. Wood Excelsior Mulch: Bale wood excelsior and determine the mass (weight). Use the mass of the material, furnished by the manufacturer, to determine the rate of application.

5. Straw Mulch: Certify weight. Furnish a list of the number of bales and a corresponding ticket from an approved scale for the mulch material to be used on the project.

6. Compost: Submit certification of composted organics analysis with U.S. Compost Council's Seal of Testing Assurance (STA), recommended rates of application, and manufacturer's estimated cubic yards per ton.

7. Inoculant: Furnish information from inoculant packaging.

8. Tackifier: Submit certification of the tackifier ingredients, recommended rates of application, and expiration date.

B. Submit written instructions recommending procedures for maintenance of seeded areas.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Deliver packaged materials in original, unopened, and undamaged containers. Do not mix or blend materials except in the presence of the Engineer.

B. Deliver, handle, and store all materials according to product recommendations, and protect from loss, damage, and deterioration.

C. Materials not meeting these requirements will be rejected.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

A. Coordinate the seeding schedule with all other work on the project. Notify the Engineer at least three calendar days prior to the start of seeding operations.

B. After all land-disturbing activities are complete and the seedbed has been approved by the Engineer, perform seeding operations.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Conventional Seeding:

1. Seeding:
- **a. Measurement:** Measurement will be in acres for each type of seed.
- **b. Payment:** Payment will be in unit price per acre for each type of seed.
- **c. Includes:** Unit price includes, but is not limited to, removal of rock and other debris from the area; repairing rills and washes; preparing the seedbed; furnishing and placing seed, including any treatment required; furnishing and placing fertilizer and mulch; and furnishing water and other care during the care period, unless these items are bid separately.

2. Fertilizing:
- **a. Measurement:** Measurement will be in acres of fertilizer.
- **b. Payment:** Payment will be at unit price per acre of fertilizer.
- **c. Includes:** Unit price includes, but is not limited to, furnishing, applying, and incorporating fertilizer to the area to be seeded.

3. Mulching:
- **a. Measurement:** Measurement will be in acres of mulch.
- **b. Payment:** Payment will be in unit price per acre of mulch.
- **c. Includes:** Unit price includes, but is not limited to, furnishing, applying, and incorporating mulch to the area to be seeded.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Seeding, Fertilizing, and Mulching for Hydraulic Seeding:

1. **Measurement:** Measurement will be in acres for each type of seed.

2. **Payment:** Payment will be in unit price per acre for each type of seed.

3. **Includes:** Unit price includes, but is not limited to, removal of rock and other debris from the area; repairing rills and washes; preparing the seedbed; furnishing and placing seed, including any treatment required; furnishing and placing fertilizer and mulch; and furnishing water and other care during the care period, unless these items are bid separately.

C. Seeding, Fertilizing, and Mulching for Pneumatic Seeding:

1. **Measurement:** Measurement will be in acres for each type of seed.

2. **Payment:** Payment will be in unit price per acre for each type of seed.

3. **Includes:** Unit price includes, but is not limited to, removal of rock and other debris from the area; repairing rills and washes; preparing the seedbed; furnishing and placing seed, including any treatment required; furnishing and placing fertilizer and mulch; and furnishing water and other care during the care period, unless these items are bid separately.

D. Watering:

1. **Measurement:** Measurement will be by metering of water applied. If metering is not available, measurement will be by counting the loads from a transporting tank of known volume and gauging the contents of the transporting truck for partial loads.

2. **Payment:** Payment will be at the unit price per 1,000 gallons (MGAL) of water used.

3. **Includes:** Unit price includes, but is not limited to, water, pumps, meters, equipment, water tanker/container, transportation, hoses, and sprinklers.

E. Warranty:

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be at the lump sum price for the warranty.

3. **Includes:** Lump sum price includes, but is not limited to, all work required to correct any defects in the original placement of the seeding for the period of time designated.

PART 2 - PRODUCTS

2.01 SEED

A. General:

1. Provide fresh, clean, new crop, certified seed complying with tolerance for germination and purity and free of poa annua, bent grass, and noxious weed seed. Furnish all seeds, including grass, legume, forbs, and cereal crop seeds, from an established seed dealer or certified seed grower. All materials and suppliers are to follow Iowa Seed Law and Iowa Department of Agriculture and Land Stewardship regulations, and be labeled accordingly.
   a. Provide turfgrass with a certified “blue tag” or "gold tag."
   b. Provide native grass and forbs that are source-identified as G0-Iowa certified "yellow tag," when available. If G0-Iowa certified "yellow tag" sourced seed is unavailable, or is only available from a single source, a substitution may be approved by the Engineer.

2. Mix seed to the specified proportions by weight. Use methods approved by the Engineer.

B. Seed Quality: Ensure the seed provided meets or exceeds the minimum requirements of purity and germination stated on an independent certificate of seed analysis document according to the Association of Official Seed Analysis (AOSA) rules. The seed certification tag and seed analysis document provided must be from the same lot number as shown on the seed tag. Ensure the date of test results is no greater than 9 months from the seed application date. Approval of all seed for use will be based on the accumulated total of Pure Live Seed (PLS) for each phase of work. PLS is obtained by multiplying purity times germination. PLS shall not be less than the accumulated total of the PLS specified.

If the seed does not comply with minimum requirements for purity and germination and such seed cannot be obtained, the Engineer may approve use of the seed on a basis of PLS or may authorize a suitable substitution for the seed specified.

C. Requirements on Containers:

1. Seed: Provide seed with a tag on each container. Ensure the seed analysis on the label is mechanically printed.

2. Mulch: When packaged, provide mulch in new labeled containers.

3. Tackifier: Provide tackifier packaged in new labeled containers.

4. Inoculant: Use inoculant that has a manufacturer’s container, indicating the specific legume seed to be inoculated and the expiration date. All inoculant must meet requirements of the Iowa Seed Law. Follow precautions specified on the product label.

5. Sticking Agent: Use a commercial sticking agent recommended by the manufacturer of the inoculant. For quantities less than 50 pounds, the sticking agent need not be a commercial agent, but requires approval by the Engineer. Apply sticking agent separately prior to application of inoculant. Follow safety precautions specified on the product label.

2.01 SEED (Continued)

Table 9010.01: Domestic Grasses

Common Name	Scientific Name	Purity (%)	Germination (%)
Bluegrass, Kentucky	Poa pratensis	85	80
Brome, smooth-LINCOLN	Bromus inermis	90	85
Fescue, creeping, red	Festuca rubra	98	85
Fescue, tall, FAWN	Festuca arundinacea-FAWN	98	85
Orchardgrass	Dactylis glomerata	90	90
Red top	Agrostis alba	92	85
Ryegrass, perennial	Lolium perenne	95	90
Wildrye, Canada	Elymus Canadensis	95	85
Wildrye, Russian	Psathyrostachys junceus	95	85

Table 9010.02: Legumes

Common Name	Scientific Name	Purity (%)	Germination (%)
Alfalfa, RANGER/VERNAL	Medicago sativa	99	90*
Alfalfa, travois	Medicoa spp.	99	90*
Clover, Alsike	Trifolium hybridum	99	90*
Clover, red, medium	Trifolium pratense	99	90*
Clover, white	Trifolium repens	98	90*
Hairy vetch	Vicia villosa	96	85*
Lespedeza, Korean	Lespedeza stipulacea	98	80*

* Includes hard seed.

Table 9010.03: Stabilizing Crop

Common Name	Scientific Name	Purity (%)	Germination (%)
Oats	Avena sativa	97	90
Rye	Secale cereale	97	90
Sudangrass, PIPER	Sorghum vulgare var. sudanese	98	85

2.01 SEED (Continued)

Table 9010.04: Native Grasses

Common Name	Scientific Name
Big bluestem*	Andropogon gerardii
Blue grama	Bouteloua gracilis
Blue-joint grass	Calamagrostis Canadensis
Bottlebrush sedge	Carex hystericina
Buffalograss*	Buchloe dactyloides
Common rush	Juncus effusus
Fowl bluegrass	Poa palustris
Fowl manna grass	Glyceria striata
Fox sedge	Carex vulpinoidea
Green bulrush	Scirpus atrovirens
Hairy wood chess	Bromus purgans
Indiangrass*	Sorghastrum nutans
Intermediate wheatgrass	Agropyron intermedium
Little bluestem*	Andropogon scoparius
Prairie dropseed	Sporobolus heterolepis
Reed manna grass	Glyceria grandis
Rice cutgrass	Leersia oryzoides
Rye grass, annual	Lolium italicum
Sand bluestem*	Andropogon gerardii, var. paucipilus
Sand dropseed	Sporobolus cryptandrus
Sand lovegrass	Eragrostis trichodes
Sideoats grama*	Bouteloua curtipendula
Slender wheatgrass	Agropyron trachycaulum, var. unilaterale
Spike rush	Eleocharis palustris
Softstem bulrush	Schoenoplectus tabernaemontani
Switchgrass*	Panicum virgatum
Tussock sedge	Carex stricta
Virginia wild-rye	Elymus virginicus
Weeping lovegrass	Eragrostis curvula
Western wheatgrass*	Agropyron smithii
Wool grass	Scirpus cyperinus

2.01 SEED (Continued)

Table 9010.05: Forbs

Common Name	Scientific Name
Black-eyed Susan	Rudbeckia hirta
Blue-flag iris	Iris virginica-shrevii
Boneset	Eupatorium perfoliatum
Canadian anemone	Anemone canadensis
Common mountainmint	Pycnanthemum virginianum
Common rush	Juncus effusus
Fowl manna grass	Glyceria striata
Golden Alexanders	Zizia aurea
Great blue lobelia	Lobelia siphilitica
Grey-headed coneflower	Ratibida pinnata
Heath aster	Symphyotrichum ericoides
Ironweed	Veronia faxciculate
Joe-pye weed	Eupatorium maculatum
Meadow blazingstar	Liatris ligulistylis
Milkweed, butterfly	Asclepias tuberosa
Milkweed, swamp	Asclepias incarnata
New England aster	Symphyotrichum novae-angliae
Ohio spiderwort	Tradescantia ohiensis
Oxeye sunflower	Heliopsis helianthoides
Pale purple coneflower	Echinacea pallida
Partridge pea	Chamaecrista fasciculate
Prairie blazing star	Liatris pycnostachya
Purple prairie clover	Dalea purpurea
Rattlesnake master	Eryngium yuccifolium
Reed manna grass	Glyceria grandis
Rice cutgrass	Leersia oryzoides
Showy goldenrod	Solidago speciosa
Showy tic-trefoil	Desmodium canadense
Stiff goldenrod	Solidago rigida
Swamp aster	Aster puniceus
White wild indigo	Baptisia alba
Wild bergamot	Monarda fistulosa

2.02 SEED MIXTURES AND SEEDING DATES

See the contract documents for the specified seed mixture. If a mixture is not specified, use the following. The Contractor may submit a modification of the mixture for the Engineer's consideration.

A. Type 1 (Permanent Lawn Mixture): Used for residential and commercial turf site, fertilized, and typically mowed. Use between March 1 and May 31 and between August 10 and September 30.

Table 9010.06: Type 1 Seed Mixture[1]

Common Name	Application Rate lb/acre
Creeping red fescue	25
Turf-type perennial ryegrass[2]	20
Turf-type perennial ryegrass[2]	20
Kentucky bluegrass cultivar[3]	65
Kentucky bluegrass cultivar[3]	65
Kentucky bluegrass cultivar[3]	65

[1] A commercial mixture may be used if it contains a high percentage of similar bluegrasses; it may or may not contain creeping red fescue.
[2] Choose two different cultivars of turf-type perennial ryegrass, at 20 lbs/acre each.
[3] Choose three different cultivars of Kentucky bluegrass, at 65 lbs/acre each.

B. Type 2 (Permanent Cool Season Mixture for Slopes and Ditches): Not typically mowed. Reaches a maximum height of 2 to 3 feet, low fertility requirements, grows in the spring and fall, and can go dormant in the summer. Use between March 1 and May 31 and between August 10 and September 30.

Table 9010.07: Type 2 Seed Mixture

Common Name	Application Rate lb/acre
Tall fescue[1]	100
Kentucky bluegrass	20
Ryegrass, perennial[2]	75

[1] Use endophyte free cultivars including Fawn, K-31, or a combination.
[2] Use cultivars including Linn, Amazon, Noriea, or Nui, or a combination.

C. Type 3 (Permanent Warm-Season Slope and Ditch Mixture): Not typically mowed. Reaches a height of 5 to 6 feet, stays green throughout summer, and responds well to being burned in spring; no fertilizer. Use between March 1 and June 30.

Table 9010.08: Type 3 Seed Mixture

Common Name	Application Rate lb/acre
Big bluestem*	3 PLS
Grain rye	40
Indiangrass*	4 PLS
Little bluestem*	3 PLS
Oats	16
Sideoats grama*	5 PLS
Switchgrass*	1 PLS

* Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa.

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

D. Type 4 (Urban Temporary Erosion Control Mixture): Short lived (6 to 8 months) mix for erosion control.

Table 9010.09: Type 4 Seed Mixture

Common Name	Application Rate lb/acre
SPRING - March 1 - May 20	
Annual ryegrass	40
Oats*	65
SUMMER - May 21 - August 14	
Annual ryegrass	50
Oats*	95
FALL - August 15 - September 30	
Annual Ryegrass	40
Grain rye	65

* Engineer may delete for previously established urban areas.

E. Type 5 (Rural Temporary Erosion Control Mixture): Short lived mix for erosion control.

Table 9010.10: Type 5 Seed Mixture

Common Name	Application lb/acre
March 1 - October 31	
Canada wildrye	5 PLS/acre
Grain rye	50
Oats	50
November 1 - February 28 (or 29)	
Canada wildrye	7 PLS/acre
Grain rye	62
Oats	62

Seed does not need to be certified Source Identified Class (Yellow Tag).

F. Type 6 (Salt-resistant Mixture): Use for grass medians and areas immediately back of curb on streets subject to regular salt applications for winter de-icing. Apply between March 1 and May 31 and between August 10 and September 30.

Table 9010.11: Type 6 Seed Mixture

Common Name	Application Rate lb/acre	Purity (%)	Germination (%)
Blue chip Kentucky bluegrass	37.5	90	85
Fults alkali grass	75	98	85
Hard fescue	50	95	85
Nublue Kentucky bluegrass	37.5	90	85
Sheeps fescue	50	90	85

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

G. Wetland Seeding: Between April 1 and June 30, use the following seed mixture for wetland grass seeding areas.

Table 9010.12: Wetland Grass Seed Mixture

Common Name	Scientific Name	PLS** (per ac)
Arrowhead	Sagittaria latifolia	4 oz
Big bluestem*	Andropogon gerardii	1 lb
Bluejoint grass	Calamagrostis	1 oz
Blue vervain	Verbena Hastata	1 oz
Boneset	Eupatorium perfoliatum	1 oz
Broom sedge	Carex scoparia	2 oz
Dark green bulrush*	Scirpus atrovirens	1 oz
Fox sedge*	Carex vulpinoidea	4 oz
New England aster*	Symphyotrichum novae-angliae	2 oz
Nodding bur marigold	Bidens cernua	8 oz
Porcupine sedge	Carex hystericina	8 oz
Prairie cordgrass	Spartina pectinata	1 lb
Rice cutgrass	Leersia oryzoides	4 oz
Sneezeweed	Helenium autumnale	2 oz
Softstem bulrush	Schoenoplectus tabernaemontani	8 oz
Spike rush	Eleocharis palustris	4 oz
Swamp milkweed*	Asclepias incarnata	1 lb
Switchgrass*	Panicum virgatum	8 oz
Tussock sedge	Carex stricta	2 oz
Virginia wild-rye*	Elymus virginicus	5 lbs
Water plantain	Alisma plantago-aquatica	4 oz

* Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa.
** Seeding rates for wetland grasses are given as PLS. Either the germination test or Tetrazolium (TZ) test is acceptable to determine PLS for native species.

2.02 SEED MIXTURES AND SEEDING DATES (Continued)

H. Native Grass and Forbs (Wildflower) Seeding: Between April 1 and June 30, use the following seed mixture for areas designated for native grass and wildflower seeding.

Table 9010.13: Native Grass and Forbs (Wildflower) Seeding Mixture

Common Name	Scientific Name	Application Rate**
GRASSES		**lb/acre**
Big bluestem*	Andropogon gerardii	1.0
Canada wild rye	Elymus Canadensis	1.5
Indiangrass*	Sorghastrum nutans	1.0
Little bluestem*	Schizachyrium scorparium	2.0
Sideoats grama*	Bouteloua curtipendula	2.5
Switchgrass*	Panicum virgatum	0.5
FORBS (WILDFLOWERS)		**oz/acre**
Black-eyed Susan	Rudbeckia hirta	3.0
Butterfly milkweed	Asclepias tuberosa	4.0
Canadian anemone	Anemone canadensis	0.5
Common mountainmint	Pycnanthemum virginianum	0.25
Golden Alexanders	Zizia aurea	8.0
Grey-headed coneflower	Ratibida pinnata	2.75
Heath aster	Symphyotrichum ericoides	0.25
Ironweed	Veronia faxciculate	3.0
New England aster	Symphyotrichum novae-angliae	1.25
Ohio spiderwort	Tradescantia ohiensis	7.0
Oxeye sunflower	Heliopsis helianthoides	12.0
Pale purple coneflower	Echinacea pallida	15.0
Partridge pea	Chamaecrista fasciculate	32.0
Prairie blazing star	Liatris pycnostachya	4.5
Purple prairie clover	Dalea purpurea	2.5
Rattlesnake master	Eryngium yuccifolium	1.75
Showy goldenrod	Solidago speciosa	0.50
Stiff goldenrod	Solidago rigida	1.0
Swamp milkweed	Asclepias incarnata	4.0
White wild indigo	Baptisia alba	2.0
Wild bergamot	Monarda fistulosa	1.25
NURSE CROP		**lb/acre**
Oats (spring seeding - April 1 to June 30)		32
Winter wheat (dormant/frost seeding - November 1 to March 31)		25

* Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa.

** Seeding rates for native grass and forb species are given as PLS. Either the germination test or Tetrazolium (TZ) test is acceptable to determine PLS for native species.

2.03 FERTILIZER

Use fertilizer of the grade, type, and form specified that complies with rules of the Iowa Department of Agriculture and Land Stewardship and the following requirements:

A. Grade: Identify the grade of fertilizer according to the percent nitrogen (N), percent of available phosphoric acid (P_2O_5), and percent water soluble potassium (K_2O), in that order, and base approval on that identification.

The Contractor may substitute other fertilizer containing analysis percentages different from those specified, provided that the minimum amounts of actual nitrogen, phosphate, and potash per acre are supplied, and that in no case does the total amount per acre of the three fertilizer elements be exceeded by 30% of the following minimum amounts.

1. **For Conventional Seeding, Permanent:** Apply a 6-24-24 commercial fertilizer or the equivalent units of nitrogen, phosphate, and potash at the rate of 300 pounds per acre.

2. **For Conventional Seeding, Temporary:** Apply commercial fertilizer to all seeded areas at the rate of 250 pounds per acre of 13-13-13 (or equivalent) for rural mixes and 300 pounds per acre of 6-24-24 (or equivalent) for urban mixes, unless otherwise specified in the contract documents.

3. **For Hydraulic Seeding:** Apply fertilizer in combination with seeding by a hydraulic seeder and as specified in Iowa DOT Article 2601.03, B. Apply a commercial fertilizer or the equivalent units of nitrogen, phosphate, and potash at the rate specified for the type of seeding being applied.

4. **For Pneumatic Seeding:** Based on the compost nutrient analysis, supply any additional commercial fertilizer necessary to meet the 13-13-13 units of nitrogen, phosphate, and potash at the rate of 450 pounds per acre as the compost is applied.

B. Type: Use fertilizer that can be uniformly distributed by the application equipment. Furnish fertilizer either as separate ingredients or in chemically-combined form.

2.04 STICKING AGENT

A. Use a sticking agent that is a commercial material recommended by the manufacturer to improve adhesion of inoculant to the seed. For small quantities less than 50 pounds, the sticking agent need not be a commercial agent, but it must be approved by the Engineer and must be applied separately, prior to application of inoculant.

B. Follow safety precautions specified on the product label. A sticking agent is not required if a liquid formulation of inoculant is used.

2.05 INOCULANT FOR LEGUMES

An inoculant is a culture of bacteria specifically formulated for each legume seed (alfalfa, clovers, lespedesa, and hairy vetch). Ensure the manufacturer's container indicates the specific legume seed to be inoculated and the expiration date. Use inoculant that meets the requirements of the Iowa Seed Law. Follow the safety precautions specified on the product label.

2.06 WATER

Use water that is free of any substance harmful to seed germination or plant growth.

2.07 MULCH

A. For Conventional Seeding:

1. Material used as mulch may consist of the following:
   a. Dry cereal straw (oats, wheat, barley, or rye)
   b. Prairie hay
   c. Wood excelsior composed of wood fibers, at least 8 inches long, based on an average of 100 fibers, and approximately 0.024 inch thick and 0.031 inch wide. The fibers must be cut from green wood and be reasonably free of seeds or other viable plant material.

2. Do not use other hay (bromegrass, timothy, orchard grass, alfalfa, or clover).

3. All material used as mulch must be free from all noxious weed, seed-bearing stalks, or roots and will be inspected and approved by the Engineer prior to its use.

4. The Contractor may use other materials, subject to the approval of the Engineer.

B. For Hydraulic Seeding:

1. Wood Cellulose:
   a. Use material that is a natural or cooked cellulose fiber processed from whole wood chips, or a combination of up to 50% of cellulose fiber produced from whole wood chips, recycled fiber from sawdust, or recycled paper (by volume).
   b. Product contains a colloidal polysaccharide tackifier adhered to the fiber to prevent separation during shipment and avoid chemical co-agglomeration during mixing.
   c. Form a homogeneous slurry of material, tackifier, and water.
   d. Use a slurry that can be applied with standard hydraulic mulching equipment.
   e. Dye the slurry green to facilitate visual metering during application.
   f. Do not use materials that have growth or germination-inhibiting factors or any toxic effect on plant or animal life when combined with seed or fertilizer.

2. Bonded Fiber Matrix (BFM):
   a. Manufactured to be applied hydraulically.
   b. Dyed to facilitate visual metering.
   c. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.
   d. Meet the following requirements:
      1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.
      2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
      3) Hydraulic mulch that is completely photo-degradable or biodegradable.
      4) Have a rainfall event (R-factor) of 140 < R according to ASTM D 6459.
      5) Have a cover factor of C ≤ 0.03 according to ASTM D 6459.
      6) Vegetation Establishment of 400% minimum according to ASTM D 7322.
      7) Water Holding Capacity 600% minimum according to ASTM D 7367.

3. Mechanically-Bonded Fiber Matrix (MBFM):
   a. Manufactured to be applied hydraulically.
   b. Dyed to facilitate visual metering.
   c. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.

2.07 MULCH (Continued)

d. Meet the following requirements:
   1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.
   2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
   3) Hydraulic mulch that is completely photo-degradable or biodegradable.
   4) Have a rainfall event (R-factor) of 162 < R according to ASTM D 6459.
   5) Have a cover factor of C ≤ 0.01 according to ASTM D 6459.
   6) Vegetation establishment of 500% minimum according to ASTM D 7322.
   7) Water holding capacity of 700% minimum according to ASTM D 7367.

C. For Pneumatic Seeding: Use compost meeting the following requirements.

1. Derived from a well-decomposed source of organic matter.

2. Produced using an aerobic composting process, meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations.

3. No visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.

4. Certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program.

5. Conforms to chemical, physical, and biological parameters of AASHTO R 52, with the following additional requirements:
   a. Follow U.S. Composting Council's TMECC guidelines for all testing.
   b. Organic Matter Content: 30% minimum.
   c. pH: between 6.0 and 8.0.
   d. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
   e. Particle Size:

Sieve Size	Percent Passing*
2"	100
1"	90-100
3/4"	65-100
3/8"	0-75

*6 inch maximum particle length.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. Aerial Equipment: When aerial application of seed and fertilizer is specified, use aerial equipment capable of providing a uniform distribution of seed and fertilizer on the specified area.

B. Compost Blower: A compost blower is pneumatic equipment to blow compost over the desired area. It may be equipped with a supplemental seed injection system. Use equipment with sufficient power to cover the required area without driving on the prepared seedbed.

C. Cultipacker: Use a pull-type cultipacker with individual rollers or wheels. Cultipackers with sprocket-type spacers between the wheels may be used. The cultipacker must produce a corrugated surface on the area being compacted. Operate the cultipacker separately from all other operations, and do not attach the cultipacker to the seeder or disk, unless combined cultipacker seeder is manufactured to operate as a unit. Make provisions for addition of weight.

D. Disk: When preparing a seedbed on ground having heavy vegetation, use a disk with cutaway blades. Make provisions for the addition of weight to obtain proper cutting depth.

E. Drop Seeder: Use one piece of equipment containing pulverizer rollers in front of the seed tubes, ground driven seed meters, maximum seed tube spacing of 3 inches delivering seed between the pulverizer rollers and packer wheels, and packer wheels that press and firmly pack seed into the soil.

F. Endgate Cyclone Seeders: Endgate cyclone seeders must be suitably mounted. Movement must be provided by mechanical means. The seed drops through an adjustable flow regulator onto a rotating, power driven, horizontal disk or fan.

G. Expanded Mesh Roller: Use equipment that is an open grid type or a cultipacker type, modified by covering with expanded metal mesh.

H. Field Tiller: Use equipment designed for the preparation of the seedbed to the degree specified.

I. Gravity Seeders: Gravity seeders must provide agitation of the seed, have an adjustable gate opening, and uniformly distribute seed on the prepared seedbed. Use a seed hopper equipped with baffle plates spaced no more than 2 feet apart. The baffle plates must extend from the agitator shaft to within approximately 2 inches of the top of the seed hopper. Wind guards are required to facilitate seeding when moderate wind conditions exist and when ordered by the Engineer. Place wind guards in front or in back (or both) of the seed outlet and extend them to near the ground line. This seeder may be used for application of fertilizer.

J. Hand Cyclone Seeders: Hand cyclone seeders are carried by the person dispensing seed. The seed drops through an adjustable flow regulator onto a rotating, hand driven, horizontal disk or fan.

K. Hydraulic Seeder: Use hydraulic seeding equipment with a pump rated at no less than 100 gallons per minute. Inoculant, seed, and fertilizer may be applied in a single operation. The equipment must have a suitable working pressure and a nozzle adapted to the type of work. Supply tanks must have a means of agitation. Calibrate tanks and provide them with a calibration stick or other approved device to indicate the volume used or remaining in the tank.

L. Mowers: Use mowers that are rotary, flail, disk, or sickle type. Do not use mowers that bunch or windrow the mowed material.

3.01 EQUIPMENT (Continued)

M. Mulch Anchoring Equipment: Use mulch anchoring equipment designed to anchor straw or hay mulch into soil by means of dull blades or disks. It should have flat blades or disks, may have cutaway edges and must be spaced at approximately 8 inch intervals. The mulch anchoring equipment must be pulled by mechanical means and weigh approximately 1,000 pounds. When directed by the Engineer, increase the weight by addition of ballast.

N. Native Grass Seed Drill: Use a native grass seed drill designed to provide uniform distribution of native grass and wildflower seeds. Provide separate seed boxes to apply both small seeds as well as fluffy bearded seeds. If a no-till attachment is specified, use an attachment of the same manufacturer as the drill.

O. Pneumatic Seeder: Use an air blown system with sufficient power and hose to reach 300 feet.

P. Pulverizer: Use equipment designed to break up compacted soil to prepare a seedbed.

Q. Rotary Tiller: Use equipment with rotary-type blades designed for the preparation of seedbed to the degree specified.

R. Slit Seeder: Use a gas, diesel or electric powered mechanical slit seeder that is capable of cutting vertical grooves a maximum of 1/4 inch deep into the soil with a maximum horizontal blade spacing of 3 inches, deposits metered seed directly after the formation of the vertical grooves, and contains packer wheels that press and firmly pack seed into the soil.

S. Slope Harrow: Use a slope harrow, consisting of a rolling weight attached by heavy chain to a tractor. The chain must be of suitable length, with picks attached, and a means of rotating the picks as the rolling weight is pulled in a direction parallel to the movement of the tractor.

T. Spike Tooth Harrow: Use equipment designed to provide adjustment of the spike teeth to level the ground, or to be used as specified by the Engineer.

U. Straw Mulching Machine: Use a machine to uniformly apply mulch material over the desired area without excessive pulverization. Excessive pulverization is the general absence of straw longer than 6 inches after distribution.

3.02 AREA OF SEEDING

Place seed only in the areas specified in the contract documents. Repair damaged areas that are disturbed outside the contract limits at the expense of the Contractor. Do not disturb areas having a satisfactory growth of desirable grasses or legumes.

3.03 FINISH GRADING AND TOPSOIL

See Section 2010 for finish grading and topsoil placement.

3.04 CONVENTIONAL SEEDING

A. Order of Operations: 1) fertilizing, 2) seedbed preparation, 3) seed preparation/application, and 4) mulching.

B. Fertilizing:

1. Apply fertilizer immediately prior to seedbed preparation. Incorporate the fertilizer into the top 2 to 3 inches of topsoil during the seedbed preparation. Equipment that results in ruts or excessive compaction will not be allowed.

2. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

3.04 CONVENTIONAL SEEDING (Continued)

C. Seedbed Preparation, Permanent:

1. Limit preparation of seedbed to areas that will be seeded immediately upon completion.

2. Work areas accessible to field equipment to a depth of no less than 3 inches. Use mechanical rotary tillage equipment for the preparation of seedbed on earth shoulders, urban or raised medians, and rest areas. Prepare by hand areas inaccessible to field machinery, to a depth of no less than 2 inches. Use care that the entire width of the shoulder and areas around headwalls, wingwalls, flumes, and other structures are prepared in the manner specified. Where weed growth has developed extensively, they may be disked into the ground. If weed growth develops sufficiently to interfere with proper seedbed preparation, mow the weeds and remove them from the project at no additional cost to the Contracting Authority.

   Use crawler type or dual-wheeled tractors for seedbed preparation. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross-section. Harrow ridging in excess of 4 inches due to operation of tillage equipment prior to rolling with the cultipacker. Roll the area with no less than one pass of the cultipacker prior to permanent seeding.

3. Shape and fine grade to remove rills or gullies, water pockets, undesirable vegetation, and irregularities to provide a smooth, firm, and even surface true to grade and cross-section. For Type 1 (lawn seeding), prepare to a fine texture and without soil lumps. Coordinate preparation of all ditches designated for special ditch control with the seedbed preparation. Till parallel to the contours.

4. Smooth the seedbed with a cultivator-type tillage tool having a rake bar or a rock rake. Pick up and remove all debris, such as rocks, stones, concrete larger than 2 inches (1/2 inch maximum for lawn seeding), or roots and other objectionable material that will interfere with the seeding operation. A spring tooth cultivator may be used in lieu of a rock picker. Remove the rock by hand after each use of the cultivator; repeat the process until the soil is relatively free of rock as determined by the Engineer.

5. Choose equipment to minimize soil compaction. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross-section. Roll the area with at least one pass of the cultipacker. Remove ruts that develop during the sequence of operations before subsequent operations are performed. This must be completed just prior to seeding and the work approved by the Engineer before the seeding application.

D. Seedbed Preparation, Temporary: Till the soil to a minimum depth of 5 inches with a disk, harrow, or field cultivator.

E. Seeding:

1. Seed Preparation:

a. Thoroughly mix all seed specified for the contract prior to placing the seed in the seed hopper. Provide 48 hours notice prior to mixing the seed, and give the Engineer an opportunity to witness the seed mixing. The mixing of a certified blue tag seed mix at an approved (by Iowa Crop Improvement Association) seed conditioner's facility need not be witnessed.

b. Treat all legume seed with a commercial sticking agent to be applied prior to application of inoculant, or as a mixture when the sticking agent is compatible with other materials. A sticking agent is not required if a liquid formulation of inoculant is used. Use mechanical mixing equipment to apply sticking agent and inoculant on seed quantities over 50 pounds.

3.04 CONVENTIONAL SEEDING (Continued)

c. Inoculate all legumes with a standard product humus culture before being mixed with other seeds for sowing.
d. Inoculate all legumes with a standard culture at the rate specified by the manufacturer of the inoculant according to Iowa DOT Article 4169.04. Do not expose inoculated seed to direct sunlight for more than 30 minutes. Re-inoculate seed that is not sown within 8 hours after inoculation prior to use. Pre-inoculated seed with manufacturer's recommended protective coating may be used in lieu of seed with Contractor-applied inoculant.
e. When the gravity or cyclone seeder is used for application of seed, inoculate legume seed according to the manufacturer's recommended procedures, before mixing with other grass seeds for sowing. Furnish and apply inoculant.

2. Seed Application, Permanent:
a. Prior to seeding, the seedbed will be inspected and approved by the Engineer. Use methods and procedures consistent with equipment manufacturer's recommendations; however, do not operate ground-driven equipment at speeds greater than 10 mph.
b. On all areas accessible to machinery, sow seed with a gravity seeder, endgate cyclone seeder, or seed drill.
c. On areas inaccessible to field machinery, the use of hand-operated cyclone seeders will be allowed, but no other hand-seeding methods will be accepted.
d. The application of grass and legume seed with hand seeders on early spring work must be performed as separate operations. No mixing of the two types of seed will be allowed.
e. All seeded areas will have one pass with a roller or cultipacker to firm the soil.

3. Seed Application, Temporary:
a. On areas accessible to field machinery, sow seed with an endgate cyclone seeder.
b. On areas inaccessible to field machinery, the use of hand-operated cyclone seeders will be allowed, but no other hand-operated seeding methods will be accepted.
c. Cover the seed and fertilizer by lightly tilling the seeded area with a disk, rigid harrow, spring tooth harrow, or field cultivator.

4. Seeding Outside of the Specified Seeding Dates: With the agreement of the Engineer and at the full responsibility of the Contractor, seeding operations for all seed types may be conducted outside the specified seeding dates. Should the seeded areas require reseeding, it must be done as specified and at no additional cost to the Contracting Authority.

a. Dormant Seeding: When winter dormant seeding is allowed or specified by the Jurisdiction, complete it when air temperatures are consistently below 40°F and prior to December 25 of a given year. Dormant seeding is not allowed on snow.
1) Prepare the seedbed before the ground freezes.
2) To ensure protection of the seed, apply on a frosty morning or before a predicted snow.
3) Seeding may be done by hand or with seeding equipment.
4) For hydraulic seeding, apply the fertilizer at no more than 0.5 pounds nitrogen per 1000 square feet, followed by the seed.

b. Frost Seeding (Overseeding):
1) Complete frost seeding, also referred to as overseeding, in the spring when the ground is friable from frost action (February 1 to April 1).
2) Frost seeding is not allowed on more than 1 inch of snow.
3) Seeding can be done with a hand-operated cyclone seeder or other equipment.
4) Seedbed preparation will not be required provided the ground is friable from frost action.

3.04 CONVENTIONAL SEEDING (Continued)

F. Mulching:

1. Mulch all conventionally seeded areas the same day the seed is sown. Uniformly distribute the mulch over the required areas at a rate of 1.5 tons/acre for dry cereal straw, or native grass straw. Prairie hay is not suitable for Type 1 (lawn seeding).

2. Work the mulch into the soil with mulch anchoring equipment designed to anchor the mulch into the soil by means of dull blades or disks with a minimum of two passes. Operate equipment in a manner to minimize displacement of the soil and disturbance of the design cross-section.

3. Do not operate mulch-blowing equipment on slopes steeper than 2.5 to 1 or on slopes that may rut. Use attachments to apply mulch without traversing slopes.

4. Do not mulch when wind velocities exceed 15 mph.

3.05 HYDRAULIC SEEDING

A. Order of Operations:

1. Seedbed preparation

2. Seed application, fertilizing, and mulching

B. Seedbed Preparation: Follow seedbed preparation for conventional seeding in Section 9010, 3.04.

C. Seed Preparation: Inoculant, in the quantities specified above, may be applied directly into the supply tank with seed, water, and other material.

D. Seed Application, Fertilizing, and Mulching:

1. Application Process:
   a. Combination: Place all material, seed, fertilizer, mulch, and tackifier (if applicable) in hydraulic mulching equipment specifically manufactured for hydraulic seeding.
   b. Separate: At the Contractor's option and at no additional cost to the Contracting Authority, the hydraulic seeding, fertilizing, and mulching may be undertaken separately. If hydraulic seeding is done separately, add 50 pounds of wood cellulose fiber complying with Section 9010, 2.07, B as a tracer for each 500 gallons of water in the hydraulic seeder tank. If operations are undertaken separately, complete fertilizing and mulching application within 24 hours of completing seeding work. Do not separate the applications if inclement weather is forecasted within 24 hours of the scheduled application period.

2. Ensure the hydraulic equipment, pump, and application process do not damage or crack seeds.

3. Mix materials with fresh potable water using a combination of both recirculation through the equipment's pump, and mechanical agitation to form a homogeneous slurry.

4. Apply mixture within 1 hour after seed and fertilizer are placed in the hydraulic seeder.

5. If necessary, dampen dry, dusty soil, to prevent balling of the material during application.

3.05 HYDRAULIC SEEDING (Continued)

6. Apply the slurry evenly over all specified areas at component material rates specified.
   a. Wood Cellulose Mulch:
      1) Mulch: Minimum 3,000 lb/acre dry weight.
      2) Tackifier: Minimum 50 lb/acre.
   b. Bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.
   c. Mechanically-bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.

7. Retain and count empty bags of mulch to ensure final application rate.

8. Hydromulching may be done over conventional seeding and/or fertilizing, if approved by the Engineer.

E. Native Grass, Wildflower, and Wetland Grass Seeding: Hydraulic seeding of native grasses, wildflowers, and wetland grasses is allowed only if approved by the Engineer. If allowed, increase specific seed rates by 25%. Do not apply fertilizer.

3.06 PNEUMATIC SEEDING

A. Order of Operations: 1) seedbed preparation, 2) seed preparation, and 3) seed application.

B. Seedbed Preparation: Follow seedbed preparation for conventional seeding in Section 9010, 3.04.

C. Seed Preparation: Follow seed preparation for conventional seeding in Section 9010, 3.04. Pre-inoculate seed in the quantities specified above prior to placing in the seed equipment.

D. Seed Application:

1. Place all material, seed, fertilizer, and compost in equipment with a calibrated seeder attachment specifically designed for pneumatic seeding. Do not apply fertilizer with native grass, wildflower, or wetland seeding.

2. Apply compost to a 1 inch minimum depth on all designated disturbed areas. Apply the compost with a pneumatic (air blower) system with sufficient power and hose to reach 300 feet. Driving on the soil to apply compost will not be allowed.

3. Inject seed and fertilizer into the top 1/4 inch to 1/2 inch of compost during application with a calibrated seed injector at the specified rate. Do not inject native grasses and forbs more than 1/4 inch.

3.07 WATERING

A. Provide water, equipment, transportation, water tanker, hoses, and sprinklers.

B. Use enough water to keep the soil and mulch moist to a depth of 1 inch and ensure growth of the seed. For turfgrass seeding areas, sufficiently water to keep the soil moist for a minimum of 21 days. If natural rainfall is adequate to keep the soil and mulch moist, artificial watering may not be needed.

3.08 RE-SEEDING

A. When all work related to seeding, fertilizing, and/or mulching has been completed on an area, and is washed out or damaged, re-seed, fertilize, and/or mulch the area at the contract unit price(s) when so ordered by the Engineer.

B. When work related to seeding, fertilizing, and/or mulching has not been completed in an area and is washed out or damaged, re-seed, fertilize, and/or mulch the area as necessary at no additional cost to the Contracting Authority.

3.09 CLEAN UP

All work related to clean up throughout the project and upon completion is the responsibility of the Contractor, at no additional cost to the Contracting Authority.

A. Remove all excess materials, debris, and equipment upon completion of work.

B. Clean all paved surfaces open for public use at the end of each day and prior to forecasted precipitation.

C. Repair any damage resulting from seeding operations.

D. Remove hydraulic slurry and other excess debris related to seeding operations from buildings, landscaping, mulch, pavement, signs, sign posts, and any other areas not specified for application, at the end of each day.

3.10 ACCEPTANCE AND WARRANTY

A. Acceptance:

1. Guarantee in writing that all work has been completed as specified and provide the date that all activities were completed. When a warranty is a separately-bid item, this also establishes the beginning of the warranty period.

2. Acceptance will occur, provided seeded areas are in a live, healthy, growing, and well-established condition without eroded areas, bare spots, weeds, undesirable grasses, disease, or insects.
   a. Projects without a separately-bid warranty will be accepted no sooner than 60 days from the date that all activities were completed.
   b. When a warranty is established as a bid item and the warranty period exceeds 60 days, projects may be accepted after all specified work, excluding the warranty, is satisfactorily completed, and a supplemental contract for the warranty is executed according to the Code of Iowa Section 573.27.

B. Warranty:

1. Required only when established as a bid item by the Engineer.

2. The warranty is to guarantee completed seeding areas for a maximum period of twelve months.

3. During the warranty period, correct and reseed any defects in the seeded areas and grass stand, such as weedy areas, eroded areas, and bare spots, until all affected areas are accepted by the Engineer.

4. Replace or repair to original condition, all damages to property resulting from the seeding operation or from the remedying of defects, at the Contractor’s expense.

5. Replacement costs are the Contractor’s responsibility, except for those resulting from loss or damage due to occupancy of the project in any part, vandalism, civil disobedience, acts of neglect on the part of others, physical damage by animals, vehicles, fire, or losses due to curtailment of water by local authority, or by "Acts of God.”

END OF SECTION